



EUROPEAN COMMISSION
European Research Executive Agency

Director



GRANT AGREEMENT

NUMBER 101037247 — SILVANUS

This **Agreement** ('the Agreement') is **between** the following parties:

on the one part,

the **European Research Executive Agency (REA)** ('the Agency'), under the powers delegated by the European Commission ('the Commission'), represented for the purposes of signature of this Agreement by European Research Executive Agency, Green Europe, Biodiversity, Circular Economy and Environment, Arnoldas MILUKAS,

and

on the other part,

1. 'the coordinator':

UNIVERSITA TELEMATICA PEGASO (PEGASO), established in PIAZZA TRIESTE ETRENTO 48, NAPOLI 80132, Italy, VAT number: IT05411471211, represented for the purposes of signing the Agreement by President, Danilo IERVOLINO

and the following other beneficiaries, if they sign their 'Accession Form' (see Annex 3 and Article 56):

2. **ZANASI ALESSANDRO SRL (Z&P)**, established in VIA G B AMICI 29, MODENA 41100, Italy, VAT number: IT03141870364,

3. **INTRASOFT INTERNATIONAL SA (INTRA)**, established in RUE NICOLAS BOVE 2B, LUXEMBOURG 1253, Luxembourg, VAT number: LU16853659,

4. **THALES (TRT)**, established in TOUR CARPE DIEM PLACE DES COROLLES ESPLANADE NORD, COURBEVOIE 92400, France, VAT number: FR54552059024,

5. **FINCONS SPA (FINC)**, established in CORSO MAGENTA 56, MILANO MI 20123, Italy, VAT number: IT12795320154,

6. **ATOS IT SOLUTIONS AND SERVICES IBERIA SL (ATOS IT)**, established in RONDA DE EUROPA 5, TRES CANTOS MADRID 28760, Spain, VAT number: ESB85908093,

7. **EMC INFORMATION SYSTEMS INTERNATIONAL (DELL)**, established in IDA INDUSTRIAL SITE, OVENS, Ireland, VAT number: IE9692485U,



8. **SOFTWARE IMAGINATION & VISION SRL (SIMAVI)**, established in SOSEAUA BUCURESTI-PLOIESTI 73-81 COMPLEX VICTORIA CORP CLADIRE C4 EТАJ 2, BUCURESTI 013685, Romania, VAT number: RO41963989,
9. **CNET CENTRE FOR NEW ENERGY TECHNOLOGIES SA (EDP)**, established in RUA CIDADE DE GOA 4, SACAVEM E PRIOR VELHO LISBOA 2685 039, Portugal, VAT number: PT513247521,
10. **ADP VALOR - SERVIÇOS AMBIENTAIS, S.A. (ADP)**, established in Rua Visconde de Seabra 3, LISBOA 1700 421, Portugal, VAT number: PT 505296950,
11. **TERRAPRIMA - SERVICOS AMBIENTAIS SOCIEDADE UNIPESSOAL LDA (TP)**, established in QUINTA DA FRANCA BORRALHEIRA, CARIA 6200 710, Portugal, VAT number: PT508759790,
12. **3MON, S. R. O. (3MON, s. r. o.)**, established in CERNYSEVSKEHO 10, BRATISLAVA 851 01, Slovakia, VAT number: SK2023248458,
13. **CATALINK LIMITED (CTL)**, established in CHARITINIS SAKKADA 5, NICOSIA 1040, Cyprus, VAT number: CY10378448C,
14. **SYNTHESIS CENTER FOR RESEARCH AND EDUCATION LIMITED (SYNC)**, established in TAGMATARCHI POULIOU 33, LEFKOSIA 1101, Cyprus, VAT number: 10133359J,
15. **EXPERT.AI S.P.A. (EAI)**, established in VIA FORTUNATO ZENI 8, ROVERETO 38068, Italy, VAT number: IT02608970360,
16. **ITTI SP ZOO (ITTI)**, established in RUBIEZ 46, POZNAN 61 612, Poland, VAT number: PL7811019801,
17. **IZQUIERDO/PIATRIK GBR (VMG)**, established in OLGA-BENARIO-PRESTES-STRASSE 2, BERLIN 10407, Germany,
18. **MASSIVE DYNAMIC SWEDEN AB (MDS)**, established in SANKT ERIKSGATAN 117, STOCKHOLM 113 43, Sweden, VAT number: SE559239008101,
19. **FONDAZIONE CENTRO EURO-MEDITERRANEOSUI CAMBIAMENTI CLIMATICI (CMCC F)**, established in VIA A IMPERATORE 16, LECCE 73100, Italy, VAT number: IT03873750750,
20. **EXUS SOFTWARE MONOPROSOPI ETAIRIA PERIORISMENIS EVTHINIS (EXUS)**, established in 73-75 MESOGION AVENUE, ATHENS 11526, Greece, VAT number: EL800663995,
21. **RINIGARD DOO ZA USLUGE (RINI)**, established in KUSLANOVA 2, Zagreb 10000, Croatia, VAT number: HR55503963392,
22. **MICRO DIGITAL DOO ZA INFORMACIJSKE TEHNOLOGIJE (MD)**, established in RUDESKA CESTA 177, ZAGREB 10000, Croatia, VAT number: HR81606288326,
23. **POLITECHNIKA WARSZAWSKA (WUT)**, established in PLAC POLITECHNIKI 1, WARSZAWA 00 661, Poland, VAT number: PL5250005834,



24. **HOEGSKOLAN I BORAS (HB)**, established in ALLEGATAN 1, BORAS 50190, Sweden, VAT number: SE202100313801,
25. **GEOPONIKO PANEPISTIMION ATHINON (AUA)**, established in IERA ODOS 75, ATHINA 11855, Greece, VAT number: EL090042767,
26. **ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS (CERTH)**, established in CHARILAOU THERMI ROAD 6 KM, THERMI THESSALONIKI 57001, Greece, VAT number: EL099785242,
27. **PANEPISTIMIO THESSALIAS (UTH)**, established in ARGONAFTON FILELLINON, VOLOS 38221, Greece, VAT number: EL090055634,
28. **ASSOCIACAO DO INSTITUTO SUPERIOR TECNICO PARA A INVESTIGACAO E DESENVOLVIMENTO (IST)**, established in AVENIDA ROVISCO PAIS 1, LISBOA 1049 001, Portugal, VAT number: PT509830072,
29. **VELEUCILISTE VELIKA GORICA (UASVG)**, established in ZAGREBACKA 5, VELIKA GORICA 10410, Croatia, VAT number: HR09032023114,
30. **USTAV INFORMATIKY, SLOVENSKA AKADEMIA VIED (UISAV)**, established in DUBRAVSKA CESTA 9, BRATISLAVA 845 07, Slovakia,
31. **POMPIERS DE L'URGENCE INTERNATIONALE (PUI)**, established in 1 AVENUE DE L ABATTOIR, LIMOGES 87000, France,
32. **THE MAIN SCHOOL OF FIRE SERVICE (SGSP)**, established in SLOWACKIEGO 52/54, WARSZAWA 01-629, Poland, VAT number: PL1180035927,
33. **AGENZIA REGIONALE STRATEGICA PER LO SVILUPPO ECOSOSTENIBILE DEL TERRITORIO (ASSET)**, established in VIA GIOVANNI GENTILE 52, BARI 70126, Italy,
34. **LETS ITALIA SRLS (LETS)**, established in VIA PARINI 164, MODENA 41123, Italy, VAT number: IT03757240365,
35. **PARCO NATURALE REGIONALE DI TEPILORA (PNRT)**, established in VIA ATTILIO DEFFENU 69, BITTI 08021, Italy, VAT number: IT01465970919,
36. **FUNDATIA PENTRU SMURD (FptSMURD)**, established in STRADA GHEORGHE MARINESCU 50, MURES TIRGU MURES 540136, Romania, VAT number: RO28076033,
37. **ASOCIAȚIA FORESTIERILOR DIN ROMANIA ASFOR (ASFOR)**, established in SOS PIPERA 46 A SECTOR 2, BUCURESTI 020112, Romania, VAT number: RO6812970,
38. **KENTRO MELETON ASFALEIAS (KEMEA)**, established in P KANELLOPOULOU 4 ST, ATHINA 10177, Greece, VAT number: EL999333507,
39. **ELLINIKI OMADA DIASOSIS SOMATEIO (HRT)**, established in EMM PAPA 5, THESSALONIKI 54 248, Greece, VAT number: EL090197790,
40. **ARISTOTELIO PANEPISTIMIO THESSALONIKIS (AHEPA)**, established in KEDEA BUILDING, TRITIS SEPTEMVRIOU, ARISTOTLE UNIV CAMPUS, THESSALONIKI 54636, Greece, VAT number: EL090049627,



41. **OSPEDALE ISRAELITICO (OIR)**, established in P ZZA SAN BARTOLOMEO ALL ISO 21, ROMA 00186, Italy, VAT number: IT02133341004,
42. **PERIFERIA STEREAS ELLADAS (PSTE)**, established in YPSILANDI 1, LAMIA 35131, Greece, VAT number: EL997947718,
43. **HASICSKY ZACHRANNY SBOR MORAVSKOSLEZSKEHO KRAJE (FRS MB)**, established in VYSKOVICKA 40 ZABREH, OSTRAVA 700 30, Czech Republic, VAT number: CZ70884561,
44. **HRVATSKA VATROGASNA ZAJEDNICA (HVZ)**, established in SELSKA CESTA 90A, ZAGREB 10000, Croatia, VAT number: HR08474627795,
45. **TECHNICKA UNIVERZITA VO ZVOLENE (TUZVO)**, established in T G MASARYKA 24, ZVOLEN 960 01, Slovakia, VAT number: SK2020474808,
46. **OBCIANSKE ZDRUZENIE PLAMEN BADIN (Plamen)**, established in HLINY 426 7, BADIN 976 32, Slovakia,
47. **YAYASAN AMIKOM YOGYAKARTA (AMIKOM)**, established in JL RINGROAD UTARA, DESA CONDONGCATUR, KECAMATAN DEPOK, KABUPATEN SLEMAN, PROPINSI DAERAH ISTIMEWA YOGYAKARTA, SLEMAN 55283, Indonesia, VAT number: ID016951071542000,
48. **COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION (CSIRO)**, established in CLUNIES ROSS STREET CSIRO BLACK MOUNTAIN SCIENCE AND INNOVATION PARK, ACTON ACT 2601, Australia, VAT number: AU41687119230,
49. **UNIVERSIDADE FEDERAL DO RIO DE JANEIRO (UFRJ)**, established in AV BRIGADEIRO TROMPOWSKI SN 2, RIO DE JANEIRO 21941 590, Brazil,

Unless otherwise specified, references to ‘beneficiary’ or ‘beneficiaries’ include the coordinator.

The parties referred to above have agreed to enter into the Agreement under the terms and conditions below.

By signing the Agreement or the Accession Form, the beneficiaries accept the grant and agree to implement it under their own responsibility and in accordance with the Agreement, with all the obligations and conditions it sets out.



The Agreement is composed of:

Terms and Conditions

Annex 1 Description of the action

Annex 2 Estimated budget for the action

 2a Additional information on the estimated budget

Annex 3 Accession Forms

Annex 4 Model for the financial statements

Annex 5 Model for the certificate on the financial statements

Annex 6 Model for the certificate on the methodology



TERMS AND CONDITIONS

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CHAPTER 1 GENERAL

ARTICLE 1 — SUBJECT OF THE AGREEMENT

This Agreement sets out the rights and obligations and the terms and conditions applicable to the grant awarded to the beneficiaries for implementing the action set out in Chapter 2.

CHAPTER 2 ACTION

ARTICLE 2 — ACTION TO BE IMPLEMENTED

The grant is awarded for the action entitled '**Integrated Technological and Information Platform for wildfire Management**' — '**SILVANUS**' ('action'), as described in Annex 1.

ARTICLE 3 — DURATION AND STARTING DATE OF THE ACTION

The duration of the action will be **42 months** as of the first day of the month following the date the Agreement enters into force (see Article 58) ('**starting date of the action**').

ARTICLE 4 — ESTIMATED BUDGET AND BUDGET TRANSFERS

4.1 Estimated budget

The '**estimated budget**' for the action is set out in Annex 2.

It contains the estimated eligible costs and the forms of costs, broken down by beneficiary (and linked third party) and budget category (see Articles 5, 6, and 14).

4.2 Budget transfers

The estimated budget breakdown indicated in Annex 2 may be adjusted — without an amendment (see Article 55) — by transfers of amounts between beneficiaries, budget categories and/or forms of costs set out in Annex 2, if the action is implemented as described in Annex 1.

However, the beneficiaries may not add costs relating to subcontracts not provided for in Annex 1, unless such additional subcontracts are approved by an amendment or in accordance with Article 13.

CHAPTER 3 GRANT

ARTICLE 5 — GRANT AMOUNT, FORM OF GRANT, REIMBURSEMENT RATES AND FORMS OF COSTS

5.1 Maximum grant amount

The '**maximum grant amount**' is **EUR 19 902 190.26** (nineteen million nine hundred and two thousand one hundred and ninety EURO and twenty six eurocents).

5.2 Form of grant, reimbursement rates and forms of costs



The grant reimburses **100% of the eligible costs of the beneficiaries that are non-profit legal entities and 70% of the eligible costs of the beneficiaries and the affiliated entities that are profit legal entities** (see Article 6) ('reimbursement of eligible costs grant') (see Annex 2).

The estimated eligible costs of the action are EUR **24 186 845.00** (twenty four million one hundred and eighty six thousand eight hundred and forty five EURO).

Eligible costs (see Article 6) must be declared under the following forms ('**forms of costs**'):

(a) for **direct personnel costs**:

- as actually incurred costs ('**actual costs**') or
- on the basis of an amount per unit calculated by the beneficiary in accordance with its usual cost accounting practices ('**unit costs**').

Personnel costs for SME owners or beneficiaries that are natural persons not receiving a salary (see Article 6.2, Points A.4 and A.5) must be declared on the basis of the amount per unit set out in Annex 2a (**unit costs**);

(b) for **direct costs for subcontracting**: as actually incurred costs (**actual costs**);

(c) for **direct costs of providing financial support to third parties**: not applicable;

(d) for **other direct costs**:

- for costs of internally invoiced goods and services: on the basis of an amount per unit calculated by the beneficiary in accordance with its usual cost accounting practices ('**unit costs**');
- for all other costs: as actually incurred costs (**actual costs**);

(e) for **indirect costs**: on the basis of a flat-rate applied as set out in Article 6.2, Point E ('**flat-rate costs**');

(f) **specific cost category(ies)**: not applicable.

5.3 Final grant amount — Calculation

The '**final grant amount**' depends on the actual extent to which the action is implemented in accordance with the Agreement's terms and conditions.

This amount is calculated by the Agency — when the payment of the balance is made (see Article 21.4) — in the following steps:

Step 1 — Application of the reimbursement rates to the eligible costs

Step 2 — Limit to the maximum grant amount

Step 3 — Reduction due to the no-profit rule

Step 4 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations



5.3.1 Step 1 — Application of the reimbursement rates to the eligible costs

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) declared by the beneficiaries and linked third parties (see Article 20) and approved by the Agency (see Article 21).

5.3.2 Step 2 — Limit to the maximum grant amount

If the amount obtained following Step 1 is higher than the maximum grant amount set out in Article 5.1, it will be limited to the latter.

5.3.3 Step 3 — Reduction due to the no-profit rule

The grant must not produce a profit.

‘**Profit**’ means the surplus of the amount obtained following Steps 1 and 2 plus the action’s total receipts, over the action’s total eligible costs.

The ‘**action’s total eligible costs**’ are the consolidated total eligible costs approved by the Agency.

The ‘**action’s total receipts**’ are the consolidated total receipts generated during its duration (see Article 3).

The following are considered **receipts**:

- (a) income generated by the action; if the income is generated from selling equipment or other assets purchased under the Agreement, the receipt is up to the amount declared as eligible under the Agreement;
- (b) financial contributions given by third parties to the beneficiary or to a linked third party specifically to be used for the action, and
- (c) in-kind contributions provided by third parties free of charge and specifically to be used for the action, if they have been declared as eligible costs.

The following are however not considered receipts:

- (a) income generated by exploiting the action’s results (see Article 28);
- (b) financial contributions by third parties, if they may be used to cover costs other than the eligible costs (see Article 6);
- (c) financial contributions by third parties with no obligation to repay any amount unused at the end of the period set out in Article 3.

If there is a profit, it will be deducted from the amount obtained following Steps 1 and 2.

5.3.4 Step 4 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations — Reduced grant amount — Calculation

If the grant is reduced (see Article 43), the Agency will calculate the reduced grant amount by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors,



irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the maximum grant amount set out in Article 5.1.

The final grant amount will be the lower of the following two:

- the amount obtained following Steps 1 to 3 or
- the reduced grant amount following Step 4.

5.4 Revised final grant amount — Calculation

If — after the payment of the balance (in particular, after checks, reviews, audits or investigations; see Article 22) — the Agency rejects costs (see Article 42) or reduces the grant (see Article 43), it will calculate the ‘**revised final grant amount**’ for the beneficiary concerned by the findings.

This amount is calculated by the Agency on the basis of the findings, as follows:

- in case of **rejection of costs**: by applying the reimbursement rate to the revised eligible costs approved by the Agency for the beneficiary concerned;
- in case of **reduction of the grant**: by calculating the concerned beneficiary’s share in the grant amount reduced in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations (see Article 43.2).

In case of **rejection of costs and reduction of the grant**, the revised final grant amount for the beneficiary concerned will be the lower of the two amounts above.

ARTICLE 6 — ELIGIBLE AND INELIGIBLE COSTS

6.1 General conditions for costs to be eligible

‘**Eligible costs**’ are costs that meet the following criteria:

(a) for actual costs:

- (i) they must be actually incurred by the beneficiary;
- (ii) they must be incurred in the period set out in Article 3, with the exception of costs relating to the submission of the periodic report for the last reporting period and the final report (see Article 20);
- (iii) they must be indicated in the estimated budget set out in Annex 2;
- (iv) they must be incurred in connection with the action as described in Annex 1 and necessary for its implementation;
- (v) they must be identifiable and verifiable, in particular recorded in the beneficiary’s accounts in accordance with the accounting standards applicable in the country where the beneficiary is established and with the beneficiary’s usual cost accounting practices;
- (vi) they must comply with the applicable national law on taxes, labour and social security, and



(vii) they must be reasonable, justified and must comply with the principle of sound financial management, in particular regarding economy and efficiency;

(b) for unit costs:

(i) they must be calculated as follows:

{amounts per unit set out in Annex 2a or calculated by the beneficiary in accordance with its usual cost accounting practices (see Article 6.2, Point A and Article 6.2.D.5)}

multiplied by

the number of actual units};

(ii) the number of actual units must comply with the following conditions:

- the units must be actually used or produced in the period set out in Article 3;
- the units must be necessary for implementing the action or produced by it, and
- the number of units must be identifiable and verifiable, in particular supported by records and documentation (see Article 18);

(c) for flat-rate costs:

(i) they must be calculated by applying the flat-rate set out in Annex 2, and

(ii) the costs (actual costs or unit costs) to which the flat-rate is applied must comply with the conditions for eligibility set out in this Article.

6.2 Specific conditions for costs to be eligible

Costs are eligible if they comply with the general conditions (see above) and the specific conditions set out below for each of the following budget categories:

- A. direct personnel costs;
- B. direct costs of subcontracting;
- C. not applicable;
- D. other direct costs;
- E. indirect costs;
- F. not applicable.

‘Direct costs’ are costs that are directly linked to the action implementation and can therefore be attributed to it directly. They must not include any indirect costs (see Point E below).

‘Indirect costs’ are costs that are not directly linked to the action implementation and therefore cannot be attributed directly to it.

A. Direct personnel costs

Types of eligible personnel costs



A.1 Personnel costs are eligible, if they are related to personnel working for the beneficiary under an employment contract (or equivalent appointing act) and assigned to the action ('**costs for employees (or equivalent)**'). They must be limited to salaries (including during parental leave), social security contributions, taxes and other costs included in the **remuneration**, if they arise from national law or the employment contract (or equivalent appointing act).

Beneficiaries that are non-profit legal entities¹ may also declare as personnel costs **additional remuneration** for personnel assigned to the action (including payments on the basis of supplementary contracts regardless of their nature), if:

- (a) it is part of the beneficiary's usual remuneration practices and is paid in a consistent manner whenever the same kind of work or expertise is required;
- (b) the criteria used to calculate the supplementary payments are objective and generally applied by the beneficiary, regardless of the source of funding used.

'Additional remuneration' means any part of the remuneration which exceeds what the person would be paid for time worked in projects funded by national schemes.

Additional remuneration for personnel assigned to the action is eligible up to the following amount:

- (a) if the person works full time and exclusively on the action during the full year: up to EUR 8 000;
- (b) if the person works exclusively on the action but not full-time or not for the full year: up to the corresponding pro-rata amount of EUR 8 000, or
- (c) if the person does not work exclusively on the action: up to a pro-rata amount calculated as follows:

{ {EUR 8 000

divided by

the number of annual productive hours (see below)},

multiplied by

the number of hours that the person has worked on the action during the year}.

A.2 The **costs for natural persons working under a direct contract** with the beneficiary other than an employment contract are eligible personnel costs, if:

- (a) the person works under conditions similar to those of an employee (in particular regarding the way the work is organised, the tasks that are performed and the premises where they are performed);
- (b) the result of the work carried out belongs to the beneficiary (unless exceptionally agreed otherwise), and

¹ For the definition, see Article 2.1(14) of the Rules for Participation Regulation No 1290/2013: '**non-profit legal entity**' means a legal entity which by its legal form is non-profit-making or which has a legal or statutory obligation not to distribute profits to its shareholders or individual members.



- (c) the costs are not significantly different from those for personnel performing similar tasks under an employment contract with the beneficiary.

A.3 The costs of personnel seconded by a third party against payment are eligible personnel costs, if the conditions in Article 11.1 are met.

A.4 Costs of owners of beneficiaries that are small and medium-sized enterprises ('**SME owners**') who are working on the action and who do not receive a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2a multiplied by the number of actual hours worked on the action.

A.5 Costs of ‘beneficiaries that are natural persons’ not receiving a salary are eligible personnel costs, if they correspond to the amount per unit set out in Annex 2a multiplied by the number of actual hours worked on the action.

Calculation

Personnel costs must be calculated by the beneficiaries as follows:

{ {hourly rate
multiplied by
the number of actual hours worked on the action},
plus
for non-profit legal entities: additional remuneration to personnel assigned to the action under the
conditions set out above (Point A.1)}.

The number of actual hours declared for a person must be identifiable and verifiable (see Article 18).

The total number of hours declared in EU or Euratom grants, for a person for a year, cannot be higher than the annual productive hours used for the calculations of the hourly rate. Therefore, the maximum number of hours that can be declared for the grant are:

{number of annual productive hours for the year (see below)
minus
total number of hours declared by the beneficiary, for that person in that year, for other EU or Euratom
grants}.

The ‘**hourly rate**’ is one of the following:

(a) for personnel costs declared as **actual costs** (i.e. budget categories A.1, A.2, A.3): the hourly rate is calculated *per full financial year*, as follows:

{actual annual personnel costs (excluding additional remuneration) for the person
divided by
number of annual productive hours}.

using the personnel costs and the number of productive hours for each full financial year covered by the reporting period concerned. If a financial year is not closed at the end of the



reporting period, the beneficiaries must use the hourly rate of the last closed financial year available.

For the ‘number of annual productive hours’, the beneficiaries may choose one of the following:

- (i) ‘fixed number of hours’: 1 720 hours for persons working full time (or corresponding pro-rata for persons not working full time);
- (ii) ‘individual annual productive hours’: the total number of hours worked by the person in the year for the beneficiary, calculated as follows:

{annual workable hours of the person (according to the employment contract, applicable collective labour agreement or national law)}

plus

overtime worked

minus

absences (such as sick leave and special leave)}.

‘Annual workable hours’ means the period during which the personnel must be working, at the employer’s disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation.

If the contract (or applicable collective labour agreement or national working time legislation) does not allow to determine the annual workable hours, this option cannot be used;

- (iii) ‘standard annual productive hours’: the ‘standard number of annual hours’ generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the ‘standard annual workable hours’.

If there is no applicable reference for the standard annual workable hours, this option cannot be used.

For all options, the actual time spent on **parental leave** by a person assigned to the action may be deducted from the number of annual productive hours.

As an alternative, beneficiaries may calculate the hourly rate *per month*, as follows:

{actual monthly personnel cost (excluding additional remuneration) for the person

divided by

{number of annual productive hours / 12)}

using the personnel costs for each month and (one twelfth of) the annual productive hours calculated according to either option (i) or (iii) above, i.e.:

- fixed number of hours or
- standard annual productive hours.



Time spent on **parental leave** may not be deducted when calculating the hourly rate per month. However, beneficiaries may declare personnel costs incurred in periods of parental leave in proportion to the time the person worked on the action in that financial year.

If parts of a basic remuneration are generated over a period longer than a month, the beneficiaries may include only the share which is generated in the month (irrespective of the amount actually paid for that month).

Each beneficiary must use only one option (per full financial year or per month) for each full financial year;

(b) for personnel costs declared on the basis of **unit costs** (i.e. budget categories A.1, A.2, A.4, A.5): the hourly rate is one of the following:

- (i) for SME owners or beneficiaries that are natural persons: the hourly rate set out in Annex 2a (see Points A.4 and A.5 above), or
- (ii) for personnel costs declared on the basis of the beneficiary's usual cost accounting practices: the hourly rate calculated by the beneficiary in accordance with its usual cost accounting practices, if:
 - the cost accounting practices used are applied in a consistent manner, based on objective criteria, regardless of the source of funding;
 - the hourly rate is calculated using the actual personnel costs recorded in the beneficiary's accounts, excluding any ineligible cost or costs included in other budget categories.

The actual personnel costs may be adjusted by the beneficiary on the basis of budgeted or estimated elements. Those elements must be relevant for calculating the personnel costs, reasonable and correspond to objective and verifiable information;

and

- the hourly rate is calculated using the number of annual productive hours (see above).

B. Direct costs of subcontracting (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if the conditions in Article 13.1.1 are met.

C. Direct costs of providing financial support to third parties

Not applicable

D. Other direct costs

D.1 Travel costs and related subsistence allowances (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible if they are in line with the beneficiary's usual practices on travel.

D.2 The depreciation costs of equipment, infrastructure or other assets (new or second-hand) as recorded in the beneficiary's accounts are eligible, if they were purchased in accordance with



Article 10.1.1 and written off in accordance with international accounting standards and the beneficiary's usual accounting practices.

The **costs of renting or leasing** equipment, infrastructure or other assets (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are also eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets and do not include any financing fees.

The costs of equipment, infrastructure or other assets **contributed in-kind against payment** are eligible, if they do not exceed the depreciation costs of similar equipment, infrastructure or assets, do not include any financing fees and if the conditions in Article 11.1 are met.

The only portion of the costs that will be taken into account is that which corresponds to the duration of the action and rate of actual use for the purposes of the action.

D.3 Costs of other goods and services (including related duties, taxes and charges such as non-deductible value added tax (VAT) paid by the beneficiary) are eligible, if they are:

- (a) purchased specifically for the action and in accordance with Article 10.1.1 or
- (b) contributed in kind against payment and in accordance with Article 11.1.

Such goods and services include, for instance, consumables and supplies, dissemination (including open access), protection of results, certificates on the financial statements (if they are required by the Agreement), certificates on the methodology, translations and publications.

D.4 Capitalised and operating costs of ‘large research infrastructure’² directly used for the action are eligible, if:

- (a) the value of the large research infrastructure represents at least 75% of the total fixed assets (at historical value in its last closed balance sheet before the date of the signature of the Agreement or as determined on the basis of the rental and leasing costs of the research infrastructure³);
- (b) the beneficiary’s methodology for declaring the costs for large research infrastructure has been positively assessed by the Commission (**‘ex-ante assessment’**);
- (c) the beneficiary declares as direct eligible costs only the portion which corresponds to the duration of the action and the rate of actual use for the purposes of the action, and
- (d) they comply with the conditions as further detailed in the annotations to the H2020 grant agreements.

² ‘**Large research infrastructure**’ means research infrastructure of a total value of at least EUR 20 million, for a beneficiary, calculated as the sum of historical asset values of each individual research infrastructure of that beneficiary, as they appear in its last closed balance sheet before the date of the signature of the Agreement or as determined on the basis of the rental and leasing costs of the research infrastructure.

³ For the definition, see Article 2(6) of the H2020 Framework Programme Regulation No 1291/2013: ‘**Research infrastructure**’ are facilities, resources and services that are used by the research communities to conduct research and foster innovation in their fields. Where relevant, they may be used beyond research, e.g. for education or public services. They include: major scientific equipment (or sets of instruments); knowledge-based resources such as collections, archives or scientific data; e-infrastructures such as data and computing systems and communication networks; and any other infrastructure of a unique nature essential to achieve excellence in research and innovation. Such infrastructures may be ‘single-sited’, ‘virtual’ or ‘distributed’.



D.5 Costs of internally invoiced goods and services directly used for the action are eligible, if:

- (a) they are declared on the basis of a unit cost calculated in accordance with the beneficiary's usual cost accounting practices;
- (b) the cost accounting practices used are applied in a consistent manner, based on objective criteria, regardless of the source of funding;
- (c) the unit cost is calculated using the actual costs for the good or service recorded in the beneficiary's accounts, excluding any ineligible cost or costs included in other budget categories.

The actual costs may be adjusted by the beneficiary on the basis of budgeted or estimated elements. Those elements must be relevant for calculating the costs, reasonable and correspond to objective and verifiable information;

- (d) the unit cost excludes any costs of items which are not directly linked to the production of the invoiced goods or service.

'Internally invoiced goods and services' means goods or services which are provided by the beneficiary directly for the action and which the beneficiary values on the basis of its usual cost accounting practices.

E. Indirect costs

Indirect costs are eligible if they are declared on the basis of the flat-rate of 25% of the eligible direct costs (see Article 5.2 and Points A to D above), from which are excluded:

- (a) costs of subcontracting and
- (b) costs of in-kind contributions provided by third parties which are not used on the beneficiary's premises;
- (c) not applicable;
- (d) not applicable.

Beneficiaries receiving an operating grant⁴ financed by the EU or Euratom budget cannot declare indirect costs for the period covered by the operating grant, unless they can demonstrate that the operating grant does not cover any costs of the action.

F. Specific cost category(ies)

Not applicable

6.3 Conditions for costs of linked third parties to be eligible

⁴ For the definition, see Article 121(1)(b) of Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 ('Financial Regulation No 966/2012')(OJ L 218, 26.10.2012, p.1): '**operating grant**' means direct financial contribution, by way of donation, from the budget in order to finance the functioning of a body which pursues an aim of general EU interest or has an objective forming part of and supporting an EU policy.



Costs incurred by linked third parties are eligible if they fulfil — *mutatis mutandis* — the general and specific conditions for eligibility set out in this Article (Article 6.1 and 6.2) and Article 14.1.1.

6.4 Conditions for in-kind contributions provided by third parties free of charge to be eligible

In-kind contributions provided free of charge are eligible direct costs (for the beneficiary or linked third party), if the costs incurred by the third party fulfil — *mutatis mutandis* — the general and specific conditions for eligibility set out in this Article (Article 6.1 and 6.2) and Article 12.1.

6.5 Ineligible costs

‘Ineligible costs’ are:

- (a) costs that do not comply with the conditions set out above (Article 6.1 to 6.4), in particular:
 - (i) costs related to return on capital;
 - (ii) debt and debt service charges;
 - (iii) provisions for future losses or debts;
 - (iv) interest owed;
 - (v) doubtful debts;
 - (vi) currency exchange losses;
 - (vii) bank costs charged by the beneficiary’s bank for transfers from the Agency;
 - (viii) excessive or reckless expenditure;
 - (ix) deductible VAT;
 - (x) costs incurred during suspension of the implementation of the action (see Article 49);
- (b) costs declared under another EU or Euratom grant (including grants awarded by a Member State and financed by the EU or Euratom budget and grants awarded by bodies other than the Agency for the purpose of implementing the EU or Euratom budget); in particular, indirect costs if the beneficiary is already receiving an operating grant financed by the EU or Euratom budget in the same period, unless it can demonstrate that the operating grant does not cover any costs of the action.

6.6 Consequences of declaration of ineligible costs

Declared costs that are ineligible will be rejected (see Article 42).

This may also lead to any of the other measures described in Chapter 6.

CHAPTER 4 RIGHTS AND OBLIGATIONS OF THE PARTIES



SECTION 1 RIGHTS AND OBLIGATIONS RELATED TO IMPLEMENTING THE ACTION

ARTICLE 7 — GENERAL OBLIGATION TO PROPERLY IMPLEMENT THE ACTION

7.1 General obligation to properly implement the action

The beneficiaries must implement the action as described in Annex 1 and in compliance with the provisions of the Agreement and all legal obligations under applicable EU, international and national law.

7.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 8 — RESOURCES TO IMPLEMENT THE ACTION — THIRD PARTIES INVOLVED IN THE ACTION

The beneficiaries must have the appropriate resources to implement the action.

If it is necessary to implement the action, the beneficiaries may:

- purchase goods, works and services (see Article 10);
- use in-kind contributions provided by third parties against payment (see Article 11);
- use in-kind contributions provided by third parties free of charge (see Article 12);
- call upon subcontractors to implement action tasks described in Annex 1 (see Article 13);
- call upon linked third parties to implement action tasks described in Annex 1 (see Article 14);
- call upon international partners to implement action tasks described in Annex 1 (see Article 14a).

In these cases, the beneficiaries retain sole responsibility towards the Agency and the other beneficiaries for implementing the action.

ARTICLE 9 — IMPLEMENTATION OF ACTION TASKS BY BENEFICIARIES NOT RECEIVING EU FUNDING

Not applicable

ARTICLE 10 — PURCHASE OF GOODS, WORKS OR SERVICES

10.1 Rules for purchasing goods, works or services

10.1.1 If necessary to implement the action, the beneficiaries may purchase goods, works or services.



The beneficiaries must make such purchases ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).

The beneficiaries must ensure that the Agency, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their contractors.

10.1.2 Beneficiaries that are ‘contracting authorities’ within the meaning of Directive 2004/18/EC⁵ (or 2014/24/EU⁶) or ‘contracting entities’ within the meaning of Directive 2004/17/EC⁷ (or 2014/25/EU⁸) must comply with the applicable national law on public procurement.

10.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 10.1.1, the costs related to the contract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 10.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 11 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES AGAINST PAYMENT

11.1 Rules for the use of in-kind contributions against payment

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties against payment.

The beneficiaries may declare costs related to the payment of in-kind contributions as eligible (see Article 6.1 and 6.2), up to the third parties’ costs for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services.

The third parties and their contributions must be set out in Annex 1. The Agency may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the Agency, the Commission, the European Court of Auditors

⁵ Directive 2004/18/EC of the European Parliament and of the Council of 31 March 2004 on the coordination of procedures for the award of public work contracts, public supply contracts and public service contracts (OJ L 134, 30.04.2004, p. 114).

⁶ Directive 2014/24/EU of the European Parliament and of the Council of 26 February 2014 on public procurement and repealing Directive 2004/18/EC. (OJ L 94, 28.03.2014, p. 65).

⁷ Directive 2004/17/EC of the European Parliament and of the Council of 31 March 2004 coordinating the procurement procedures of entities operating in the water, energy, transport and postal services sectors (OJ L 134, 30.04.2004, p. 1)

⁸ Directive 2014/25/EU of the European Parliament and of the Council of 26 February 2014 on procurement by entities operating in the water, energy, transport and postal services sectors and repealing Directive 2004/17/EC (OJ L 94, 28.03.2014, p. 243).



(ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

11.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the costs related to the payment of the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 12 — USE OF IN-KIND CONTRIBUTIONS PROVIDED BY THIRD PARTIES FREE OF CHARGE

12.1 Rules for the use of in-kind contributions free of charge

If necessary to implement the action, the beneficiaries may use in-kind contributions provided by third parties free of charge.

The beneficiaries may declare costs incurred by the third parties for the seconded persons, contributed equipment, infrastructure or other assets or other contributed goods and services as eligible in accordance with Article 6.4.

The third parties and their contributions must be set out in Annex 1. The Agency may however approve in-kind contributions not set out in Annex 1 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- their use does not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the Agency, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards the third parties.

12.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the costs incurred by the third parties related to the in-kind contribution will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 13 — IMPLEMENTATION OF ACTION TASKS BY SUBCONTRACTORS

13.1 Rules for subcontracting action tasks

13.1.1 If necessary to implement the action, the beneficiaries may award subcontracts covering the implementation of certain action tasks described in Annex 1.

Subcontracting may cover only a limited part of the action.

The beneficiaries must award the subcontracts ensuring the best value for money or, if appropriate, the lowest price. In doing so, they must avoid any conflict of interests (see Article 35).



The tasks to be implemented and the estimated cost for each subcontract must be set out in Annex 1 and the total estimated costs of subcontracting per beneficiary must be set out in Annex 2. The Agency may however approve subcontracts not set out in Annex 1 and 2 without amendment (see Article 55), if:

- they are specifically justified in the periodic technical report and
- they do not entail changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

The beneficiaries must ensure that the Agency, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their subcontractors.

13.1.2 The beneficiaries must ensure that their obligations under Articles 35, 36, 38 and 46 also apply to the subcontractors.

Beneficiaries that are ‘contracting authorities’ within the meaning of Directive 2004/18/EC (or 2014/24/EU) or ‘contracting entities’ within the meaning of Directive 2004/17/EC (or 2014/25/EU) must comply with the applicable national law on public procurement.

13.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 13.1.1, the costs related to the subcontract concerned will be ineligible (see Article 6) and will be rejected (see Article 42).

If a beneficiary breaches any of its obligations under Article 13.1.2, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 14 — IMPLEMENTATION OF ACTION TASKS BY LINKED THIRD PARTIES

14.1 Rules for calling upon linked third parties to implement part of the action

14.1.1 The following **affiliated entities¹⁰** and **third parties with a legal link to a beneficiary¹¹** (**‘linked third parties’**) may implement the action tasks attributed to them in Annex 1:

¹⁰ For the definition see Article 2.1(2) Rules for Participation Regulation No 1290/2013: ‘affiliated entity’ means any legal entity that is:

- under the direct or indirect control of a participant, or
- under the same direct or indirect control as the participant, or
- directly or indirectly controlling a participant.

‘Control’ may take any of the following forms:

- (a) the direct or indirect holding of more than 50% of the nominal value of the issued share capital in the legal entity concerned, or of a majority of the voting rights of the shareholders or associates of that entity;
- (b) the direct or indirect holding, in fact or in law, of decision-making powers in the legal entity concerned.

However the following relationships between legal entities shall not in themselves be deemed to constitute controlling relationships:

- (a) the same public investment corporation, institutional investor or venture-capital company has a direct or indirect holding of more than 50% of the nominal value of the issued share capital or a majority of voting rights of the shareholders or associates;
- (b) the legal entities concerned are owned or supervised by the same public body.



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The linked third parties may declare as eligible the costs they incur for implementing the action tasks in accordance with Article 6.3.

The beneficiaries must ensure that the Agency, the Commission, the European Court of Auditors (ECA) and the European Anti-Fraud Office (OLAF) can exercise their rights under Articles 22 and 23 also towards their linked third parties.

14.1.2 The beneficiaries must ensure that their obligations under Articles 18, 20, 35, 36 and 38 also apply to their linked third parties.

14.2 Consequences of non-compliance

If any obligation under Article 14.1.1 is breached, the costs of the linked third party will be ineligible (see Article 6) and will be rejected (see Article 42).

If any obligation under Article 14.1.2 is breached, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 14a — IMPLEMENTATION OF ACTION TASKS BY INTERNATIONAL PARTNERS

Not applicable

ARTICLE 15 — FINANCIAL SUPPORT TO THIRD PARTIES

15.1 Rules for providing financial support to third parties

Not applicable

15.2 Financial support in the form of prizes

Not applicable

15.3 Consequences of non-compliance

Not applicable

ARTICLE 16 — PROVISION OF TRANS-NATIONAL OR VIRTUAL ACCESS TO RESEARCH INFRASTRUCTURE

16.1 Rules for providing trans-national access to research infrastructure

Not applicable

16.2 Rules for providing virtual access to research infrastructure

¹¹ ‘Third party with a legal link to a beneficiary’ is any legal entity which has a legal link to the beneficiary implying collaboration that is not limited to the action.



Not applicable

16.3 Consequences of non-compliance

Not applicable

SECTION 2 RIGHTS AND OBLIGATIONS RELATED TO THE GRANT ADMINISTRATION

ARTICLE 17 — GENERAL OBLIGATION TO INFORM

17.1 General obligation to provide information upon request

The beneficiaries must provide — during implementation of the action or afterwards and in accordance with Article 41.2 — any information requested in order to verify eligibility of the costs, proper implementation of the action and compliance with any other obligation under the Agreement.

17.2 Obligation to keep information up to date and to inform about events and circumstances likely to affect the Agreement

Each beneficiary must keep information stored in the Participant Portal Beneficiary Register (via the electronic exchange system; see Article 52) up to date, in particular, its name, address, legal representatives, legal form and organisation type.

Each beneficiary must immediately inform the coordinator — which must immediately inform the Agency and the other beneficiaries — of any of the following:

- (a) **events** which are likely to affect significantly or delay the implementation of the action or the EU's financial interests, in particular:
 - (i) changes in its legal, financial, technical, organisational or ownership situation or those of its linked third parties and
 - (ii) changes in the name, address, legal form, organisation type of its linked third parties;
- (b) **circumstances** affecting:
 - (i) the decision to award the grant or
 - (ii) compliance with requirements under the Agreement.

17.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 18 — KEEPING RECORDS — SUPPORTING DOCUMENTATION

18.1 Obligation to keep records and other supporting documentation



The beneficiaries must — for a period of five years after the payment of the balance — keep records and other supporting documentation in order to prove the proper implementation of the action and the costs they declare as eligible.

They must make them available upon request (see Article 17) or in the context of checks, reviews, audits or investigations (see Article 22).

If there are on-going checks, reviews, audits, investigations, litigation or other pursuits of claims under the Agreement (including the extension of findings; see Article 22), the beneficiaries must keep the records and other supporting documentation until the end of these procedures.

The beneficiaries must keep the original documents. Digital and digitalised documents are considered originals if they are authorised by the applicable national law. The Agency may accept non-original documents if it considers that they offer a comparable level of assurance.

18.1.1 Records and other supporting documentation on the scientific and technical implementation

The beneficiaries must keep records and other supporting documentation on scientific and technical implementation of the action in line with the accepted standards in the respective field.

18.1.2 Records and other documentation to support the costs declared

The beneficiaries must keep the records and documentation supporting the costs declared, in particular the following:

- (a) for **actual costs**: adequate records and other supporting documentation to prove the costs declared, such as contracts, subcontracts, invoices and accounting records. In addition, the beneficiaries' usual cost accounting practices and internal control procedures must enable direct reconciliation between the amounts declared, the amounts recorded in their accounts and the amounts stated in the supporting documentation;
- (b) for **unit costs**: adequate records and other supporting documentation to prove the number of units declared. Beneficiaries do not need to identify the actual eligible costs covered or to keep or provide supporting documentation (such as accounting statements) to prove the amount per unit.

In addition, for **unit costs calculated in accordance with the beneficiary's usual cost accounting practices**, the beneficiaries must keep adequate records and documentation to prove that the cost accounting practices used comply with the conditions set out in Article 6.2.

The beneficiaries and linked third parties may submit to the Commission, for approval, a certificate (drawn up in accordance with Annex 6) stating that their usual cost accounting practices comply with these conditions ('**certificate on the methodology**'). If the certificate is approved, costs declared in line with this methodology will not be challenged subsequently, unless the beneficiaries have concealed information for the purpose of the approval.

- (c) for **flat-rate costs**: adequate records and other supporting documentation to prove the eligibility of the costs to which the flat-rate is applied. The beneficiaries do not need to identify the costs covered or provide supporting documentation (such as accounting statements) to prove the amount declared at a flat-rate.



In addition, for **personnel costs** (declared as actual costs or on the basis of unit costs), the beneficiaries must keep **time records** for the number of hours declared. The time records must be in writing and approved by the persons working on the action and their supervisors, at least monthly. In the absence of reliable time records of the hours worked on the action, the Agency may accept alternative evidence supporting the number of hours declared, if it considers that it offers an adequate level of assurance.

As an exception, for **persons working exclusively on the action**, there is no need to keep time records, if the beneficiary signs a **declaration** confirming that the persons concerned have worked exclusively on the action.

For costs declared by linked third parties (see Article 14), it is the beneficiary that must keep the originals of the financial statements and the certificates on the financial statements of the linked third parties.

18.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, costs insufficiently substantiated will be ineligible (see Article 6) and will be rejected (see Article 42), and the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 19 — SUBMISSION OF DELIVERABLES

19.1 Obligation to submit deliverables

The coordinator must submit the ‘**deliverables**’ identified in Annex 1, in accordance with the timing and conditions set out in it.

19.2 Consequences of non-compliance

If the coordinator breaches any of its obligations under this Article, the Agency may apply any of the measures described in Chapter 6.

ARTICLE 20 — REPORTING — PAYMENT REQUESTS

20.1 Obligation to submit reports

The coordinator must submit to the Agency (see Article 52) the technical and financial reports set out in this Article. These reports include requests for payment and must be drawn up using the forms and templates provided in the electronic exchange system (see Article 52).

20.2 Reporting periods

The action is divided into the following ‘**reporting periods**’:

- RP1: from month 1 to month 18
- RP2: from month 19 to month 30
- RP3: from month 31 to month 42

20.3 Periodic reports — Requests for interim payments



The coordinator must submit a periodic report within 60 days following the end of each reporting period.

The **periodic report** must include the following:

(a) a '**periodic technical report**' containing:

- (i) an **explanation of the work carried out** by the beneficiaries;
- (ii) an **overview of the progress** towards the objectives of the action, including milestones and deliverables identified in Annex 1.

This report must include explanations justifying the differences between work expected to be carried out in accordance with Annex 1 and that actually carried out.

The report must detail the exploitation and dissemination of the results and — if required in Annex 1 — an updated '**plan for the exploitation and dissemination of the results**'.

The report must indicate the communication activities;

- (iii) a **summary** for publication by the Agency;
- (iv) the answers to the '**questionnaire**', covering issues related to the action implementation and the economic and societal impact, notably in the context of the Horizon 2020 key performance indicators and the Horizon 2020 monitoring requirements;

(b) a '**periodic financial report**' containing:

- (i) an '**individual financial statement**' (see Annex 4) from each beneficiary and from each linked third party, for the reporting period concerned.

The individual financial statement must detail the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) for each budget category (see Annex 2).

The beneficiaries and linked third parties must declare all eligible costs, even if — for actual costs, unit costs and flat-rate costs — they exceed the amounts indicated in the estimated budget (see Annex 2). Amounts which are not declared in the individual financial statement will not be taken into account by the Agency.

If an individual financial statement is not submitted for a reporting period, it may be included in the periodic financial report for the next reporting period.

The individual financial statements of the last reporting period must also detail the **receipts of the action** (see Article 5.3.3).

Each beneficiary and each linked third party must **certify** that:

- the information provided is full, reliable and true;
- the costs declared are eligible (see Article 6);
- the costs can be substantiated by adequate records and supporting documentation



(see Article 18) that will be produced upon request (see Article 17) or in the context of checks, reviews, audits and investigations (see Article 22), and

- for the last reporting period: that all the receipts have been declared (see Article 5.3.3);
- (ii) an **explanation of the use of resources** and the information on subcontracting (see Article 13) and in-kind contributions provided by third parties (see Articles 11 and 12) from each beneficiary and from each linked third party, for the reporting period concerned;
- (iii) not applicable;
- (iv) a '**periodic summary financial statement**', created automatically by the electronic exchange system, consolidating the individual financial statements for the reporting period concerned and including — except for the last reporting period — the **request for interim payment**.

20.4 Final report — Request for payment of the balance

In addition to the periodic report for the last reporting period, the coordinator must submit the final report within 60 days following the end of the last reporting period.

The **final report** must include the following:

- (a) a '**final technical report**' with a **summary** for publication containing:
 - (i) an overview of the results and their exploitation and dissemination;
 - (ii) the conclusions on the action, and
 - (iii) the socio-economic impact of the action;
- (b) a '**final financial report**' containing:
 - (i) a '**final summary financial statement**', created automatically by the electronic exchange system, consolidating the individual financial statements for all reporting periods and including the **request for payment of the balance** and
 - (ii) a '**certificate on the financial statements**' (drawn up in accordance with Annex 5) for each beneficiary and for each linked third party, if it requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 5.2 and Article 6.2).

20.5 Information on cumulative expenditure incurred

Not applicable

20.6 Currency for financial statements and conversion into euro

Financial statements must be drafted in euro.

Beneficiaries and linked third parties with accounting established in a currency other than the euro



must convert the costs recorded in their accounts into euro, at the average of the daily exchange rates published in the C series of the *Official Journal of the European Union*, calculated over the corresponding reporting period.

If no daily euro exchange rate is published in the *Official Journal of the European Union* for the currency in question, they must be converted at the average of the monthly accounting rates published on the Commission's website, calculated over the corresponding reporting period.

Beneficiaries and linked third parties with accounting established in euro must convert costs incurred in another currency into euro according to their usual accounting practices.

20.7 Language of reports

All reports (technical and financial reports, including financial statements) must be submitted in the language of the Agreement.

20.8 Consequences of non-compliance

If the reports submitted do not comply with this Article, the Agency may suspend the payment deadline (see Article 47) and apply any of the other measures described in Chapter 6.

If the coordinator breaches its obligation to submit the reports and if it fails to comply with this obligation within 30 days following a written reminder, the Agency may terminate the Agreement (see Article 50) or apply any of the other measures described in Chapter 6.

ARTICLE 21 — PAYMENTS AND PAYMENT ARRANGEMENTS

21.1 Payments to be made

The following payments will be made to the coordinator:

- one **pre-financing payment**;
- one or more **interim payments**, on the basis of the request(s) for interim payment (see Article 20), and
- one **payment of the balance**, on the basis of the request for payment of the balance (see Article 20).

21.2 Pre-financing payment — Amount — Amount retained for the Guarantee Fund

The aim of the pre-financing is to provide the beneficiaries with a float.

It remains the property of the EU until the payment of the balance.

The amount of the pre-financing payment will be EUR **10 614 501.47** (ten million six hundred and fourteen thousand five hundred and one EURO and forty seven eurocents).

The Agency will — except if Article 48 applies — make the pre-financing payment to the coordinator within 30 days, either from the entry into force of the Agreement (see Article 58) or from 10 days before the starting date of the action (see Article 3), whichever is the latest.



An amount of EUR **995 109.51** (nine hundred and ninety five thousand one hundred and nine EURO and fifty one eurocents), corresponding to 5% of the maximum grant amount (see Article 5.1), is retained by the Agency from the pre-financing payment and transferred into the '**Guarantee Fund**'.

21.3 Interim payments — Amount — Calculation

Interim payments reimburse the eligible costs incurred for the implementation of the action during the corresponding reporting periods.

The Agency will pay to the coordinator the amount due as interim payment within 90 days from receiving the periodic report (see Article 20.3), except if Articles 47 or 48 apply.

Payment is subject to the approval of the periodic report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as interim payment** is calculated by the Agency in the following steps:

Step 1 — Application of the reimbursement rates

Step 2 — Limit to 90% of the maximum grant amount

21.3.1 Step 1 — Application of the reimbursement rates

The reimbursement rate(s) (see Article 5.2) are applied to the eligible costs (actual costs, unit costs and flat-rate costs; see Article 6) declared by the beneficiaries and the linked third parties (see Article 20) and approved by the Agency (see above) for the concerned reporting period.

21.3.2 Step 2 — Limit to 90% of the maximum grant amount

The total amount of pre-financing and interim payments must not exceed 90% of the maximum grant amount set out in Article 5.1. The maximum amount for the interim payment will be calculated as follows:

{90% of the maximum grant amount (see Article 5.1)}

minus

{pre-financing and previous interim payments} }.

21.4 Payment of the balance — Amount — Calculation — Release of the amount retained for the Guarantee Fund

The payment of the balance reimburses the remaining part of the eligible costs incurred by the beneficiaries for the implementation of the action.

If the total amount of earlier payments is greater than the final grant amount (see Article 5.3), the payment of the balance takes the form of a recovery (see Article 44).

If the total amount of earlier payments is lower than the final grant amount, the Agency will pay the balance within 90 days from receiving the final report (see Article 20.4), except if Articles 47 or 48 apply.



Payment is subject to the approval of the final report. Its approval does not imply recognition of the compliance, authenticity, completeness or correctness of its content.

The **amount due as the balance** is calculated by the Agency by deducting the total amount of pre-financing and interim payments (if any) already made, from the final grant amount determined in accordance with Article 5.3:

{final grant amount (see Article 5.3)
 minus
 {pre-financing and interim payments (if any) made}}.

At the payment of the balance, the amount retained for the Guarantee Fund (see above) will be released and:

- if the balance is positive: the amount released will be paid in full to the coordinator together with the amount due as the balance;
- if the balance is negative (payment of the balance taking the form of recovery): it will be deducted from the amount released (see Article 44.1.2). If the resulting amount:
 - is positive, it will be paid to the coordinator
 - is negative, it will be recovered.

The amount to be paid may however be offset — without the beneficiaries' consent — against any other amount owed by a beneficiary to the Agency, the Commission or another executive agency (under the EU or Euratom budget), up to the maximum EU contribution indicated, for that beneficiary, in the estimated budget (see Annex 2).

21.5 Notification of amounts due

When making payments, the Agency will formally notify to the coordinator the amount due, specifying whether it concerns an interim payment or the payment of the balance.

For the payment of the balance, the notification will also specify the final grant amount.

In the case of reduction of the grant or recovery of undue amounts, the notification will be preceded by the contradictory procedure set out in Articles 43 and 44.

21.6 Currency for payments

The Agency will make all payments in euro.

21.7 Payments to the coordinator — Distribution to the beneficiaries

Payments will be made to the coordinator.

Payments to the coordinator will discharge the Agency from its payment obligation.

The coordinator must distribute the payments between the beneficiaries without unjustified delay.

Pre-financing may however be distributed only:



- (a) if the minimum number of beneficiaries set out in the call for proposals has acceded to the Agreement (see Article 56) and
- (b) to beneficiaries that have acceded to the Agreement (see Article 56).

21.8 Bank account for payments

All payments will be made to the following bank account:

Name of bank: FIDEURAM INTESA SANPAOLO PRIVATE BANKING
 Full name of the account holder: UNIVERSITA' TELEMATICA PEGASO SRL
 IBAN code: IT47B0329601601000067370763

21.9 Costs of payment transfers

The cost of the payment transfers is borne as follows:

- the Agency bears the cost of transfers charged by its bank;
- the beneficiary bears the cost of transfers charged by its bank;
- the party causing a repetition of a transfer bears all costs of the repeated transfer.

21.10 Date of payment

Payments by the Agency are considered to have been carried out on the date when they are debited to its account.

21.11 Consequences of non-compliance

21.11.1 If the Agency does not pay within the payment deadlines (see above), the beneficiaries are entitled to **late-payment interest** at the rate applied by the European Central Bank (ECB) for its main refinancing operations in euros ('reference rate'), plus three and a half points. The reference rate is the rate in force on the first day of the month in which the payment deadline expires, as published in the C series of the *Official Journal of the European Union*.

If the late-payment interest is lower than or equal to EUR 200, it will be paid to the coordinator only upon request submitted within two months of receiving the late payment.

Late-payment interest is not due if all beneficiaries are EU Member States (including regional and local government authorities or other public bodies acting on behalf of a Member State for the purpose of this Agreement).

Suspension of the payment deadline or payments (see Articles 47 and 48) will not be considered as late payment.

Late-payment interest covers the period running from the day following the due date for payment (see above), up to and including the date of payment.

Late-payment interest is not considered for the purposes of calculating the final grant amount.



21.11.2 If the coordinator breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or the participation of the coordinator may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 22 — CHECKS, REVIEWS, AUDITS AND INVESTIGATIONS — EXTENSION OF FINDINGS

22.1 Checks, reviews and audits by the Agency and the Commission

22.1.1 Right to carry out checks

The Agency or the Commission will — during the implementation of the action or afterwards — check the proper implementation of the action and compliance with the obligations under the Agreement, including assessing deliverables and reports.

For this purpose the Agency or the Commission may be assisted by external persons or bodies.

The Agency or the Commission may also request additional information in accordance with Article 17. The Agency or the Commission may request beneficiaries to provide such information to it directly.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

22.1.2 Right to carry out reviews

The Agency or the Commission may — during the implementation of the action or afterwards — carry out reviews on the proper implementation of the action (including assessment of deliverables and reports), compliance with the obligations under the Agreement and continued scientific or technological relevance of the action.

Reviews may be started up to two years after the payment of the balance. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the review is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The Agency or the Commission may carry out reviews directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information and data in addition to deliverables and reports already submitted (including information on the use of resources). The Agency or the Commission may request beneficiaries to provide such information to it directly.

The coordinator or beneficiary concerned may be requested to participate in meetings, including with external experts.



For **on-the-spot** reviews, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the review findings, a '**review report**' will be drawn up.

The Agency or the Commission will formally notify the review report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations ('**contradictory review procedure**').

Reviews (including review reports) are in the language of the Agreement.

22.1.3 Right to carry out audits

The Agency or the Commission may — during the implementation of the action or afterwards — carry out audits on the proper implementation of the action and compliance with the obligations under the Agreement.

Audits may be started up to two years after the payment of the balance. They will be formally notified to the coordinator or beneficiary concerned and will be considered to have started on the date of the formal notification.

If the audit is carried out on a third party (see Articles 10 to 16), the beneficiary concerned must inform the third party.

The Agency or the Commission may carry out audits directly (using its own staff) or indirectly (using external persons or bodies appointed to do so). It will inform the coordinator or beneficiary concerned of the identity of the external persons or bodies. They have the right to object to the appointment on grounds of commercial confidentiality.

The coordinator or beneficiary concerned must provide — within the deadline requested — any information (including complete accounts, individual salary statements or other personal data) to verify compliance with the Agreement. The Agency or the Commission may request beneficiaries to provide such information to it directly.

For **on-the-spot** audits, the beneficiaries must allow access to their sites and premises, including to external persons or bodies, and must ensure that information requested is readily available.

Information provided must be accurate, precise and complete and in the format requested, including electronic format.

On the basis of the audit findings, a '**draft audit report**' will be drawn up.

The Agency or the Commission will formally notify the draft audit report to the coordinator or beneficiary concerned, which has 30 days to formally notify observations ('**contradictory audit procedure**'). This period may be extended by the Agency or the Commission in justified cases.

The '**final audit report**' will take into account observations by the coordinator or beneficiary concerned. The report will be formally notified to it.

Audits (including audit reports) are in the language of the Agreement.



The Agency or the Commission may also access the beneficiaries' statutory records for the periodical assessment of unit costs or flat-rate amounts.

22.2 Investigations by the European Anti-Fraud Office (OLAF)

Under Regulations No 883/2013¹⁶ and No 2185/96¹⁷ (and in accordance with their provisions and procedures), the European Anti-Fraud Office (OLAF) may — at any moment during implementation of the action or afterwards — carry out investigations, including on-the-spot checks and inspections, to establish whether there has been fraud, corruption or any other illegal activity affecting the financial interests of the EU.

22.3 Checks and audits by the European Court of Auditors (ECA)

Under Article 287 of the Treaty on the Functioning of the European Union (TFEU) and Article 161 of the Financial Regulation No 966/2012¹⁸, the European Court of Auditors (ECA) may — at any moment during implementation of the action or afterwards — carry out audits.

The ECA has the right of access for the purpose of checks and audits.

22.4 Checks, reviews, audits and investigations for international organisations

Not applicable

22.5 Consequences of findings in checks, reviews, audits and investigations — Extension of findings

22.5.1 Findings in this grant

Findings in checks, reviews, audits or investigations carried out in the context of this grant may lead to the rejection of ineligible costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44) or to any of the other measures described in Chapter 6.

Rejection of costs or reduction of the grant after the payment of the balance will lead to a revised final grant amount (see Article 5.4).

Findings in checks, reviews, audits or investigations may lead to a request for amendment for the modification of Annex 1 (see Article 55).

Checks, reviews, audits or investigations that find systemic or recurrent errors, irregularities, fraud or breach of obligations may also lead to consequences in other EU or Euratom grants awarded under similar conditions ('**extension of findings from this grant to other grants**').

¹⁶ Regulation (EU, Euratom) No 883/2013 of the European Parliament and of the Council of 11 September 2013 concerning investigations conducted by the European Anti-Fraud Office (OLAF) and repealing Regulation (EC) No 1073/1999 of the European Parliament and of the Council and Council Regulation (Euratom) No 1074/1999 (OJ L 248, 18.09.2013, p. 1).

¹⁷ Council Regulation (Euratom, EC) No 2185/1996 of 11 November 1996 concerning on-the-spot checks and inspections carried out by the Commission in order to protect the European Communities' financial interests against fraud and other irregularities (OJ L 292, 15.11.1996, p. 2).

¹⁸ Regulation (EU, Euratom) No 966/2012 of the European Parliament and of the Council of 25 October 2012 on the financial rules applicable to the general budget of the Union and repealing Council Regulation (EC, Euratom) No 1605/2002 (OJ L 298, 26.10.2012, p. 1).



Moreover, findings arising from an OLAF investigation may lead to criminal prosecution under national law.

22.5.2 Findings in other grants

The Agency or the Commission may extend findings from other grants to this grant ('**extension of findings from other grants to this grant**'), if:

- (a) the beneficiary concerned is found, in other EU or Euratom grants awarded under similar conditions, to have committed systemic or recurrent errors, irregularities, fraud or breach of obligations that have a material impact on this grant and
- (b) those findings are formally notified to the beneficiary concerned — together with the list of grants affected by the findings — no later than two years after the payment of the balance of this grant.

The extension of findings may lead to the rejection of costs (see Article 42), reduction of the grant (see Article 43), recovery of undue amounts (see Article 44), suspension of payments (see Article 48), suspension of the action implementation (see Article 49) or termination (see Article 50).

22.5.3 Procedure

The Agency or the Commission will formally notify the beneficiary concerned the systemic or recurrent errors and its intention to extend these audit findings, together with the list of grants affected.

22.5.3.1 If the findings concern **eligibility of costs:** the formal notification will include:

- (a) an invitation to submit observations on the list of grants affected by the findings;
- (b) the request to submit **revised financial statements** for all grants affected;
- (c) the **correction rate for extrapolation** established by the Agency or the Commission on the basis of the systemic or recurrent errors, to calculate the amounts to be rejected if the beneficiary concerned:
 - (i) considers that the submission of revised financial statements is not possible or practicable or
 - (ii) does not submit revised financial statements.

The beneficiary concerned has 90 days from receiving notification to submit observations, revised financial statements or to propose a duly substantiated **alternative correction method**. This period may be extended by the Agency or the Commission in justified cases.

The Agency or the Commission may then start a rejection procedure in accordance with Article 42, on the basis of:

- the revised financial statements, if approved;
 - the proposed alternative correction method, if accepted
- or



- the initially notified correction rate for extrapolation, if it does not receive any observations or revised financial statements, does not accept the observations or the proposed alternative correction method or does not approve the revised financial statements.

22.5.3.2 If the findings concern **substantial errors, irregularities or fraud or serious breach of obligations:** the formal notification will include:

- (a) an invitation to submit observations on the list of grants affected by the findings and
- (b) the flat-rate the Agency or the Commission intends to apply according to the principle of proportionality.

The beneficiary concerned has 90 days from receiving notification to submit observations or to propose a duly substantiated alternative flat-rate.

The Agency or the Commission may then start a reduction procedure in accordance with Article 43, on the basis of:

- the proposed alternative flat-rate, if accepted
- or
- the initially notified flat-rate, if it does not receive any observations or does not accept the observations or the proposed alternative flat-rate.

22.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, any insufficiently substantiated costs will be ineligible (see Article 6) and will be rejected (see Article 42).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 23 — EVALUATION OF THE IMPACT OF THE ACTION

23.1 Right to evaluate the impact of the action

The Agency or the Commission may carry out interim and final evaluations of the impact of the action measured against the objective of the EU programme.

Evaluations may be started during implementation of the action and up to five years after the payment of the balance. The evaluation is considered to start on the date of the formal notification to the coordinator or beneficiaries.

The Agency or the Commission may make these evaluations directly (using its own staff) or indirectly (using external bodies or persons it has authorised to do so).

The coordinator or beneficiaries must provide any information relevant to evaluate the impact of the action, including information in electronic format.

23.2 Consequences of non-compliance



If a beneficiary breaches any of its obligations under this Article, the Agency may apply the measures described in Chapter 6.

SECTION 3 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND AND RESULTS

SUBSECTION 1 GENERAL

ARTICLE 23a — MANAGEMENT OF INTELLECTUAL PROPERTY

23a.1 Obligation to take measures to implement the Commission Recommendation on the management of intellectual property in knowledge transfer activities

Beneficiaries that are universities or other public research organisations must take measures to implement the principles set out in Points 1 and 2 of the Code of Practice annexed to the Commission Recommendation on the management of intellectual property in knowledge transfer activities¹⁹.

This does not change the obligations set out in Subsections 2 and 3 of this Section.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

23a.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the Agency may apply any of the measures described in Chapter 6.

SUBSECTION 2 RIGHTS AND OBLIGATIONS RELATED TO BACKGROUND

ARTICLE 24 — AGREEMENT ON BACKGROUND

24.1 Agreement on background

The beneficiaries must identify and agree (in writing) on the background for the action ('**agreement on background**').

'**Background**' means any data, know-how or information — whatever its form or nature (tangible or intangible), including any rights such as intellectual property rights — that:

- (a) is held by the beneficiaries before they acceded to the Agreement, and
- (b) is needed to implement the action or exploit the results.

24.2 Consequences of non-compliance

¹⁹ Commission Recommendation C(2008) 1329 of 10.4.2008 on the management of intellectual property in knowledge transfer activities and the Code of Practice for universities and other public research institutions attached to this recommendation.



If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 25 — ACCESS RIGHTS TO BACKGROUND

25.1 Exercise of access rights — Waiving of access rights — No sub-licensing

To exercise access rights, this must first be requested in writing ('request for access').

'Access rights' means rights to use results or background under the terms and conditions laid down in this Agreement.

Waivers of access rights are not valid unless in writing.

Unless agreed otherwise, access rights do not include the right to sub-license.

25.2 Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to background needed to implement their own tasks under the action, unless the beneficiary that holds the background has — before acceding to the Agreement —:

- (a) informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel), or
- (b) agreed with the other beneficiaries that access would not be on a royalty-free basis.

25.3 Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other access — under fair and reasonable conditions — to background needed for exploiting their own results, unless the beneficiary that holds the background has — before acceding to the Agreement — informed the other beneficiaries that access to its background is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel).

'Fair and reasonable conditions' means appropriate conditions, including possible financial terms or royalty-free conditions, taking into account the specific circumstances of the request for access, for example the actual or potential value of the results or background to which access is requested and/or the scope, duration or other characteristics of the exploitation envisaged.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

25.4 Access rights for affiliated entities

Unless otherwise agreed in the consortium agreement, access to background must also be given — under fair and reasonable conditions (see above; Article 25.3) and unless it is subject to legal restrictions or limits, including those imposed by the rights of third parties (including personnel) —



to affiliated entities²⁰ established in an EU Member State or ‘**associated country**’²¹, if this is needed to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 25.1), the affiliated entity concerned must make the request directly to the beneficiary that holds the background.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

25.5 Access rights for third parties

Not applicable

25.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

SUBSECTION 3 RIGHTS AND OBLIGATIONS RELATED TO RESULTS

ARTICLE 26 — OWNERSHIP OF RESULTS

26.1 Ownership by the beneficiary that generates the results

Results are owned by the beneficiary that generates them.

‘**Results**’ means any (tangible or intangible) output of the action such as data, knowledge or information — whatever its form or nature, whether it can be protected or not — that is generated in the action, as well as any rights attached to it, including intellectual property rights.

26.2 Joint ownership by several beneficiaries

Two or more beneficiaries own results jointly if:

- (a) they have jointly generated them and
- (b) it is not possible to:
 - (i) establish the respective contribution of each beneficiary, or
 - (ii) separate them for the purpose of applying for, obtaining or maintaining their protection (see Article 27).

²⁰ For the definition, see ‘affiliated entity’ footnote (Article 14.1).

²¹ For the definition, see Article 2.1(3) of the Rules for Participation Regulation No 1290/2013: ‘**associated country**’ means a third country which is party to an international agreement with the Union, as identified in Article 7 of Horizon 2020 Framework Programme Regulation No 1291/2013. Article 7 sets out the conditions for association of non-EU countries to Horizon 2020.



The joint owners must agree (in writing) on the allocation and terms of exercise of their joint ownership ('**joint ownership agreement**'), to ensure compliance with their obligations under this Agreement.

Unless otherwise agreed in the joint ownership agreement, each joint owner may grant non-exclusive licences to third parties to exploit jointly-owned results (without any right to sub-license), if the other joint owners are given:

- (a) at least 45 days advance notice and
- (b) fair and reasonable compensation.

Once the results have been generated, joint owners may agree (in writing) to apply another regime than joint ownership (such as, for instance, transfer to a single owner (see Article 30) with access rights for the others).

26.3 Rights of third parties (including personnel)

If third parties (including personnel) may claim rights to the results, the beneficiary concerned must ensure that it complies with its obligations under the Agreement.

If a third party generates results, the beneficiary concerned must obtain all necessary rights (transfer, licences or other) from the third party, in order to be able to respect its obligations as if those results were generated by the beneficiary itself.

If obtaining the rights is impossible, the beneficiary must refrain from using the third party to generate the results.

26.4 Agency ownership, to protect results

26.4.1 The Agency may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to disseminate its results without protecting them, except in any of the following cases:

- (a) the lack of protection is because protecting the results is not possible, reasonable or justified (given the circumstances);
- (b) the lack of protection is because there is a lack of potential for commercial or industrial exploitation, or
- (c) the beneficiary intends to transfer the results to another beneficiary or third party established in an EU Member State or associated country, which will protect them.

Before the results are disseminated and unless any of the cases above under Points (a), (b) or (c) applies, the beneficiary must formally notify the Agency and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the Agency decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

No dissemination relating to these results may take place before the end of this period or, if the Agency takes a positive decision, until it has taken the necessary steps to protect the results.



26.4.2 The Agency may — with the consent of the beneficiary concerned — assume ownership of results to protect them, if a beneficiary intends — up to four years after the period set out in Article 3 — to stop protecting them or not to seek an extension of protection, except in any of the following cases:

- (a) the protection is stopped because of a lack of potential for commercial or industrial exploitation;
- (b) an extension would not be justified given the circumstances.

A beneficiary that intends to stop protecting results or not seek an extension must — unless any of the cases above under Points (a) or (b) applies — formally notify the Agency at least 60 days before the protection lapses or its extension is no longer possible and at the same time inform it of any reasons for refusing consent. The beneficiary may refuse consent only if it can show that its legitimate interests would suffer significant harm.

If the Agency decides to assume ownership, it will formally notify the beneficiary concerned within 45 days of receiving notification.

26.5 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to the any of the other measures described in Chapter 6.

ARTICLE 27 — PROTECTION OF RESULTS — VISIBILITY OF EU FUNDING

27.1 Obligation to protect the results

Each beneficiary must examine the possibility of protecting its results and must adequately protect them — for an appropriate period and with appropriate territorial coverage — if:

- (a) the results can reasonably be expected to be commercially or industrially exploited and
- (b) protecting them is possible, reasonable and justified (given the circumstances).

When deciding on protection, the beneficiary must consider its own legitimate interests and the legitimate interests (especially commercial) of the other beneficiaries.

27.2 Agency ownership, to protect the results

If a beneficiary intends not to protect its results, to stop protecting them or not seek an extension of protection, the Agency may — under certain conditions (see Article 26.4) — assume ownership to ensure their (continued) protection.

27.3 Information on EU funding

Applications for protection of results (including patent applications) filed by or on behalf of a beneficiary must — unless the Agency requests or agrees otherwise or unless it is impossible — include the following:

“The project leading to this application has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 101037247”.



27.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 28 — EXPLOITATION OF RESULTS

28.1 Obligation to exploit the results

Each beneficiary must — up to four years after the period set out in Article 3 — take measures aiming to ensure ‘**exploitation**’ of its results (either directly or indirectly, in particular through transfer or licensing; see Article 30) by:

- (a) using them in further research activities (outside the action);
- (b) developing, creating or marketing a product or process;
- (c) creating and providing a service, or
- (d) using them in standardisation activities.

This does not change the security obligations in Article 37, which still apply.

28.2 Results that could contribute to European or international standards — Information on EU funding

If results could reasonably be expected to contribute to European or international standards, the beneficiary concerned must — up to four years after the period set out in Article 3 — inform the Agency.

If results are incorporated in a standard, the beneficiary concerned must — unless the Agency requests or agrees otherwise or unless it is impossible — ask the standardisation body to include the following statement in (information related to) the standard:

“Results incorporated in this standard received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 101037247”.

28.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced in accordance with Article 43.

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 29 — DISSEMINATION OF RESULTS — OPEN ACCESS — VISIBILITY OF EU FUNDING

29.1 Obligation to disseminate results

Unless it goes against their legitimate interests, each beneficiary must — as soon as possible —



‘**disseminate**’ its results by disclosing them to the public by appropriate means (other than those resulting from protecting or exploiting the results), including in scientific publications (in any medium).

In addition, the beneficiaries must comply with the additional dissemination obligations set out in Annex 1.

Moreover, the beneficiaries must — up to four years after the period set out in Article 3 — disseminate the deliverables relating to cross-border interoperability (see Annex 1) and any results needed for cross-border interoperability (in particular common technical specifications and software components).

This does not change the obligation to protect results in Article 27, the confidentiality obligations in Article 36, the security obligations in Article 37 or the obligations to protect personal data in Article 39, all of which still apply.

A beneficiary that intends to disseminate its results must give advance notice to the other beneficiaries of — unless agreed otherwise — at least 45 days, together with sufficient information on the results it will disseminate.

Any other beneficiary may object within — unless agreed otherwise — 30 days of receiving notification, if it can show that its legitimate interests in relation to the results or background would be significantly harmed. In such cases, the dissemination may not take place unless appropriate steps are taken to safeguard these legitimate interests.

If a beneficiary intends not to protect its results, it may — under certain conditions (see Article 26.4.1) — need to formally notify the Agency before dissemination takes place.

29.2 Open access to scientific publications

Each beneficiary must ensure open access (free of charge online access for any user) to all peer-reviewed scientific publications relating to its results.

In particular, it must:

- (a) as soon as possible and at the latest on publication, deposit a machine-readable electronic copy of the published version or final peer-reviewed manuscript accepted for publication in a repository for scientific publications;

Moreover, the beneficiary must aim to deposit at the same time the research data needed to validate the results presented in the deposited scientific publications.

- (b) ensure open access to the deposited publication — via the repository — at the latest:
 - (i) on publication, if an electronic version is available for free via the publisher, or
 - (ii) within six months of publication (twelve months for publications in the social sciences and humanities) in any other case.
- (c) ensure open access — via the repository — to the bibliographic metadata that identify the deposited publication.



The bibliographic metadata must be in a standard format and must include all of the following:

- the terms “European Union (EU)” and “Horizon 2020”;
- the name of the action, acronym and grant number;
- the publication date, and length of embargo period if applicable, and
- a persistent identifier.

29.3 Open access to research data

Regarding the digital research data generated in the action ('**data**'), the beneficiaries must:

- (a) deposit in a research data repository and take measures to make it possible for third parties to access, mine, exploit, reproduce and disseminate — free of charge for any user — the following:
 - (i) the data, including associated metadata, needed to validate the results presented in scientific publications, as soon as possible;
 - (ii) not applicable;
 - (iii) other data, including associated metadata, as specified and within the deadlines laid down in the ‘data management plan’ (see Annex 1);
- (b) provide information — via the repository — about tools and instruments at the disposal of the beneficiaries and necessary for validating the results (and — where possible — provide the tools and instruments themselves).

This does not change the obligation to protect results in Article 27, the confidentiality obligations in Article 36, the security obligations in Article 37 or the obligations to protect personal data in Article 39, all of which still apply.

As an exception, the beneficiaries do not have to ensure open access to specific parts of their research data under Point (a)(i) and (iii), if the achievement of the action's main objective (as described in Annex 1) would be jeopardised by making those specific parts of the research data openly accessible. In this case, the data management plan must contain the reasons for not giving access.

29.4 Information on EU funding — Obligation and right to use the EU emblem

Unless the Agency requests or agrees otherwise or unless it is impossible, any dissemination of results (in any form, including electronic) must:

- (a) display the EU emblem and
- (b) include the following text:

“This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 101037247”.

When displayed together with another logo, the EU emblem must have appropriate prominence.



For the purposes of their obligations under this Article, the beneficiaries may use the EU emblem without first obtaining approval from the Agency.

This does not however give them the right to exclusive use.

Moreover, they may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

29.5 Disclaimer excluding Agency responsibility

Any dissemination of results must indicate that it reflects only the author's view and that the Agency is not responsible for any use that may be made of the information it contains.

29.6 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 30 — TRANSFER AND LICENSING OF RESULTS

30.1 Transfer of ownership

Each beneficiary may transfer ownership of its results.

It must however ensure that its obligations under Articles 26.2, 26.4, 27, 28, 29, 30 and 31 also apply to the new owner and that this owner has the obligation to pass them on in any subsequent transfer.

This does not change the security obligations in Article 37, which still apply.

Unless agreed otherwise (in writing) for specifically-identified third parties or unless impossible under applicable EU and national laws on mergers and acquisitions, a beneficiary that intends to transfer ownership of results must give at least 45 days advance notice (or less if agreed in writing) to the other beneficiaries that still have (or still may request) access rights to the results. This notification must include sufficient information on the new owner to enable any beneficiary concerned to assess the effects on its access rights.

Unless agreed otherwise (in writing) for specifically-identified third parties, any other beneficiary may object within 30 days of receiving notification (or less if agreed in writing), if it can show that the transfer would adversely affect its access rights. In this case, the transfer may not take place until agreement has been reached between the beneficiaries concerned.

30.2 Granting licenses

Each beneficiary may grant licences to its results (or otherwise give the right to exploit them), if:

- (a) this does not impede the access rights under Article 31 and
- (b) not applicable.



In addition to Points (a) and (b), exclusive licences for results may be granted only if all the other beneficiaries concerned have waived their access rights (see Article 31.1).

This does not change the dissemination obligations in Article 29 or security obligations in Article 37, which still apply.

30.3 Agency right to object to transfers or licensing

Not applicable

30.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such a breach may also lead to any of the other measures described in Chapter 6.

ARTICLE 31 — ACCESS RIGHTS TO RESULTS

31.1 Exercise of access rights — Waiving of access rights — No sub-licensing

The conditions set out in Article 25.1 apply.

The obligations set out in this Article do not change the security obligations in Article 37, which still apply.

31.2 Access rights for other beneficiaries, for implementing their own tasks under the action

The beneficiaries must give each other access — on a royalty-free basis — to results needed for implementing their own tasks under the action.

31.3 Access rights for other beneficiaries, for exploiting their own results

The beneficiaries must give each other — under fair and reasonable conditions (see Article 25.3) — access to results needed for exploiting their own results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.

31.4 Access rights of affiliated entities

Unless agreed otherwise in the consortium agreement, access to results must also be given — under fair and reasonable conditions (Article 25.3) — to affiliated entities established in an EU Member State or associated country, if this is needed for those entities to exploit the results generated by the beneficiaries to which they are affiliated.

Unless agreed otherwise (see above; Article 31.1), the affiliated entity concerned must make any such request directly to the beneficiary that owns the results.

Requests for access may be made — unless agreed otherwise — up to one year after the period set out in Article 3.



31.5 Access rights for the EU institutions, bodies, offices or agencies and EU Member States

The beneficiaries must give access to their results — on a royalty-free basis — to EU institutions, bodies, offices or agencies, for developing, implementing or monitoring EU policies or programmes.

Such access rights are limited to non-commercial and non-competitive use.

This does not change the right to use any material, document or information received from the beneficiaries for communication and publicising activities (see Article 38.2).

31.6 Access rights for third parties

Not applicable

31.7 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

SECTION 4 OTHER RIGHTS AND OBLIGATIONS

ARTICLE 32 — RECRUITMENT AND WORKING CONDITIONS FOR RESEARCHERS

32.1 Obligation to take measures to implement the European Charter for Researchers and Code of Conduct for the Recruitment of Researchers

The beneficiaries must take all measures to implement the principles set out in the Commission Recommendation on the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers²³, in particular regarding:

- working conditions;
- transparent recruitment processes based on merit, and
- career development.

The beneficiaries must ensure that researchers and third parties involved in the action are aware of them.

32.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the Agency may apply any of the measures described in Chapter 6.

ARTICLE 33 — GENDER EQUALITY

²³ Commission Recommendation 2005/251/EC of 11 March 2005 on the European Charter for Researchers and on a Code of Conduct for the Recruitment of Researchers (OJ L 75, 22.3.2005, p. 67).



33.1 Obligation to aim for gender equality

The beneficiaries must take all measures to promote equal opportunities between men and women in the implementation of the action. They must aim, to the extent possible, for a gender balance at all levels of personnel assigned to the action, including at supervisory and managerial level.

33.2 Consequences of non-compliance

If a beneficiary breaches its obligations under this Article, the Agency may apply any of the measures described in Chapter 6.

ARTICLE 34 — ETHICS AND RESEARCH INTEGRITY

34.1 Obligation to comply with ethical and research integrity principles

The beneficiaries must carry out the action in compliance with:

- (a) ethical principles (including the highest standards of research integrity)
- and
- (b) applicable international, EU and national law.

Funding will not be granted for activities carried out outside the EU if they are prohibited in all Member States or for activities which destroy human embryos (for example, for obtaining stem cells).

The beneficiaries must ensure that the activities under the action have an exclusive focus on civil applications.

The beneficiaries must ensure that the activities under the action do not:

- (a) aim at human cloning for reproductive purposes;
- (b) intend to modify the genetic heritage of human beings which could make such changes heritable (with the exception of research relating to cancer treatment of the gonads, which may be financed), or
- (c) intend to create human embryos solely for the purpose of research or for the purpose of stem cell procurement, including by means of somatic cell nuclear transfer.

In addition, the beneficiaries must respect the fundamental principle of research integrity — as set out, for instance, in the European Code of Conduct for Research Integrity²⁴.

This implies compliance with the following fundamental principles:

- **reliability** in ensuring the quality of research reflected in the design, the methodology, the analysis and the use of resources;
- **honesty** in developing, undertaking, reviewing, reporting and communicating research in a transparent, fair and unbiased way;

²⁴ European Code of Conduct for Research Integrity of ALLEA (All European Academies)

http://ec.europa.eu/research/participants/data/ref/h2020/other/hi/h2020-ethics_code-of-conduct_en.pdf



- **respect** for colleagues, research participants, society, ecosystems, cultural heritage and the environment;
- **accountability** for the research from idea to publication, for its management and organisation, for training, supervision and mentoring, and for its wider impacts

and means that beneficiaries must ensure that persons carrying out research tasks follow the good research practices and refrain from the research integrity violations described in this Code.

This does not change the other obligations under this Agreement or obligations under applicable international, EU or national law, all of which still apply.

34.2 Activities raising ethical issues

Activities raising ethical issues must comply with the '**ethics requirements**' set out as deliverables in Annex 1.

Before the beginning of an activity raising an ethical issue, each beneficiary must have obtained:

- (a) any ethics committee opinion required under national law and
- (b) any notification or authorisation for activities raising ethical issues required under national and/or European law

needed for implementing the action tasks in question.

The documents must be kept on file and be submitted upon request by the coordinator to the Agency (see Article 52). If they are not in English, they must be submitted together with an English summary, which shows that the action tasks in question are covered and includes the conclusions of the committee or authority concerned (if available).

34.3 Activities involving human embryos or human embryonic stem cells

Activities involving research on human embryos or human embryonic stem cells may be carried out, in addition to Article 34.1, only if:

- they are set out in Annex 1 or
- the coordinator has obtained explicit approval (in writing) from the Agency (see Article 52).

34.4 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 35 — CONFLICT OF INTERESTS

35.1 Obligation to avoid a conflict of interests

The beneficiaries must take all measures to prevent any situation where the impartial and objective



implementation of the action is compromised for reasons involving economic interest, political or national affinity, family or emotional ties or any other shared interest ('**conflict of interests**').

They must formally notify to the Agency without delay any situation constituting or likely to lead to a conflict of interests and immediately take all the necessary steps to rectify this situation.

The Agency may verify that the measures taken are appropriate and may require additional measures to be taken by a specified deadline.

35.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43) and the Agreement or participation of the beneficiary may be terminated (see Article 50).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 36 — CONFIDENTIALITY

36.1 General obligation to maintain confidentiality

During implementation of the action and for four years after the period set out in Article 3, the parties must keep confidential any data, documents or other material (in any form) that is identified as confidential at the time it is disclosed ('**confidential information**').

If a beneficiary requests, the Agency may agree to keep such information confidential for an additional period beyond the initial four years.

If information has been identified as confidential only orally, it will be considered to be confidential only if this is confirmed in writing within 15 days of the oral disclosure.

Unless otherwise agreed between the parties, they may use confidential information only to implement the Agreement.

The beneficiaries may disclose confidential information to their personnel or third parties involved in the action only if they:

- (a) need to know to implement the Agreement and
- (b) are bound by an obligation of confidentiality.

This does not change the security obligations in Article 37, which still apply.

The Agency may disclose confidential information to its staff, other EU institutions and bodies. It may disclose confidential information to third parties, if:

- (a) this is necessary to implement the Agreement or safeguard the EU's financial interests and
- (b) the recipients of the information are bound by an obligation of confidentiality.

Under the conditions set out in Article 4 of the Rules for Participation Regulation No 1290/2013²⁵,

²⁵ Regulation (EU) No 1290/2013 of the European Parliament and of the Council of 11 December 2013 laying down the



the Commission must moreover make available information on the results to other EU institutions, bodies, offices or agencies as well as Member States or associated countries.

The confidentiality obligations no longer apply if:

- (a) the disclosing party agrees to release the other party;
- (b) the information was already known by the recipient or is given to him without obligation of confidentiality by a third party that was not bound by any obligation of confidentiality;
- (c) the recipient proves that the information was developed without the use of confidential information;
- (d) the information becomes generally and publicly available, without breaching any confidentiality obligation, or
- (e) the disclosure of the information is required by EU or national law.

36.2 Consequences of non-compliance

If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 37 — SECURITY-RELATED OBLIGATIONS

37.1 Results with a security recommendation

Not applicable

37.2 Classified information

Not applicable

37.3 Activities involving dual-use goods or dangerous materials and substances

Not applicable

37.4 Consequences of non-compliance

Not applicable

ARTICLE 38 — PROMOTING THE ACTION — VISIBILITY OF EU FUNDING

38.1 Communication activities by beneficiaries

38.1.1 Obligation to promote the action and its results

rules for participation and dissemination in "Horizon 2020 - the Framework Programme for Research and Innovation (2014-2020)" (OJ L 347, 20.12.2013 p.81).



The beneficiaries must promote the action and its results, by providing targeted information to multiple audiences (including the media and the public) in a strategic and effective manner.

This does not change the dissemination obligations in Article 29, the confidentiality obligations in Article 36 or the security obligations in Article 37, all of which still apply.

Before engaging in a communication activity expected to have a major media impact, the beneficiaries must inform the Agency (see Article 52).

38.1.2 Information on EU funding — Obligation and right to use the EU emblem

Unless the Agency requests or agrees otherwise or unless it is impossible, any communication activity related to the action (including in electronic form, via social media, etc.) and any infrastructure, equipment and major results funded by the grant must:

(a) display the EU emblem and

(b) include the following text:

For communication activities:

“This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 101037247”.

For infrastructure, equipment and major results:

“This [infrastructure][equipment][insert type of result] is part of a project that has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 101037247”.

When displayed together with another logo, the EU emblem must have appropriate prominence.

For the purposes of their obligations under this Article, the beneficiaries may use the EU emblem without first obtaining approval from the Agency.

This does not, however, give them the right to exclusive use.

Moreover, they may not appropriate the EU emblem or any similar trademark or logo, either by registration or by any other means.

38.1.3 Disclaimer excluding Agency and Commission responsibility

Any communication activity related to the action must indicate that it reflects only the author's view and that the Agency and the Commission are not responsible for any use that may be made of the information it contains.

38.2 Communication activities by the Agency and the Commission

38.2.1 Right to use beneficiaries' materials, documents or information

The Agency and the Commission may use, for its communication and publicising activities, information relating to the action, documents notably summaries for publication and public deliverables as well as any other material, such as pictures or audio-visual material received from any beneficiary (including in electronic form).



This does not change the confidentiality obligations in Article 36 and the security obligations in Article 37, all of which still apply.

If the Agency's or the Commission's use of these materials, documents or information would risk compromising legitimate interests, the beneficiary concerned may request the Agency or the Commission not to use it (see Article 52).

The right to use a beneficiary's materials, documents and information includes:

- (a) **use for its own purposes** (in particular, making them available to persons working for the Agency, the Commission or any other EU institution, body, office or agency or body or institutions in EU Member States; and copying or reproducing them in whole or in part, in unlimited numbers);
- (b) **distribution to the public** (in particular, publication as hard copies and in electronic or digital format, publication on the internet, as a downloadable or non-downloadable file, broadcasting by any channel, public display or presentation, communicating through press information services, or inclusion in widely accessible databases or indexes);
- (c) **editing or redrafting** for communication and publicising activities (including shortening, summarising, inserting other elements (such as meta-data, legends, other graphic, visual, audio or text elements), extracting parts (e.g. audio or video files), dividing into parts, use in a compilation);
- (d) translation;
- (e) giving **access in response to individual requests** under Regulation No 1049/2001²⁷, without the right to reproduce or exploit;
- (f) **storage** in paper, electronic or other form;
- (g) **archiving**, in line with applicable document-management rules, and
- (h) the right to authorise **third parties** to act on its behalf or sub-license the modes of use set out in Points (b), (c), (d) and (f) to third parties if needed for the communication and publicising activities of the Agency or the Commission.

If the right of use is subject to rights of a third party (including personnel of the beneficiary), the beneficiary must ensure that it complies with its obligations under this Agreement (in particular, by obtaining the necessary approval from the third parties concerned).

Where applicable (and if provided by the beneficiaries), the Agency or the Commission will insert the following information:

“© – [year] – [name of the copyright owner]. All rights reserved. Licensed to the European Research Executive Agency (REA) and the European Union (EU) under conditions.”

38.3 Consequences of non-compliance

²⁷ Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents, OJ L 145, 31.5.2001, p. 43.



If a beneficiary breaches any of its obligations under this Article, the grant may be reduced (see Article 43).

Such breaches may also lead to any of the other measures described in Chapter 6.

ARTICLE 39 — PROCESSING OF PERSONAL DATA

39.1 Processing of personal data by the Agency and the Commission

Any personal data under the Agreement will be processed by the Agency or the Commission under Regulation No 45/2001²⁸ and according to the ‘notifications of the processing operations’ to the Data Protection Officer (DPO) of the Agency or the Commission (publicly accessible in the DPO register).

Such data will be processed by the ‘**data controller**’ of the Agency or the Commission for the purposes of implementing, managing and monitoring the Agreement or protecting the financial interests of the EU or Euratom (including checks, reviews, audits and investigations; see Article 22).

The persons whose personal data are processed have the right to access and correct their own personal data. For this purpose, they must send any queries about the processing of their personal data to the data controller, via the contact point indicated in the privacy statement(s) that are published on the Agency and the Commission websites.

They also have the right to have recourse at any time to the European Data Protection Supervisor (EDPS).

39.2 Processing of personal data by the beneficiaries

The beneficiaries must process personal data under the Agreement in compliance with applicable EU and national law on data protection (including authorisations or notification requirements).

The beneficiaries may grant their personnel access only to data that is strictly necessary for implementing, managing and monitoring the Agreement.

The beneficiaries must inform the personnel whose personal data are collected and processed by the Agency or the Commission. For this purpose, they must provide them with the privacy statement(s) (see above), before transmitting their data to the Agency or the Commission.

39.3 Consequences of non-compliance

If a beneficiary breaches any of its obligations under Article 39.2, the Agency may apply any of the measures described in Chapter 6.

ARTICLE 40 — ASSIGNMENTS OF CLAIMS FOR PAYMENT AGAINST THE AGENCY

The beneficiaries may not assign any of their claims for payment against the Agency to any third party, except if approved by the Agency on the basis of a reasoned, written request by the coordinator (on behalf of the beneficiary concerned).

²⁸ Regulation (EC) No 45/2001 of the European Parliament and of the Council of 18 December 2000 on the protection of individuals with regard to the processing of personal data by the Community institutions and bodies and on the free movement of such data (OJ L 8, 12.01.2001, p. 1).



If the Agency has not accepted the assignment or the terms of it are not observed, the assignment will have no effect on it.

In no circumstances will an assignment release the beneficiaries from their obligations towards the Agency.

CHAPTER 5 DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES

— RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES —

RELATIONSHIP WITH PARTNERS OF A JOINT ACTION

ARTICLE 41 — DIVISION OF BENEFICIARIES' ROLES AND RESPONSIBILITIES

— RELATIONSHIP WITH COMPLEMENTARY BENEFICIARIES —

RELATIONSHIP WITH PARTNERS OF A JOINT ACTION

41.1 Roles and responsibility towards the Agency

The beneficiaries have full responsibility for implementing the action and complying with the Agreement.

The beneficiaries are jointly and severally liable for the **technical implementation** of the action as described in Annex 1. If a beneficiary fails to implement its part of the action, the other beneficiaries become responsible for implementing this part (without being entitled to any additional EU funding for doing so), unless the Agency expressly relieves them of this obligation.

The **financial responsibility** of each beneficiary is governed by Article 44.

41.2 Internal division of roles and responsibilities

The internal roles and responsibilities of the beneficiaries are divided as follows:

(a) Each **beneficiary** must:

- (i) keep information stored in the Participant Portal Beneficiary Register (via the electronic exchange system) up to date (see Article 17);
- (ii) inform the coordinator immediately of any events or circumstances likely to affect significantly or delay the implementation of the action (see Article 17);
- (iii) submit to the coordinator in good time:
 - individual financial statements for itself and its linked third parties and, if required, certificates on the financial statements (see Article 20);
 - the data needed to draw up the technical reports (see Article 20);
 - ethics committee opinions and notifications or authorisations for activities raising ethical issues (see Article 34);
 - any other documents or information required by the Agency or the Commission under the Agreement, unless the Agreement requires the beneficiary to submit this information directly to the Agency or the Commission.



(b) The **coordinator** must:

- (i) monitor that the action is implemented properly (see Article 7);
- (ii) act as the intermediary for all communications between the beneficiaries and the Agency (in particular, providing the Agency with the information described in Article 17), unless the Agreement specifies otherwise;
- (iii) request and review any documents or information required by the Agency and verify their completeness and correctness before passing them on to the Agency;
- (iv) submit the deliverables and reports to the Agency (see Articles 19 and 20);
- (v) ensure that all payments are made to the other beneficiaries without unjustified delay (see Article 21);
- (vi) inform the Agency of the amounts paid to each beneficiary, when required under the Agreement (see Articles 44 and 50) or requested by the Agency.

The coordinator may not delegate or subcontract the above-mentioned tasks to any other beneficiary or third party (including linked third parties).

41.3 Internal arrangements between beneficiaries — Consortium agreement

The beneficiaries must have internal arrangements regarding their operation and co-ordination to ensure that the action is implemented properly. These internal arrangements must be set out in a written '**consortium agreement**' between the beneficiaries, which may cover:

- internal organisation of the consortium;
- management of access to the electronic exchange system;
- distribution of EU funding;
- additional rules on rights and obligations related to background and results (including whether access rights remain or not, if a beneficiary is in breach of its obligations) (see Section 3 of Chapter 4);
- settlement of internal disputes;
- liability, indemnification and confidentiality arrangements between the beneficiaries.

The consortium agreement must not contain any provision contrary to the Agreement.

41.4 Relationship with complementary beneficiaries — Collaboration agreement

Not applicable

41.5 Relationship with partners of a joint action — Coordination agreement

Not applicable



CHAPTER 6 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — SANCTIONS — DAMAGES — SUSPENSION — TERMINATION — FORCE MAJEURE

SECTION 1 REJECTION OF COSTS — REDUCTION OF THE GRANT — RECOVERY — SANCTIONS

ARTICLE 42 — REJECTION OF INELIGIBLE COSTS

42.1 Conditions

The Agency will — after **termination of the participation of a beneficiary**, at the time of an **interim payment, at the payment of the balance or afterwards** — reject any costs which are ineligible (see Article 6), in particular following checks, reviews, audits or investigations (see Article 22).

The rejection may also be based on the **extension of findings from other grants to this grant** (see Article 22.5.2).

42.2 Ineligible costs to be rejected — Calculation — Procedure

Ineligible costs will be rejected in full.

If the rejection of costs does not lead to a recovery (see Article 44), the Agency will formally notify the coordinator or beneficiary concerned of the rejection of costs, the amounts and the reasons why (if applicable, together with the notification of amounts due; see Article 21.5). The coordinator or beneficiary concerned may — within 30 days of receiving notification — formally notify the Agency of its disagreement and the reasons why.

If the rejection of costs leads to a recovery, the Agency will follow the contradictory procedure with pre-information letter set out in Article 44.

42.3 Effects

If the Agency rejects costs at the time of an **interim payment or the payment of the balance**, it will deduct them from the total eligible costs declared, for the action, in the periodic or final summary financial statement (see Articles 20.3 and 20.4). It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the Agency rejects costs **after termination of the participation of a beneficiary**, it will deduct them from the costs declared by the beneficiary in the termination report and include the rejection in the calculation after termination (see Article 50.2 and 50.3).

If the Agency — **after an interim payment but before the payment of the balance** — rejects costs declared in a periodic summary financial statement, it will deduct them from the total eligible costs declared, for the action, in the next periodic summary financial statement or in the final summary financial statement. It will then calculate the interim payment or payment of the balance as set out in Articles 21.3 or 21.4.

If the Agency rejects costs **after the payment of the balance**, it will deduct the amount rejected from



the total eligible costs declared, by the beneficiary, in the final summary financial statement. It will then calculate the revised final grant amount as set out in Article 5.4.

ARTICLE 43 — REDUCTION OF THE GRANT

43.1 Conditions

The Agency may — **after termination of the participation of a beneficiary, at the payment of the balance or afterwards** — reduce the grant amount (see Article 5.1), if :

- (a) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles) or
- (b) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2).

43.2 Amount to be reduced — Calculation — Procedure

The amount of the reduction will be proportionate to the seriousness of the errors, irregularities or fraud or breach of obligations.

Before reduction of the grant, the Agency will formally notify a ‘**pre-information letter**’ to the coordinator or beneficiary concerned:

- informing it of its intention to reduce the grant, the amount it intends to reduce and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the Agency does not receive any observations or decides to pursue reduction despite the observations it has received, it will formally notify **confirmation** of the reduction (if applicable, together with the notification of amounts due; see Article 21).

43.3 Effects

If the Agency reduces the grant **after termination of the participation of a beneficiary**, it will calculate the reduced grant amount for that beneficiary and then determine the amount due to that beneficiary (see Article 50.2 and 50.3).

If the Agency reduces the grant **at the payment of the balance**, it will calculate the reduced grant amount for the action and then determine the amount due as payment of the balance (see Articles 5.3.4 and 21.4).



If the Agency reduces the grant **after the payment of the balance**, it will calculate the revised final grant amount for the beneficiary concerned (see Article 5.4). If the revised final grant amount for the beneficiary concerned is lower than its share of the final grant amount, the Agency will recover the difference (see Article 44).

ARTICLE 44 — RECOVERY OF UNDUE AMOUNTS

44.1 Amount to be recovered — Calculation — Procedure

The Agency will — after **termination of the participation of a beneficiary, at the payment of the balance or afterwards** — claim back any amount that was paid, but is not due under the Agreement.

Each beneficiary's financial responsibility in case of recovery is limited to its own debt (including undue amounts paid by the Agency for costs declared by its linked third parties), except for the amount retained for the Guarantee Fund (see Article 21.4).

44.1.1 Recovery after termination of a beneficiary's participation

If recovery takes place after termination of a beneficiary's participation (including the coordinator), the Agency will claim back the undue amount from the beneficiary concerned, by formally notifying it a debit note (see Article 50.2 and 50.3). This note will specify the amount to be recovered, the terms and the date for payment.

If payment is not made by the date specified in the debit note, the Agency or the Commission will **recover** the amount:

- (a) by '**offsetting**' it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the Agency, the Commission or another executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the Agency or the Commission may offset before the payment date specified in the debit note;

- (b) not applicable;
- (c) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date specified in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the Agency or the Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC²⁹ applies.

²⁹ Directive 2007/64/EC of the European Parliament and of the Council of 13 November 2007 on payment services



44.1.2 Recovery at payment of the balance

If the payment of the balance takes the form of a recovery (see Article 21.4), the Agency will formally notify a '**pre-information letter**' to the coordinator:

- informing it of its intention to recover, the amount due as the balance and the reasons why;
- specifying that it intends to deduct the amount to be recovered from the amount retained for the Guarantee Fund;
- requesting the coordinator to submit a report on the distribution of payments to the beneficiaries within 30 days of receiving notification, and
- inviting the coordinator to submit observations within 30 days of receiving notification.

If no observations are submitted or the Agency decides to pursue recovery despite the observations it has received, it will **confirm recovery** (together with the notification of amounts due; see Article 21.5) and:

- pay the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is positive** or
- formally notify to the coordinator a **debit note** for the difference between the amount to be recovered and the amount retained for the Guarantee Fund, **if the difference is negative**. This note will also specify the terms and the date for payment.

If the coordinator does not repay the Agency by the date in the debit note and has not submitted the report on the distribution of payments: the Agency or the Commission will **recover** the amount set out in the debit note from the coordinator (see below).

If the coordinator does not repay the Agency by the date in the debit note, but has submitted the report on the distribution of payments: the Agency will:

- (a) identify the beneficiaries for which the amount calculated as follows is negative:

{ {{beneficiary's costs declared in the final summary financial statement and approved by the Agency multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned}}

plus

its linked third parties' costs declared in the final summary financial statement and approved by the Agency multiplied by the reimbursement rate set out in Article 5.2 for each linked third party concerned}}

divided by

the EU contribution for the action calculated according to Article 5.3.1}}

multiplied by

the final grant amount (see Article 5.3)},

minus

in the internal market amending Directives 97/7/EC, 2002/65/EC, 2005/60/EC and 2006/48/EC and repealing Directive 97/5/EC (OJ L 319, 05.12.2007, p. 1).



{pre-financing and interim payments received by the beneficiary} }.

- (b) formally notify to each beneficiary identified according to point (a) a **debit note** specifying the terms and date for payment. The amount of the debit note is calculated as follows:

{amount calculated according to point (a) for the beneficiary concerned

divided by

the sum of the amounts calculated according to point (a) for all the beneficiaries identified according to point (a)}

multiplied by

the amount set out in the debit note formally notified to the coordinator}.

If payment is not made by the date specified in the debit note, the Agency or the Commission will **recover** the amount:

- (a) by **offsetting** it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the Agency, the Commission or another executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the Agency or the Commission may offset before the payment date specified in the debit note;

- (b) by **drawing on the Guarantee Fund**. The Agency or the Commission will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:

(i) not applicable;

(ii) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the payment date in the debit note, up to and including the date the Agency or the Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.

Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

44.1.3 Recovery of amounts after payment of the balance

If, for a beneficiary, the revised final grant amount (see Article 5.4) is lower than its share of the final grant amount, it must repay the difference to the Agency.

The beneficiary's share of the final grant amount is calculated as follows:



{ { {beneficiary's costs declared in the final summary financial statement and approved by the Agency multiplied by the reimbursement rate set out in Article 5.2 for the beneficiary concerned}

plus

its linked third parties' costs declared in the final summary financial statement and approved by the Agency multiplied by the reimbursement rate set out in Article 5.2 for each linked third party concerned}

divided by

the EU contribution for the action calculated according to Article 5.3.1} }

multiplied by

the final grant amount (see Article 5.3)} .

If the coordinator has not distributed amounts received (see Article 21.7), the Agency will also recover these amounts.

The Agency will formally notify a **pre-information letter** to the beneficiary concerned:

- informing it of its intention to recover, the due amount and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If no observations are submitted or the Agency decides to pursue recovery despite the observations it has received, it will **confirm** the amount to be recovered and formally notify to the beneficiary concerned a **debit note**. This note will also specify the terms and the date for payment.

If payment is not made by the date specified in the debit note, the Agency or the Commission will **recover** the amount:

- (a) by **offsetting** it — without the beneficiary's consent — against any amounts owed to the beneficiary concerned by the Agency, the Commission or another executive agency (from the EU or Euratom budget).

In exceptional circumstances, to safeguard the EU's financial interests, the Agency or the Commission may offset before the payment date specified in the debit note;

- (b) by **drawing on the Guarantee Fund**. The Agency or the Commission will formally notify the beneficiary concerned the debit note on behalf of the Guarantee Fund and recover the amount:

(i) not applicable;

- (ii) by **taking legal action** (see Article 57) or by **adopting an enforceable decision** under Article 299 of the Treaty on the Functioning of the EU (TFEU) and Article 79(2) of the Financial Regulation No 966/2012.

If payment is not made by the date in the debit note, the amount to be recovered (see above) will be increased by **late-payment interest** at the rate set out in Article 21.11, from the day following the date for payment in the debit note, up to and including the date the Agency or the Commission receives full payment of the amount.

Partial payments will be first credited against expenses, charges and late-payment interest and then against the principal.



Bank charges incurred in the recovery process will be borne by the beneficiary, unless Directive 2007/64/EC applies.

ARTICLE 45 — ADMINISTRATIVE SANCTIONS

In addition to contractual measures, the Agency or the Commission may also adopt administrative sanctions under Articles 106 and 131(4) of the Financial Regulation No 966/2012 (i.e. exclusion from future procurement contracts, grants, prizes and expert contracts and/or financial penalties).

SECTION 2 LIABILITY FOR DAMAGES

ARTICLE 46 — LIABILITY FOR DAMAGES

46.1 Liability of the Agency

The Agency cannot be held liable for any damage caused to the beneficiaries or to third parties as a consequence of implementing the Agreement, including for gross negligence.

The Agency cannot be held liable for any damage caused by any of the beneficiaries or third parties involved in the action, as a consequence of implementing the Agreement.

46.2 Liability of the beneficiaries

Except in case of force majeure (see Article 51), the beneficiaries must compensate the Agency for any damage it sustains as a result of the implementation of the action or because the action was not implemented in full compliance with the Agreement.

SECTION 3 SUSPENSION AND TERMINATION

ARTICLE 47 — SUSPENSION OF PAYMENT DEADLINE

47.1 Conditions

The Agency may — at any moment — suspend the payment deadline (see Article 21.2 to 21.4) if a request for payment (see Article 20) cannot be approved because:

- (a) it does not comply with the provisions of the Agreement (see Article 20);
- (b) the technical or financial reports have not been submitted or are not complete or additional information is needed, or
- (c) there is doubt about the eligibility of the costs declared in the financial statements and additional checks, reviews, audits or investigations are necessary.

47.2 Procedure

The Agency will formally notify the coordinator of the suspension and the reasons why.

The suspension will **take effect** the day notification is sent by the Agency (see Article 52).



If the conditions for suspending the payment deadline are no longer met, the suspension will be **lifted** — and the remaining period will resume.

If the suspension exceeds two months, the coordinator may request the Agency if the suspension will continue.

If the payment deadline has been suspended due to the non-compliance of the technical or financial reports (see Article 20) and the revised report or statement is not submitted or was submitted but is also rejected, the Agency may also terminate the Agreement or the participation of the beneficiary (see Article 50.3.1(l)).

ARTICLE 48 — SUSPENSION OF PAYMENTS

48.1 Conditions

The Agency may — at any moment — suspend payments, in whole or in part and interim payments or the payment of the balance for one or more beneficiaries, if:

- (a) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed or is suspected of having committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles) or
- (b) a beneficiary (or a natural person who has the power to represent or take decision on its behalf) has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2).

If payments are suspended for one or more beneficiaries, the Agency will make partial payment(s) for the part(s) not suspended. If suspension concerns the payment of the balance, — once suspension is lifted — the payment or the recovery of the amount(s) concerned will be considered the payment of the balance that closes the action.

48.2 Procedure

Before suspending payments, the Agency will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to suspend payments and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the Agency does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the suspension procedure is not continued.

The suspension will **take effect** the day the confirmation notification is sent by the Agency.

If the conditions for resuming payments are met, the suspension will be **lifted**. The Agency will formally notify the coordinator or beneficiary concerned.

During the suspension, the periodic report(s) for all reporting periods except the last one (see Article 20.3), must not contain any individual financial statements from the beneficiary concerned and its linked third parties. The coordinator must include them in the next periodic report after the suspension is lifted or — if suspension is not lifted before the end of the action — in the last periodic report.

The beneficiaries may suspend implementation of the action (see Article 49.1) or terminate the Agreement or the participation of the beneficiary concerned (see Article 50.1 and 50.2).

ARTICLE 49 — SUSPENSION OF THE ACTION IMPLEMENTATION

49.1 Suspension of the action implementation, by the beneficiaries

49.1.1 Conditions

The beneficiaries may suspend implementation of the action or any part of it, if exceptional circumstances — in particular *force majeure* (see Article 51) — make implementation impossible or excessively difficult.

49.1.2 Procedure

The coordinator must immediately formally notify to the Agency the suspension (see Article 52), stating:

- the reasons why and
- the expected date of resumption.

The suspension will **take effect** the day this notification is received by the Agency.

Once circumstances allow for implementation to resume, the coordinator must immediately formally notify the Agency and request an **amendment** of the Agreement to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement or the participation of a beneficiary has been terminated (see Article 50).

The suspension will be **lifted** with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension of the action implementation are not eligible (see Article 6).

49.2 Suspension of the action implementation, by the Agency

49.2.1 Conditions

The Agency may suspend implementation of the action or any part of it, if:

- (a) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed or is suspected of having committed:



- (i) substantial errors, irregularities or fraud or
- (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles);
- (b) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2), or
- (c) the action is suspected of having lost its scientific or technological relevance.

49.2.2 Procedure

Before suspending implementation of the action, the Agency will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to suspend the implementation and the reasons why and
- inviting it to submit observations within 30 days of receiving notification.

If the Agency does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify **confirmation** of the suspension. Otherwise, it will formally notify that the procedure is not continued.

The suspension will **take effect** five days after confirmation notification is received (or on a later date specified in the notification).

It will be **lifted** if the conditions for resuming implementation of the action are met.

The coordinator or beneficiary concerned will be formally notified of the lifting and the Agreement will be **amended** to set the date on which the action will be resumed, extend the duration of the action and make other changes necessary to adapt the action to the new situation (see Article 55) — unless the Agreement has already been terminated (see Article 50).

The suspension will be lifted with effect from the resumption date set out in the amendment. This date may be before the date on which the amendment enters into force.

Costs incurred during suspension are not eligible (see Article 6).

The beneficiaries may not claim damages due to suspension by the Agency (see Article 46).

Suspension of the action implementation does not affect the Agency's right to terminate the Agreement or participation of a beneficiary (see Article 50), reduce the grant or recover amounts unduly paid (see Articles 43 and 44).

ARTICLE 50 — TERMINATION OF THE AGREEMENT OR OF THE PARTICIPATION OF ONE OR MORE BENEFICIARIES



50.1 Termination of the Agreement, by the beneficiaries

50.1.1 Conditions and procedure

The beneficiaries may terminate the Agreement.

The coordinator must formally notify termination to the Agency (see Article 52), stating:

- the reasons why and
- the date the termination will take effect. This date must be after the notification.

If no reasons are given or if the Agency considers the reasons do not justify termination, the Agreement will be considered to have been '**terminated improperly**'.

The termination will **take effect** on the day specified in the notification.

50.1.2 Effects

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a periodic report (for the open reporting period until termination; see Article 20.3) and
- (ii) the final report (see Article 20.4).

If the Agency does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The Agency will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Improper termination may lead to a reduction of the grant (see Article 43).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

50.2 Termination of the participation of one or more beneficiaries, by the beneficiaries

50.2.1 Conditions and procedure

The participation of one or more beneficiaries may be terminated by the coordinator, on request of the beneficiary concerned or on behalf of the other beneficiaries.

The coordinator must formally notify termination to the Agency (see Article 52) and inform the beneficiary concerned.

If the coordinator's participation is terminated without its agreement, the formal notification must be done by another beneficiary (acting on behalf of the other beneficiaries).

The notification must include:

- the reasons why;



- the opinion of the beneficiary concerned (or proof that this opinion has been requested in writing);
- the date the termination takes effect. This date must be after the notification, and
- a request for amendment (see Article 55), with a proposal for reallocation of the tasks and the estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination takes effect after the period set out in Article 3, no request for amendment must be included unless the beneficiary concerned is the coordinator. In this case, the request for amendment must propose a new coordinator.

If this information is not given or if the Agency considers that the reasons do not justify termination, the participation will be considered to have been **terminated improperly**.

The termination will **take effect** on the day specified in the notification.

50.2.2 Effects

The coordinator must — within 30 days from when termination takes effect — submit:

- (i) a report on the distribution of payments to the beneficiary concerned and
- (ii) if termination takes effect during the period set out in Article 3, a '**termination report**' from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Articles 20.3 and 20.4).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the Agency (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the Agency, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The Agency will — on the basis of the periodic reports, the termination report and the report on the distribution of payments — **calculate** the amount which is due to the beneficiary and if the (pre-financing and interim) payments received by the beneficiary exceed this amount.

The **amount which is due** is calculated in the following steps:

Step 1 — Application of the reimbursement rate to the eligible costs

The grant amount for the beneficiary is calculated by applying the reimbursement rate(s) to the total eligible costs declared by the beneficiary and its linked third parties in the termination report and approved by the Agency.

Only costs incurred by the beneficiary concerned until termination takes effect are



eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Step 2 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations

In case of a reduction (see Article 43), the Agency will calculate the reduced grant amount for the beneficiary by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the grant amount for the beneficiary.

If the payments received **exceed the amounts due**:

- if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The Agency will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the Agency will draw upon the Guarantee Fund to pay the coordinator and then notify a **debit note** on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- in all other cases, in particular if termination takes effect after the period set out in Article 3, the Agency will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the Agency the amount due and the Agency will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- if the beneficiary concerned is the former coordinator, it must repay the new coordinator according to the procedure above, unless:
 - termination takes effect after an interim payment and
 - the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7).

In this case, the Agency will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the Agency the amount due. The Agency will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).

If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the Agency does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the Agency does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that



- the beneficiary concerned must not repay any amount to the coordinator.

Improper termination may lead to a reduction of the grant (see Article 43) or termination of the Agreement (see Article 50).

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

50.3 Termination of the Agreement or the participation of one or more beneficiaries, by the Agency

50.3.1 Conditions

The Agency may terminate the Agreement or the participation of one or more beneficiaries, if:

- (a) one or more beneficiaries do not accede to the Agreement (see Article 56);
- (b) a change to their legal, financial, technical, organisational or ownership situation (or those of its linked third parties) is likely to substantially affect or delay the implementation of the action or calls into question the decision to award the grant;
- (c) following termination of participation for one or more beneficiaries (see above), the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants (see Article 55);
- (d) implementation of the action is prevented by force majeure (see Article 51) or suspended by the coordinator (see Article 49.1) and either:
 - (i) resumption is impossible, or
 - (ii) the necessary changes to the Agreement would call into question the decision awarding the grant or breach the principle of equal treatment of applicants;
- (e) a beneficiary is declared bankrupt, being wound up, having its affairs administered by the courts, has entered into an arrangement with creditors, has suspended business activities, or is subject to any other similar proceedings or procedures under national law;
- (f) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has been found guilty of professional misconduct, proven by any means;
- (g) a beneficiary does not comply with the applicable national law on taxes and social security;
- (h) the action has lost scientific or technological relevance;
- (i) not applicable;
- (j) not applicable;
- (k) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed fraud, corruption, or is involved in a criminal organisation, money laundering or any other illegal activity;



- (l) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed:
 - (i) substantial errors, irregularities or fraud or
 - (ii) serious breach of obligations under the Agreement or during the award procedure (including improper implementation of the action, submission of false information, failure to provide required information, breach of ethical principles);
- (m) a beneficiary (or a natural person who has the power to represent or take decisions on its behalf) has committed — in other EU or Euratom grants awarded to it under similar conditions — systemic or recurrent errors, irregularities, fraud or serious breach of obligations that have a material impact on this grant (**extension of findings from other grants to this grant**; see Article 22.5.2);
- (n) despite a specific request by the Agency, a beneficiary does not request — through the coordinator — an amendment to the Agreement to end the participation of one of its linked third parties or international partners that is in one of the situations under points (e), (f), (g), (k), (l) or (m) and to reallocate its tasks.

50.3.2 Procedure

Before terminating the Agreement or participation of one or more beneficiaries, the Agency will formally notify the coordinator or beneficiary concerned:

- informing it of its intention to terminate and the reasons why and
- inviting it, within 30 days of receiving notification, to submit observations and — in case of Point (l.ii) above — to inform the Agency of the measures to ensure compliance with the obligations under the Agreement.

If the Agency does not receive observations or decides to pursue the procedure despite the observations it has received, it will formally notify to the coordinator or beneficiary concerned **confirmation** of the termination and the date it will take effect. Otherwise, it will formally notify that the procedure is not continued.

The termination will **take effect**:

- for terminations under Points (b), (c), (e), (g), (h), (j), (l.ii) and (n) above: on the day specified in the notification of the confirmation (see above);
- for terminations under Points (a), (d), (f), (i), (k), (l.i) and (m) above: on the day after the notification of the confirmation is received.

50.3.3 Effects

(a) for **termination of the Agreement**:

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a periodic report (for the last open reporting period until termination; see Article 20.3) and



- (ii) a final report (see Article 20.4).

If the Agreement is terminated for breach of the obligation to submit reports (see Articles 20.8 and 50.3.1(l)), the coordinator may not submit any reports after termination.

If the Agency does not receive the reports within the deadline (see above), only costs which are included in an approved periodic report will be taken into account.

The Agency will **calculate** the final grant amount (see Article 5.3) and the balance (see Article 21.4) on the basis of the reports submitted. Only costs incurred until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

This does not affect the Agency's right to reduce the grant (see Article 43) or to impose administrative sanctions (Article 45).

The beneficiaries may not claim damages due to termination by the Agency (see Article 46).

After termination, the beneficiaries' obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

(b) for termination of the participation of one or more beneficiaries:

The coordinator must — within 60 days from when termination takes effect — submit:

- (i) a report on the distribution of payments to the beneficiary concerned;
- (ii) a request for amendment (see Article 55), with a proposal for reallocation of the tasks and estimated budget of the beneficiary concerned (see Annexes 1 and 2) and, if necessary, the addition of one or more new beneficiaries (see Article 56). If termination is notified after the period set out in Article 3, no request for amendment must be submitted unless the beneficiary concerned is the coordinator. In this case the request for amendment must propose a new coordinator, and
- (iii) if termination takes effect during the period set out in Article 3, a **termination report** from the beneficiary concerned, for the open reporting period until termination, containing an overview of the progress of the work, an overview of the use of resources, the individual financial statement and, if applicable, the certificate on the financial statement (see Article 20).

The information in the termination report must also be included in the periodic report for the next reporting period (see Article 20.3).

If the request for amendment is rejected by the Agency (because it calls into question the decision awarding the grant or breaches the principle of equal treatment of applicants), the Agreement may be terminated according to Article 50.3.1(c).

If the request for amendment is accepted by the Agency, the Agreement is **amended** to introduce the necessary changes (see Article 55).

The Agency will — on the basis of the periodic reports, the termination report and the report



on the distribution of payments — **calculate** the amount which is due to the beneficiary and if the (pre-financing and interim) payments received by the beneficiary exceed this amount.

The **amount which is due** is calculated in the following steps:

Step 1 — Application of the reimbursement rate to the eligible costs

The grant amount for the beneficiary is calculated by applying the reimbursement rate(s) to the total eligible costs declared by the beneficiary and its linked third parties in the termination report and approved by the Agency.

Only costs incurred by the beneficiary concerned until termination takes effect are eligible (see Article 6). Costs relating to contracts due for execution only after termination are not eligible.

Step 2 — Reduction due to substantial errors, irregularities or fraud or serious breach of obligations

In case of a reduction (see Article 43), the Agency will calculate the reduced grant amount for the beneficiary by deducting the amount of the reduction (calculated in proportion to the seriousness of the errors, irregularities or fraud or breach of obligations, in accordance with Article 43.2) from the grant amount for the beneficiary.

If the payments received **exceed the amounts due**:

- if termination takes effect during the period set out in Article 3 and the request for amendment is accepted, the beneficiary concerned must repay to the coordinator the amount unduly received. The Agency will formally notify the amount unduly received and request the beneficiary concerned to repay it to the coordinator within 30 days of receiving notification. If it does not repay the coordinator, the Agency will draw upon the Guarantee Fund to pay the coordinator and then notify a **debit note** on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- in all other cases, in particular if termination takes effect after the period set out in Article 3, the Agency will formally notify a **debit note** to the beneficiary concerned. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the Agency the amount due and the Agency will notify a debit note on behalf of the Guarantee Fund to the beneficiary concerned (see Article 44);
- if the beneficiary concerned is the former coordinator, it must repay the new coordinator according to the procedure above, unless:
 - termination takes effect after an interim payment and
 - the former coordinator has not distributed amounts received as pre-financing or interim payments (see Article 21.7).

In this case, the Agency will formally notify a **debit note** to the former coordinator. If payment is not made by the date in the debit note, the Guarantee Fund will pay to the Agency the amount due. The Agency will then pay the new coordinator and notify a debit note on behalf of the Guarantee Fund to the former coordinator (see Article 44).



If the payments received **do not exceed the amounts due**: amounts owed to the beneficiary concerned will be included in the next interim or final payment.

If the Agency does not receive the termination report within the deadline (see above), only costs included in an approved periodic report will be taken into account.

If the Agency does not receive the report on the distribution of payments within the deadline (see above), it will consider that:

- the coordinator did not distribute any payment to the beneficiary concerned and that
- the beneficiary concerned must not repay any amount to the coordinator.

After termination, the concerned beneficiary's obligations (in particular Articles 20, 22, 23, Section 3 of Chapter 4, 36, 37, 38, 40, 42, 43 and 44) continue to apply.

SECTION 4 FORCE MAJEURE

ARTICLE 51 — FORCE MAJEURE

'Force majeure' means any situation or event that:

- prevents either party from fulfilling their obligations under the Agreement,
- was unforeseeable, exceptional situation and beyond the parties' control,
- was not due to error or negligence on their part (or on the part of third parties involved in the action), and
- proves to be inevitable in spite of exercising all due diligence.

The following cannot be invoked as force majeure:

- any default of a service, defect in equipment or material or delays in making them available, unless they stem directly from a relevant case of force majeure,
- labour disputes or strikes, or
- financial difficulties.

Any situation constituting force majeure must be formally notified to the other party without delay, stating the nature, likely duration and foreseeable effects.

The parties must immediately take all the necessary steps to limit any damage due to force majeure and do their best to resume implementation of the action as soon as possible.

The party prevented by force majeure from fulfilling its obligations under the Agreement cannot be considered in breach of them.

CHAPTER 7 FINAL PROVISIONS



ARTICLE 52 — COMMUNICATION BETWEEN THE PARTIES

52.1 Form and means of communication

Communication under the Agreement (information, requests, submissions, ‘formal notifications’, etc.) must:

- be made in writing and
- bear the number of the Agreement.

All communication must be made through the Participant Portal **electronic exchange system** and using the forms and templates provided there.

If — after the payment of the balance — the Agency finds that a formal notification was not accessed, a second formal notification will be made by registered post with proof of delivery (‘formal notification on **paper**’). Deadlines will be calculated from the moment of the second notification.

Communications in the electronic exchange system must be made by persons authorised according to the Participant Portal Terms & Conditions. For naming the authorised persons, each beneficiary must have designated — before the signature of this Agreement — a ‘legal entity appointed representative (LEAR)’. The role and tasks of the LEAR are stipulated in his/her appointment letter (see Participant Portal Terms & Conditions).

If the electronic exchange system is temporarily unavailable, instructions will be given on the Agency and Commission websites.

52.2 Date of communication

Communications are considered to have been made when they are sent by the sending party (i.e. on the date and time they are sent through the electronic exchange system).

Formal notifications through the **electronic exchange system** are considered to have been made when they are received by the receiving party (i.e. on the date and time of acceptance by the receiving party, as indicated by the time stamp). A formal notification that has not been accepted within 10 days after sending is considered to have been accepted.

Formal notifications **on paper** sent by **registered post** with proof of delivery (only after the payment of the balance) are considered to have been made on either:

- the delivery date registered by the postal service or
- the deadline for collection at the post office.

If the electronic exchange system is temporarily unavailable, the sending party cannot be considered in breach of its obligation to send a communication within a specified deadline.

52.3 Addresses for communication

The **electronic exchange system** must be accessed via the following URL:

<https://ec.europa.eu/info/funding-tenders/opportunities/portal/screen/myarea/projects>



The Agency will formally notify the coordinator and beneficiaries in advance any changes to this URL.

Formal notifications on paper (only after the payment of the balance) addressed **to the Agency** must be sent to the official mailing address indicated on the Agency's website.

Formal notifications on paper (only after the payment of the balance) addressed **to the beneficiaries** must be sent to their legal address as specified in the Participant Portal Beneficiary Register.

ARTICLE 53 — INTERPRETATION OF THE AGREEMENT

53.1 Precedence of the Terms and Conditions over the Annexes

The provisions in the Terms and Conditions of the Agreement take precedence over its Annexes.

Annex 2 takes precedence over Annex 1.

53.2 Privileges and immunities

Not applicable

ARTICLE 54 — CALCULATION OF PERIODS, DATES AND DEADLINES

In accordance with Regulation No 1182/71³⁰, periods expressed in days, months or years are calculated from the moment the triggering event occurs.

The day during which that event occurs is not considered as falling within the period.

ARTICLE 55 — AMENDMENTS TO THE AGREEMENT

55.1 Conditions

The Agreement may be amended, unless the amendment entails changes to the Agreement which would call into question the decision awarding the grant or breach the principle of equal treatment of applicants.

Amendments may be requested by any of the parties.

55.2 Procedure

The party requesting an amendment must submit a request for amendment signed in the electronic exchange system (see Article 52).

The coordinator submits and receives requests for amendment on behalf of the beneficiaries (see Annex 3).

If a change of coordinator is requested without its agreement, the submission must be done by another beneficiary (acting on behalf of the other beneficiaries).

The request for amendment must include:

³⁰ Regulation (EEC, Euratom) No 1182/71 of the Council of 3 June 1971 determining the rules applicable to periods, dates and time-limits (OJ L 124, 8.6.1971, p. 1).



- the reasons why;
- the appropriate supporting documents, and
- for a change of coordinator without its agreement: the opinion of the coordinator (or proof that this opinion has been requested in writing).

The Agency may request additional information.

If the party receiving the request agrees, it must sign the amendment in the electronic exchange system within 45 days of receiving notification (or any additional information the Agency has requested). If it does not agree, it must formally notify its disagreement within the same deadline. The deadline may be extended, if necessary for the assessment of the request. If no notification is received within the deadline, the request is considered to have been rejected.

An amendment **enters into force** on the day of the signature of the receiving party.

An amendment **takes effect** on the date agreed by the parties or, in the absence of such an agreement, on the date on which the amendment enters into force.

ARTICLE 56 — ACCESSION TO THE AGREEMENT

56.1 Accession of the beneficiaries mentioned in the Preamble

The other beneficiaries must accede to the Agreement by signing the Accession Form (see Annex 3) in the electronic exchange system (see Article 52) within 30 days after its entry into force (see Article 58).

They will assume the rights and obligations under the Agreement with effect from the date of its entry into force (see Article 58).

If a beneficiary does not accede to the Agreement within the above deadline, the coordinator must — within 30 days — request an amendment to make any changes necessary to ensure proper implementation of the action. This does not affect the Agency's right to terminate the Agreement (see Article 50).

56.2 Addition of new beneficiaries

In justified cases, the beneficiaries may request the addition of a new beneficiary.

For this purpose, the coordinator must submit a request for amendment in accordance with Article 55. It must include an Accession Form (see Annex 3) signed by the new beneficiary in the electronic exchange system (see Article 52).

New beneficiaries must assume the rights and obligations under the Agreement with effect from the date of their accession specified in the Accession Form (see Annex 3).

ARTICLE 57 — APPLICABLE LAW AND SETTLEMENT OF DISPUTES

57.1 Applicable law

The Agreement is governed by the applicable EU law, supplemented if necessary by the law of Belgium.



57.2 Dispute settlement

If a dispute concerning the interpretation, application or validity of the Agreement cannot be settled amicably, the General Court — or, on appeal, the Court of Justice of the European Union — has sole jurisdiction. Such actions must be brought under Article 272 of the Treaty on the Functioning of the EU (TFEU).

As an exception, if such a dispute is between the Agency and YAYASAN AMIKOM YOGYAKARTA, COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION, UNIVERSIDADE FEDERAL DO RIO DE JANEIRO, the competent Belgian courts have sole jurisdiction.

If a dispute concerns administrative sanctions, offsetting or an enforceable decision under Article 299 TFEU (see Articles 44, 45 and 46), the beneficiaries must bring action before the General Court — or, on appeal, the Court of Justice of the European Union — under Article 263 TFEU. Actions against offsetting and enforceable decisions must be brought against the Commission (not against the Agency).

ARTICLE 58 — ENTRY INTO FORCE OF THE AGREEMENT

The Agreement will enter into force on the day of signature by the Agency or the coordinator, depending on which is later.

SIGNATURES

For the coordinator

Danilo IERVOLINO with ECAS id niervoda signed in the Participant Portal on 28/09/2021 at 11:42:40 (transaction id SigId-54352-SqBMqxgrCPvMi7CWs2mX4neqGSKGMKMI0i3wzRPWlercVAihI76Ct6yVvNO R0uFzGWHPRgPu31QlVb3uBp3HIU-rS0vSrmBGYCagVEG22GDby-IVEJ YzGt1cWHW3sq3YzRej4exgCurAvjMMFYtssO2f14rO3ZGkkkBdDU4zz S26L2AN6GKHpsb1CmCFYBHiu6WXm). Timestamp by third party at 2021.09.28 12:42:45 CEST

For the Agency

Signed by Arnoldas MILUKAS with ECAS id milukar as an authorised representative on 28-09-2021 14:27:20 (transaction id SigId-55840-DyxskBMzM3kNMB73I4GN1bQA7s7FDfE3yNqIVxuQN6A2jSvlbsAVXnT1 MD3ckAZWV6QZG1n4uK4G8vDAQD2dIe-rS0vSrmBGYCagVEG22GDby-ahWZYPXgSCtgjCF0LhBYOUl8NO3PgbeL seNrzzcB6dzvvcbNDw1DryRWQo8sjGcGgxpjpba44InPQwwwpV2TCqG) 2021.09.28 14:27:26 CEST



EUROPEAN RESEARCH EXECUTIVE AGENCY (REA)

REA.B – Green Europe
B.03 – Biodiversity, Circular Economy and Environment

ANNEX 1 (part A)

Innovation action

NUMBER — 101037247 — SILVANUS

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1.1. The project summary



Associated with document Ref. Ares(2021)5870004 - 27/09/2021

Project Number ¹	101037247	Project Acronym ²	SILVANUS
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One form per project

General information	
Project title ³	Integrated Technological and Information Platform for wildfire Management
Starting date ⁴	The first day of the month after the signature by the Agency
Duration in months ⁵	42
Call (part) identifier ⁶	H2020-LC-GD-2020-3
Topic	LC-GD-1-1-2020 Preventing and fighting extreme wildfires with the integration and demonstration of innovative means
Fixed EC Keywords	Digital Services and Platforms, Earth Observation / Services and applications, Forest adaptation to climate change, Remote Sensing Instruments / Sensors, Agriculture / Forestry / Rural Development, In-Situ Instruments / sensors
Free keywords	Forest landscape management, 3D forest model, citizen engagement, power & waer utilities, regulation & insurance, big-data framework
Abstract ⁷	
<p>SILVANUS envisages to deliver an environmentally sustainable and climate resilient forest management platform through innovative capabilities to prevent and combat against the ignition and spread of forest fires. The platform will cater to the demands of efficient resource utilisation and provide protection against threats of wildfires encountered globally. The project will establish synergies between (i) environmental; (ii) technology and (iii) social science experts for enhancing the ability of regional and national authorities to monitor forest resources, evaluate biodiversity, generate more accurate fire risk indicators and promote safety regulations among citizens through awareness campaigns. The novelty of SILVANUS lies in the development and integration of advanced semantic technologies to systematically formalise the knowledge of forest administration and resource utilisation. Additionally, the platform will integrate a big-data processing framework capable of analysing heterogeneous data sources including earth observation resources, climate models and weather data, continuous on-board computation of multi-spectral video streams. Also, the project integrates a series of sensor and actuator technologies using innovative wireless communication infrastructure through the coordination of aerial vehicles and ground robots.</p> <p>The technological platform will be complemented with the integration of resilience models, and the results of environmental and ecological studies carried out for the assessment of fire risk indicators based on continuous surveys of forest regions. The surveys are designed to take into consideration the expertise and experience of frontline fire fighter organisations who collectively provide support for 47,504x104 sq. meters of forest area within Europe and across international communities. The project innovation will be validated through 11 pilot demonstrations across Europe and internationally using a two sprint cycle.</p>	

1.2. List of Beneficiaries



Associated with document Ref. Ares(2021)5870004 - 27/09/2021

Project Number ¹	101037247	Project Acronym ²	SILVANUS
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List of Beneficiaries

No	Name	Short name	Country	Project entry month ⁸	Project exit month
1	UNIVERSITA TELEMATICA PEGASO	PEGASO	Italy	1	42
2	ZANASI ALESSANDRO SRL	Z&P	Italy	1	42
3	INTRASOFT INTERNATIONAL SA	INTRA	Luxembourg	1	42
4	THALES	TRT	France	1	42
5	FINCONS SPA	FINC	Italy	1	42
6	ATOS IT SOLUTIONS AND SERVICES IBERIA SL	ATOS IT	Spain	1	42
7	EMC INFORMATION SYSTEMS INTERNATIONAL	DELL	Ireland	1	42
8	SOFTWARE IMAGINATION & VISION SRL	SIMAVI	Romania	1	42
9	CNET CENTRE FOR NEW ENERGY TECHNOLOGIES SA	EDP	Portugal	1	42
10	ADP VALOR - SERVIÇOS AMBIENTAIS, S.A.	ADP	Portugal	1	42
11	TERRAPRIMA - SERVICOS AMBIENTAIS SOCIEDADE UNIPESSOAL LDA	TP	Portugal	1	42
12	3MON, S. R. O.	3MON, s. r. o.	Slovakia	1	42
13	CATALINK LIMITED	CTL	Cyprus	1	42
14	SYNTHESIS CENTER FOR RESEARCH AND EDUCATION LIMITED	SYNC	Cyprus	1	42
15	EXPERT.AI S.P.A.	EAI	Italy	1	42
16	ITTI SP ZOO	ITTI	Poland	1	42
17	IZQUIERDO/PIATRIK GBR	VMG	Germany	1	42
18	MASSIVE DYNAMIC SWEDEN AB	MDS	Sweden	1	42
19	FONDAZIONE CENTRO EURO-MEDITERRANEOSUI CAMBIAMENTI CLIMATICI	CMCC F	Italy	1	42
20	EXUS SOFTWARE MONOPROSOPI ETAIRIA PERIORISMENIS EVTHINIS	EXUS	Greece	1	42
21	RINIGARD DOO ZA USLUGE	RINI	Croatia	1	42
22	MICRO DIGITAL DOO ZA INFORMACIJSKE TEHNOLOGIJE	MD	Croatia	1	42
23	POLITECHNIKA WARSZAWSKA	WUT	Poland	1	42
24	HOEGSKOLAN I BORAS	HB	Sweden	1	42
25	GEOPONIKO PANEPISTIMION ATHINON	AUA	Greece	1	42

1.2. List of Beneficiaries



Associated with document Ref. Ares(2021)5870004 - 27/09/2021

No	Name	Short name	Country	Project entry month ⁸	Project exit month
26	ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS	CERTH	Greece	1	42
27	PANEPISTIMIO THESSALIAS	UTH	Greece	1	42
28	ASSOCIACAO DO INSTITUTO SUPERIOR TECNICO PARA A INVESTIGACAO E DESENVOLVIMENTO	IST	Portugal	1	42
29	VELEUCILISTE VELIKA GORICA	UASVG	Croatia	1	42
30	USTAV INFORMATIKY, SLOVENSKA AKADEMIA VIED	UISAV	Slovakia	1	42
31	POMPIERS DE L'URGENCE INTERNATIONALE	PUI	France	1	42
32	THE MAIN SCHOOL OF FIRE SERVICE	SGSP	Poland	1	42
33	AGENZIA REGIONALE STRATEGICA PER LO SVILUPPO ECOSOSTENIBILE DEL TERRITORIO	ASSET	Italy	1	42
34	LETS ITALIA SRLS	LETS	Italy	1	42
35	PARCO NATURALE REGIONALE DI TEPILORA	PNRT	Italy	1	42
36	FUNDATIA PENTRU SMURD	FptSMURD	Romania	1	42
37	ASOCIAITIA FORESTIERILOR DIN ROMANIA ASFOR	ASFOR	Romania	1	42
38	KENTRO MELETON ASFALEIAS	KEMEA	Greece	1	42
39	ELLINIKI OMADA DIASOSIS SOMATEIO	HRT	Greece	1	42
40	ARISTOTELIO PANEPISTIMIO THESSALONIKIS	AHEPA	Greece	1	42
41	OSPEDALE ISRAELITICO	OIR	Italy	1	42
42	PERIFEREIA STEREAS ELLADAS	PSTE	Greece	1	42
43	HASICSKY ZACHRANNY SBOR MORAVSKOSLEZSKEHO KRAJE	FRS MB	Czech Republic	1	42
44	HRVATSKA VATROGASNA ZAJEDNICA	HVZ	Croatia	1	42
45	TECHNICKA UNIVERZITA VO ZVOLENE	TUZVO	Slovakia	1	42
46	OBCIANSKE ZDRUZENIE PLAMEN BADIN	Plamen	Slovakia	1	42
47	YAYASAN AMIKOM YOGYAKARTA	AMIKOM	Indonesia	1	42
48	COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION	CSIRO	Australia	1	42
49	UNIVERSIDADE FEDERAL DO RIO DE JANEIRO	UFRJ	Brazil	1	42

1.3. Workplan Tables - Detailed implementation



Associated with document Ref. Ares(2021)5870004 - 27/09/2021

1.3.1. WT1 List of work packages

WP Number ⁹	WP Title	Lead beneficiary ¹⁰	Person-months ¹¹	Start month ¹²	End month ¹³
WP1	Project coordination	1 - PEGASO	199.00	1	42
WP2	Environmentally sustainable, resilient forest models and assessment framework	45 - TUZVO	350.00	1	30
WP3	Culture of deterrence and prevention against wildfires based on sustainable forest management services	8 - SIMAVI	395.00	3	36
WP4	Advanced detection capabilities for early-stage detection of wildfires	19 - CMCC F	396.00	3	36
WP5	Response coordination to contain the spread of wildfire	7 - DELL	451.00	3	42
WP6	Enhanced resilience programme for forest management through restoration and adaptation	47 - AMIKOM	219.00	1	42
WP7	Policy recommendations on environmental sustainability and forest restoration	25 - AUA	233.00	1	42
WP8	Platform design specification, interfaces and integration	3 - INTRA	317.00	3	42
WP9	Large-scale demonstration activities of project outcomes	37 - ASFOR	521.50	12	42
WP10	Dissemination and exploitation	22 - MD	360.00	1	42
WP11	Ethics requirements	1 - PEGASO	N/A	1	42
Total			3 441.50		

1.3.2. WT2 list of deliverables

Deliverable Number¹⁴	Deliverable Title	WP number⁹	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D1.1	SILVANUS Project handbook	WP1	1 - PEGASO	Report	Confidential, only for members of the consortium (including the Commission Services)	1
D1.2	Quality assurance and risk register	WP1	1 - PEGASO	Report	Confidential, only for members of the consortium (including the Commission Services)	3
D1.3	Data management plan	WP1	1 - PEGASO	ORDP: Open Research Data Pilot	Confidential, only for members of the consortium (including the Commission Services)	6
D1.4	IPR initial report	WP1	2 - Z&P	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D1.5	Initial ethics and legal and management report	WP1	38 - KEMEA	Report	Public	6
D1.6	Quality assurance and risk register 2nd version	WP1	1 - PEGASO	Report	Confidential, only for members of the consortium (including the Commission Services)	30
D1.7	IPR final report	WP1	2 - Z&P	Report	Confidential, only for members of the consortium (including the Commission Services)	42
D1.8	Final ethics and legal management report	WP1	38 - KEMEA	Report	Public	42
D2.1	Report on existing sustainable forest management services	WP2	45 - TUZVO	Report	Public	6
D2.2	First report on environmentally sustainable, resilient forest	WP2	19 - CMCC F	Report	Public	9

Deliverable Number¹⁴	Deliverable Title	WP number⁹	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D2.3	Report on SILVANUS formal assessment methodology	WP2	34 - LETS	Report	Public	12
D2.4	Report on environmentally sustainable, resilient forest	WP2	25 - AUA	Report	Public	24
D2.5	Final report on SILVANUS formal assessment methodology	WP2	34 - LETS	Report	Public	30
D3.1	First report on the formal specification of sustainable	WP3	15 - EAI	Report	Public	9
D3.2	Planning and delivery of training activities – Phase 1	WP3	8 - SIMAVI	Report	Public	18
D3.3	First release of citizen engagement methodology	WP3	24 - HB	Demonstrator	Public	18
D3.4	Planning and delivery of training activities – Phase 2	WP3	8 - SIMAVI	Other	Public	36
D3.5	Final report on SILVANUS culture of deterrence	WP3	24 - HB	Other	Public	36
D4.1	Demonstration of data collection, aggregation of EO, weather/climate models and in-situ environmental sensors	WP4	19 - CMCC F	Demonstrator	Public	18
D4.2	Demonstration of social media analytics for localising the origin of wildfire ignition	WP4	26 - CERTH	Demonstrator	Public	18
D4.3	Demonstration of ground vehicle navigation to and from frontline wildfire spread	WP4	48 - CSIRO	Demonstrator	Public	18
D4.4	Autonomous piloting of UAV fleet and coordination for remote sensing and identification of wildfire ignition	WP4	4 - TRT	Demonstrator	Public	24

Deliverable Number¹⁴	Deliverable Title	WP number⁹	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D4.5	Report on SILVANUS advanced detection capabilities	WP4	19 - CMCC F	Demonstrator	Public	36
D5.1	Demonstration of big-data framework for situation awareness on fire danger index	WP5	19 - CMCC F	Demonstrator	Public	21
D5.2	Demonstration of MESH in the sky communication infrastructure	WP5	21 - RINI	Demonstrator	Public	21
D5.3	Demonstration of SILVANUS decision support system for response coordination	WP5	3 - INTRA	Demonstrator	Public	24
D5.4	Semantic information fusion framework	WP5	13 - CTL	Demonstrator	Public	30
D5.5	Demonstration of SILVANUS decision support system for response coordination Final version	WP5	3 - INTRA	Demonstrator	Public	36
D5.6	Report on implementation specification on communication protocols for coordinating response	WP5	21 - RINI	Report	Public	42
D6.1	Review of ecological resilience programme across EU	WP6	47 - AMIKOM	Report	Public	18
D6.2	Report on SILVANUS resilience programme for forest management, v1	WP6	47 - AMIKOM	Report	Public	24
D6.3	Report on privacy and societal im-pact assessment of technology Interventions	WP6	38 - KEMEA	Report	Public	30
D6.4	Report on SILVANUS resilience programme for forest management	WP6	47 - AMIKOM	Report	Public	36
D6.5	Final report on SILVANUS resilience programme and contribution to EU legal framework on climate change	WP6	38 - KEMEA	Report	Public	42

Deliverable Number¹⁴	Deliverable Title	WP number⁹	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D7.1	First draft on policy recommendation framework	WP7	25 - AUA	Report	Public	18
D7.2	Second draft on policy recommendation framework	WP7	25 - AUA	Report	Public	36
D7.3	Final policy recommendation framework	WP7	25 - AUA	Report	Public	42
D8.1	Report on SILVANUS reference architecture	WP8	3 - INTRA	Report	Confidential, only for members of the consortium (including the Commission Services)	9
D8.2	SILVANUS platform release, 1st version	WP8	3 - INTRA	Demonstrator	Public	18
D8.3	Report on SILVANUS final reference architecture	WP8	3 - INTRA	Report	Confidential, only for members of the consortium (including the Commission Services)	24
D8.4	SILVANUS platform release, 2nd version	WP8	3 - INTRA	Demonstrator	Public	36
D8.5	SILVANUS (final) platform release	WP8	3 - INTRA	Demonstrator	Confidential, only for members of the consortium (including the Commission Services)	42
D8.6	SILVANUS demonstration	WP8	3 - INTRA	Demonstrator	Public	42
D9.1	Report on organisational readiness of the pilot setup	WP9	37 - ASFOR	Report	Confidential, only for members of the consortium (including the Commission Services)	15
D9.2	Report on first trial period activities for Phase A, B and C	WP9	37 - ASFOR	Report	Confidential, only for members of the consortium (including the Commission Services)	27
D9.3	Report on formal assessment of trial period #1	WP9	9 - EDP	Report	Public	30

Deliverable Number¹⁴	Deliverable Title	WP number⁹	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D9.4	Report on second trial period activities for Phase A, B, C	WP9	37 - ASFOR	Report	Confidential, only for members of the consortium (including the Commission Services)	39
D9.5	Report on formal assessment of trial period #2	WP9	25 - AUA	Report	Public	42
D10.1	SILVANUS dissemination and community engagement	WP10	22 - MD	Report	Public	1
D10.2	Annual report on SILVANUS dissemination activities, v1	WP10	22 - MD	Report	Public	12
D10.3	Annual report on SILVANUS dissemination activities, v2	WP10	22 - MD	Report	Public	24
D10.4	Annual report on SILVANUS dissemination activities, v3	WP10	22 - MD	Report	Public	36
D10.5	Report on forest landscape management services	WP10	6 - ATOS IT	Report	Public	36
D10.6	SILVANUS final report on dissemination and exploitation	WP10	22 - MD	Report	Public	42
D10.7	Self-sustainability business plan for Centre for Adaptation Strategies and Development (CASD)	WP10	22 - MD	Report	Confidential, only for members of the consortium (including the Commission Services)	42
D11.1	H - Requirement No. 1	WP11	1 - PEGASO	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D11.2	POPD - Requirement No. 2	WP11	1 - PEGASO	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3

Deliverable Number¹⁴	Deliverable Title	WP number⁹	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D11.3	NEC - Requirement No. 3	WP11	1 - PEGASO	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3

1.3.3. WT3 Work package descriptions

Work package number⁹	WP1	Lead beneficiary¹⁰	1 - PEGASO
Work package title	Project coordination		
Start month	1	End month	42

Objectives

The objective of this work package is to provide overall project leadership and management to ensure the consortium partners are aligned with the project goals and the workplan is being implemented as outlined. The coordinator will be responsible for closely monitoring the resource expenditure of consortium partners along with monitoring risks that are foreseeable and otherwise. The work package will also offer leadership to the consortium in prioritising the activities that achieve project goals and objectives. This task will involve the following activities:

- to provide effective overall project management throughout the duration of the project
- to coordinate the scientific and technical activities of the project
- to establish an SRF-WG stakeholder advisory board to continuously share feedback on the project developments
- to develop the IPR framework for long-term sustainability of the developed solutions within the project
- to implement project quality assurance guidelines

Description of work and role of partners

WP1 - Project coordination [Months: 1-42]

PEGASO, Z&P, INTRA, TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, ADP, TP, 3MON, s. r. o., CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, EXUS, RINI, MD, WUT, HB, AUA, CERTH, UTH, IST, UASVG, UISAV, PUI, SGSP, ASSET, LETS, PNRT, FptSMURD, ASFOR, KEMEA, HRT, AHEPA, PSTE, FRS MB, HVZ, TUZVO, Plamen, AMIKOM, CSIRO, UFRJ

T1.1 – Project management [Lead: PEG; Participants: INTRA, TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, ADP, 3MON, CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, Z&P, EXUS, RINI, MD, WUT, HB, AUA, CERTH, UTH, IST, TP, UASVG, UISAV, SGPS, PUI, ASSET, LETS, PNRT, SMURD, ASFOR, KEMEA, HRT, PSTE, AHEPA, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM, CSIRO, UFRJ, CSIRO; Duration: M1-M42; D1.1, D1.2, D1.3, D1.4]:

This task aims at providing the overall coordination for the project including day-to-day operations of the project and the financial management. The task will setup a project management office (PMO) to handle the project wide communication along with liaising with EC and external stakeholders. The task will also provide project strategy to ensure the project achieves the set objectives. This task will involve the following activities: (i) organise the project launch; establish procedures, project management processes and tools including risk registers and indicators; organise kick-off meeting; maintain contractual documents; (ii) organise follow-up periodic project board meetings for project review, strategy, decision making and conflict resolution; coordinate internal and contractual period reporting and internal project report/reviews; coordinate the timely production of deliverables and reports and maintain project archives; (iii) monitor the activities carried out, the results and the necessary changes to the work plan because of those findings, per project milestones and indicators. This task will establish reporting procedures to the EC and manage cost reports, including the collection and control of inputs and justifications provided by partners. The report will include financial aspects of the distribution of EC funding to partners.

T1.2 - Innovation management and scientific coordination [Lead: Z&P, Participant: KEMEA; Duration: M1-M42; D1.2, D1.3, D1.4]: The SILVANUS consortium in consultation with stakeholders, has already identified a list of tangible assets that would be transformative for the holistic monitoring and protection of natural forest resources. The interdisciplinary platform development will consider the needs and requirements of the respective stakeholder represented in the consortium from 18 countries. The maturity and the technological innovation of the solutions (identified in Error: Reference source not found) will be monitored against the market needs of the sustainable forest management sector. The innovation management of the SILVANUS solutions will be closely overseen by the industrial stakeholder in collaboration with the SFR-WG consisting of front-line fire fighters, academic scientists with expertise in environmental studies, technology solutions and biodiversity analysis. The project innovation board to be setup at the beginning of the project (with few of the board members expressing their interest to join the project included in Section 5/6) and will consist of a minimum of 20 experts throughout the lifecycle of the project representing a diversity in expertise and also geographic distribution.

T1.3 - Quality assurance and risk management [Lead: PEGSO, M1-M42, D1.2, D1.6]: The project coordinator, in consultation with respective WP leaders responsible for the deliverables, will implement processes and procedures as recommended in ISO 9001 for quality management. The quality assurance process will include some flexibility to cater to the needs and demands of the project. The description of work is organised transparently and clearly, assigning responsibilities for certain tasks to certain partners, even where the responsible organisation should coordinate inputs from other participants; development, testing configuration, acceptance and maintenance plans will be defined and controlled. The task will closely monitor the progress and achievement of milestones as outlined in Error: Reference source not found. The goal of the task is to establish a continuous risk monitoring methodology that systematically categorises the foreseen and unforeseeable risks into (i) environment; (ii) human-factors and (iii) technical and scientific innovation. The envisaged technical and scientific innovation within the project (see Section 1.3) will be demonstrated within the pilot site (as outlined in Section 1.3.3), which requires the coordination of several consortium partners and end-users in the project. The task will develop foreseeable mitigation strategies in compliance with the project planning and will make recommendations to the project steering board to adopt resolutions to minimise the impact of risk on the project lifecycle.

T1.4 – Data management [lead: PEGASO, Participant: KEMEA, Duration: M1-M42; D1.3, D1.7]: The objective of the task is to develop and provide data management policies and recommendations that relate to the planning, implementation and administration of the IT systems concerned with the acquisition, storage, security and retrieval, dissemination, archival and disposal of data collected within the project for the purposes for evaluating the project outcomes As outlined in Section 1.3.3, the objective of SILVANUS is to conduct four (4) field trials across four countries that will systematically evaluate the robustness of the platform in combating forest fires across Phase A, Phase B and Phase C trials. Data management policies will be drafted for all types of data the project will collect and process will be developed. The Data Management Plan (DMP) will be created during the first six months of the project and will follow the Guidelines on Data Management of Horizon 2020. The DMP will strictly adhere to the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation- GDPR). The DMP will be updated at later stages in the project.

T1.5 - IPR management [lead: Z&P, Participant: PEGASO, ATOS IT; Duration: M1-M42; D1.3, D1.4, D1.7, D1.8]: Innovative technology will be developed within SILVANUS. Identifying ownership of IPRs on this technology will ensure its protection and exploitation. Within this purpose, this task deals with IPRs used, contributed, or generated within the Project; IPR issues (background, foreground, access rights, transfer of rights, joint ownership, dissemination etc.) shall be dealt in the Consortium Agreement, always in compliance with the Grant Agreement. More specifically, within this task, the consortium will identify, map the IPR protected materials used and/or generated within the Project and proceed with the necessary clearances and applications for protection if needed. Information related to IPRs will be collected through the distribution of surveys where partners will respond to questions in connection to their involvement. In particular, the use of open-source software will be carefully studied to ensure SILVANUS platform complies with the legal restrictions.

T1.6 Management of external legal and ethical advisory board [lead: KEMEA; Participant: PEGASO; Duration: M1-M42; D1.5, D1.9]: Particular attention will be devoted to the assessment and management of ethical issues throughout the project. Ethics and gender related questions identified in the operation of the project, management of data or report production and dissemination will be addressed, and solutions will be implemented. This task is going to identify, map and advise on the legal and ethics issues related to the research activities to be conducted under SILVANUS, providing guidance, and steering to all WPs as regards SILVANUS solution. An Ethics Advisory Board (EAB), consisting of internal and external ethics advisors and lead by KEMEA, will be established to ensure compliance of the project's activities and results to the ethical requirements of the EU directives. The Board will monitor privacy, ethics, data protection and other relevant ethical and legal issues that may arise from the development or deployment of the emerging SILVANUS techniques and methodologies. An Ethics Officer, leader of the EAB, will be appointed to advise the PM in addressing any ethical and legal issues that may occur. The Ethics Officer and the internal ethics advisors (IEA) will ensure compliance with the Ethics rules and requirements in place at European and national level; EEA will revise independently related issues. EO, IEA and EEA will work closely. KEMEA will lead this task and provide a Report with the identified legal and ethical aspects of the SILVANUS' methods and procedures including Ethics Guidelines, informed consent, Data processing Documentation Protocols, Risk Assessment if needed to identify, quantify or mitigate ethical (including personal data) risks that may occur in the course of development of technologies and methodologies.

Participation per Partner

Partner number and short name	WP1 effort
1 - PEGASO	53.00
2 - Z&P	36.00
3 - INTRA	2.00
4 - TRT	2.00
5 - FINC	2.00
6 - ATOS IT	4.00
7 - DELL	2.00
8 - SIMAVI	2.00
9 - EDP	2.00
10 - ADP	2.00
11 - TP	2.00
12 - 3MON, s. r. o.	2.00
13 - CTL	2.00
14 - SYNC	2.00
15 - EAI	2.00
16 - ITTI	2.00
17 - VMG	2.00
18 - MDS	2.00
19 - CMCC F	2.00
20 - EXUS	2.00
21 - RINI	2.00
22 - MD	2.00
23 - WUT	2.00
24 - HB	2.00
25 - AUA	2.00
26 - CERTH	2.00
27 - UTH	2.00
28 - IST	2.00
29 - UASVG	2.00
30 - UISAV	2.00
31 - PUI	2.00
32 - SGSP	2.00
33 - ASSET	2.00
34 - LETS	2.00
35 - PNRT	2.00

Partner number and short name	WP1 effort
36 - FptSMURD	2.00
37 - ASFOR	2.00
38 - KEMEA	18.00
39 - HRT	2.00
40 - AHEPA	2.00
42 - PSTE	2.00
43 - FRS MB	2.00
44 - HVZ	2.00
45 - TUZVO	2.00
46 - Plamen	2.00
47 - AMIKOM	2.00
48 - CSIRO	2.00
49 - UFRJ	2.00
Total	199.00

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D1.1	SILVANUS Project handbook	1 - PEGASO	Report	Confidential, only for members of the consortium (including the Commission Services)	1
D1.2	Quality assurance and risk register	1 - PEGASO	Report	Confidential, only for members of the consortium (including the Commission Services)	3
D1.3	Data management plan	1 - PEGASO	ORDP: Open Research Data Pilot	Confidential, only for members of the consortium (including the Commission Services)	6
D1.4	IPR initial report	2 - Z&P	Report	Confidential, only for members of the consortium (including the Commission Services)	6
D1.5	Initial ethics and legal and management report	38 - KEMEA	Report	Public	6
D1.6	Quality assurance and risk register 2nd version	1 - PEGASO	Report	Confidential, only for members of the	30

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
				consortium (including the Commission Services)	
D1.7	IPR final report	2 - Z&P	Report	Confidential, only for members of the consortium (including the Commission Services)	42
D1.8	Final ethics and legal management report	38 - KEMEA	Report	Public	42

Description of deliverables

D1.1 - SILVANUS project handbook: The deliverable will include a detailed description of the communication logistics, appointment of partner representatives, quality assurance and management guide-book to be adopted within the project. [M1]

D1.2 - Quality assurance and risk register: The document will outline in detail the quality assurance process and procedures to be adopted within the project. A risk register will also be created and monitored to ensure the project interdependencies are sufficiently addressed in a periodic manner. [M3]

D1.3 - Data Management Plan: A DMP handbook will be prepared and circulated. The final version will be made available by the end of M42 [M6]

D1.4 - IPR Initial Report: Mapping and recording the IPRs when the technology has been created but not yet tested. [M6]

D1.5 - Initial Ethics and Legal and management Report: This deliverable is going to include an initial mapping of the ethics and legal issues that will be tackled throughout of the project and the main action plan to ensure H2020 standards implementation. Guidelines will be issued in this purpose addressing ethical issues (including personal data) addressed to Partners, informed consent, Data processing Documentation Protocols and if needed a Risk Assessment. [M6]

D1.6 - Quality assurance and risk register, 2nd version: The document will revise D1.2 with new risks identified in the project. [M30]

D1.7 - Data Management Plan: Final version of DPM handbook [M42]

D1.8 - IPR Final Report: Final mapping and recording of the IPRs [M42]

D1.9 - Final Ethics and Legal management Report: This deliverable is going to document the measures established and the actions taken during the lifetime of the project to address any ethical, legal and societal issues that arose. It will provide for recommendations and lessons learnt. [M42]

D1.1 : SILVANUS Project handbook [1]

D1.1 - SILVANUS project handbook: The deliverable will include a detailed description of the communication logistics, appointment of partner representatives, quality assurance and management guidebook to be adopted within the project. [M1]

D1.2 : Quality assurance and risk register [3]

D1.2 - Quality assurance and risk register: The document will outline in detail the quality assurance process and procedures to be adopted within the project. A risk register will also be created and monitored to ensure the project interdependencies are sufficiently addressed in a periodic manner. [M3]

D1.3 : Data management plan [6]

D1.3 - Data Management Plan: A DMP handbook will be prepared and circulated. The final version will be made available by the end of M42 [M6]

D1.4 : IPR initial report [6]

D1.4 - IPR Initial Report: Mapping and recording the IPRs when the technology has been created but not yet tested. [M6]

D1.5 : Initial ethics and legal and management report [6]

D1.5 - Initial Ethics and Legal and management Report: This deliverable is going to include an initial mapping of the ethics and legal issues that will be tackled throughout of the project and the main action plan to ensure H2020 standards implementation. Guidelines will be issued in this purpose addressing ethical issues (including personal data) addressed to Partners, informed consent, Data processing Documentation Protocols and if needed a Risk Assessment. [M6]

D1.6 : Quality assurance and risk register 2nd version [30]

D1.6 - Quality assurance and risk register, 2nd version: The document will revise D1.2 with new risks identified in the project. [M30]

D1.7 : IPR final report [42]

D1.8 - IPR Final Report: Final mapping and recording of the IPRs [M42]

D1.8 : Final ethics and legal management report [42]

D1.9 - Final Ethics and Legal management Report: This deliverable is going to document the measures established and the actions taken during the lifetime of the project to address any ethical, legal and societal issues that arose. It will provide for recommendations and lessons learnt. [M42]

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS6	Final product release	3 - INTRA	42	D8.5, D10.5

Work package number⁹	WP2	Lead beneficiary¹⁰	45 - TUZVO
Work package title	Environmentally sustainable, resilient forest models and assessment framework		
Start month	1	End month	30

Objectives

The objective of this workpackage is to build interdisciplinary consensus among the different stake-holders contributing to the development of forest management services. The following specific objectives will be addressed:

- to review the sustainable forest management and fuel management services
- to develop forest landscape models for wildfire threat assessment across eight (8) EU national pilot sites and three (3) international demonstration locations
- to analyse the impact of climate sensitive forest models
- to develop formal assessment framework to be adopted for the evaluation of demonstration activities

Description of work and role of partners

WP2 - Environmentally sustainable, resilient forest models and assessment framework [Months: 1-30]

TUZVO, PEGASO, Z&P, INTRA, TRT, FINC, ATOS IT, SIMAVI, EDP, ADP, TP, 3MON, s. r. o., CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, EXUS, RINI, MD, WUT, HB, AUA, CERTH, UTH, IST, UASVG, UISAV, PUI, SGSP, ASSET, LETS, PNRT, FptSMURD, ASFOR, KEMEA, HRT, AHEPA, OIR, PSTE, FRS MB, HVZ, Plamen, AMIKOM, CSIRO, UFRJ

T2.1 Stakeholder consultation through participatory process [Lead: TUZVO; Participants: IN-TRA, TRT, FINC, ATOS IT, SIMAVI, EDP, ADP, 3MON, CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, Z&P, EXUS, RINI, MD, HB, AUA, PNRT, KEMEA, OIR, UFRJ; Duration: M1-M6; D2.1, D2.4]: The aim of the task is to develop a systematic procedure to engage the stakeholders involved in the forest management operations. The objective will be achieved by the following sub-tasks

- The project will adopt a transparent policy for launching consultation and will liaise with CSA action to enrich the outreach (TUZVO, CMCC F, SYNC, HB, MD, KEMEA, OIR).
- The rehabilitation of the forest landscape will be analysed through the participatory process methodology established to bring together interdisciplinary expertise. The task will outline in detail the process to be adopted in these sessions and will be led by evidence-based data analysis. (INTRA, TRT, FINC, ATOS IT, SIMAVI, EDP, ADP, CTL, Z&P, RINI, EAI, ITTI, MDS)
- The process will be chaired by the relevant stakeholders responsible for addressing the national priority towards forest rehabilitation and restoration. The process will include external experts invited to share specific knowledge on the process of establishing biodiversity and ecological balance. (TUZVO, SYNC, CMCC F, AUA, PNRT, UFRJ)
- The task will outline the existing infrastructures such as forest management alternatives, existing decision support systems to be integrated within the project platform (AUA, PNRT, OIR, UFRJ).

T2.2 - Functional requirements [Lead: TUZVO; Participants: PEGASO, Z&P, INTRA, TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, ADP, 3MON, CTL, SYNC, EAI, MD, HB, AUA, CERTH, UISAV, SGPS, PUI, ASSET, LETS, PNRT, SMURD, ASFOR, HRT, PSTE, AHEPA, FRB MSR, HVZ, PLAM, UFRJ; Duration: M1-M6; D2.1, D2.4]: The goal of the task is to finalise the functional requirements based on the scenarios identified in T2.1 for the three phases of forest management services to safeguard against wildfires. The objective will be achieved by the following sub-tasks

- The task will review the services supported within the forest management services such as (i) Bio-mass energy resources; (ii) Climate matching tool; (iii) Ecological Site Classification Decision Support system (ESC-DSS); (iv) Forest Condition Survey; (v) ForestGALES; (vi) Forest Planning and Management services; (vii) Forest Yield; (viii) Historic environment resources; (ix) National Forest Inventory; (x) Pest and disease resources; (xi) Provenance trials of native tree species. (TUZVO, ADP, SYNC, AUA, SGPS, PUI, ASSET, LETS, PNRT, SMURD, ASFOR, HRT, PSTE, AHEPA, FRB MSR, HVZ, PLAM)
- The functional requirements will be validated by the external stakeholders and interdisciplinary experts (PEGASO, Z&P, INTRA, TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, 3MON, CTL, EAI, CERTH, UISAV)
- The outcome of the task will be shared with CSA project to promote the scope and demonstration scenarios within SILVANUS (MD, HB).

T2.3 Forest landscape models for wildfire threat assessment [Lead: AUA; Participants: PEGASO, EAI, UASVG, SGPS, PUI, ASSET, LETS, SMURD, ASFOR, KEMEA, HRT, OIR, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM, CSIRO,

UFRJ; Duration: M6-M30; D2.4]: The objective of the task is to study and formalise the forest landscape models across each of the pilot sites. The following three sub-tasks are designed to achieve the objective.

- To develop models that incorporate other spatio-temporal processes such as natural disturbances (e.g., wildfires, hurricanes, outbreaks of native and exotic invasive pests and diseases) and human influences (e.g., harvesting, and commercial thinning, planting, fire suppression). The models are increasingly used as tools for studying forest management, ecological assessment, restoration planning, and climate change. The categorisation of forest models will be used to define the scope of demonstration activities as outlined in Section 1.3.3 (PEGASO, AUA, PUI, ASSET, LETS, SMURD, ASFOR, KEMEA, HRT, OIR, FRB MSR, HVZ, PLAM, TUZVO)
- The importance of structurally diverse forests for the conservation of biodiversity post fire suppression and provision of a wide range of ecosystem services has been widely recognised. The activities in the task will extend beyond the comprehensive list of variables comprise 1) quadratic mean diameter at breast height (DBH), 2) standard deviation of DBH, 3) standard deviation of stand height, 4) number of decay classes, 5) bark-diversity index, 6) trees with DBH \geq 40 cm, 7) diversity of flowering and fructification, 8) average mean diameter of downed deadwood, 9) mean DBH of standing deadwood, 10) tree species richness and 11) tree species richness in the regeneration layer (ADP, UASVG, AMIKOM).
- To optimize the process of forest landscape management according the wildfire threat also forest fuel (especially fine fuel which moisture content is of the highest significance to calculate the fire danger index) management systems and strategies in the forest will be studied and reviewed. Fuel management alternatives for different forest types (based on location, species composition, existing management operations), focusing the wildfire prevention and mitigation, will be developed, and further evaluated by the stakeholders in selected countries (involvement of participatory processes) (CSIRO, UFRJ).

T2.4 Climate sensitive forest models for impacts on forest management [Lead: CMCC F; Participants: INTRA, SIMAVI, ITTI, VMG, MDS, Z&P, RINI, MD, WUT, AUA, CERTH, UTH, IST, TP, UASVG, UISAV, PNRT, AHEPA, OIR, TUZVO, UFRJ; Duration: M6-M30; D2.4]: The objective of the task is to fine-tune well established forest ecosystem models, hybrid among process-based carbon balance approach with a strong inventory-based empirical component, able to take into account climate forcing and human management (e.g. FORMIT-M, 3D-CMCC-FEM, GO+) and provide both climate and impact multi-model perspective on how climate impacts forest and how management perform, in terms of maintenance of forest and their ecosystems, currently as well as under alternative climate conditions. The task will include two sub-tasks below.

- The adopted models will be compatible with the need of formalising quantifiable metrics of forest functioning and status, such as forest productivity, biomass provision and other ecosystem services and biodiversity. Such metrics, assessed also under climate predictions and/or projections, will be combined with fire indices to derive estimates of likely burned areas that, in turns, will enter in the quantification of GHG emissions adopting guidelines of IPCC in function of the data available for the region of interest (CMCC F, INTRA, SIMAVI, ITTI, MDS, Z&P, RINI, MD, WUT, UASVG, AHEPA, OIR, TUZVO).
- Additionally, the task will also build a multi-modal view of forest landscape representation based on international data formats. This will be achieved by using a set of algorithms that extend beyond the state-of-the-art that includes the use of computer vision algorithm complemented by street view analysis of geospatial data obtained from ground regions. The algorithms that will be considered will include (i) Hough transform and edge detection algorithms for detecting geometric shapes and lines; (ii) systems for relating detected object features to permit higher order object recognition; (iii) shape matching using Euclidean and affine spines; (iv) Rotational-, translation- and scale invariant transforms; (v) statistical, probabilistic and histogrammetric comparison models; (vi) object detection algorithms and; (vii) efficient local-feature matching using large hierarchical dictionaries of visual words (CERTH, UTH, IST, TP, UISAV, PNRT, UFRJ)

T2.5 Forest resilience from historical case studies [Lead: ASSET; Participants: INTRA, SIMAVI, EAI, ADP, VMG, CMCC F, Z&P, EXUS, RINI, MD, WUT, HB, AUA, SGPS, PUI, LETS, PNRT, SMURD, ASFOR, KEMEA, HRT, AHEPA, OIR, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM, UFRJ; Duration: M6-M30; D2.1, D2.4]: The goal of the task is to review the historical reports on past forest fires across 11 demonstration sites participating in the consortium.

- The structured representation of forest fire causes such as human negligence, environmental impact, climate and weather conditions and installation of power grid lines among others will be reviewed in detail for the development of most common causes of forest fire. The outcome from the task will be used to model the demonstration scenarios outlined in WP9. The objective of the task is to collect historical records of wildfires, with details on the sources of origin along with the investigative analysis (ASSET, CMCC F, Z&P, HB, AUA, SGPS, PUI, LETS, PNRT, SMURD, ASFOR, KEMEA, HRT, AHEPA, OIR, FRB MSR, HVZ, PLAM, TUZVO).
- The case-studies will be systematically categorised into (i) human causes; (ii) environment factors and (iii) impact of critical infrastructure services such as energy distribution. Each of the case-studies will be analysed along with the EO

and Copernicus data sources to document the transformation of forest landscape after the spread of wildfire. The task will consolidate the such case-studies collected across continents towards the development of scenarios which will be considered within the project demonstration (INTRA, SIMAVI, EAI, VMG, EXUX, RINI, WUT, AMIKOM, UFRJ).

T2.6 Assessment framework [Lead: LETS; Participants: PEGASO, INTRA, TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, ADP, 3MON, CTL, SYNC, CMCC F, MD, HB, AUA, CERTH, PSTE, AHEPA, OIR; Duration: M6-M30; D2.3, D2.5]: The objective of the task is to formalise the assessment methodology for the evaluation of the project platform. The framework will incorporate the stakeholder feedback on the effectiveness of technological intervention delivered by the project. Additionally, for each phase of the platform, appropriate assessment metrics will be developed. Such evaluation metrics will include:

- Phase A: engagement and public messaging services, delivery of training based on different scenarios emulated on the spread of wildfire (INTRA, SIMAVI, EDP, ADP, SYNC, CMCC F, HB).
- Within Phase B, the assessment framework will evaluate the effectiveness of the detection component in recognizing the ignition of a fire. The time latency to coordinate response and aggregate additional intelligence from the field will be further addressed. The use of advanced robotics and aerial platforms will be further analysed (LETS, TRT, FINC, ATOS IT, DELL, 3MON, CTL, CERTH)
- Within Phase C, the methodology will be evaluated against the effectiveness of natural rehabilitation strategy. Finally, the assessment framework will also include the need for identifying social economic metrics for the technology intervention (PEGASO, MD, AUA, AHEPA, OIR, PSTE)

The developed assessment framework will be employed in WP9 for the evaluation of the SILVANUS platform.

Participation per Partner

Partner number and short name	WP2 effort
1 - PEGASO	4.00
2 - Z&P	8.00
3 - INTRA	12.00
4 - TRT	6.00
5 - FINC	6.00
6 - ATOS IT	6.00
8 - SIMAVI	18.00
9 - EDP	6.00
10 - ADP	6.00
11 - TP	2.00
12 - 3MON, s. r. o.	5.00
13 - CTL	6.00
14 - SYNC	14.00
15 - EAI	10.00
16 - ITTI	4.00
17 - VMG	12.00
18 - MDS	2.00
19 - CMCC F	18.00
20 - EXUS	3.00
21 - RINI	6.00
22 - MD	10.00

Partner number and short name	WP2 effort
23 - WUT	4.00
24 - HB	8.00
25 - AUA	17.00
26 - CERTH	6.00
27 - UTH	2.00
28 - IST	2.00
29 - UASVG	6.00
30 - UISAV	6.00
31 - PUI	4.00
32 - SGSP	6.00
33 - ASSET	12.00
34 - LETS	6.00
35 - PNRT	5.00
36 - FptSMURD	6.00
37 - ASFOR	6.00
38 - KEMEA	6.00
39 - HRT	6.00
40 - AHEPA	6.00
41 - OIR	8.00
42 - PSTE	4.00
43 - FRS MB	6.00
44 - HVZ	6.00
45 - TUZVO	24.00
46 - Plamen	6.00
47 - AMIKOM	4.00
48 - CSIRO	2.00
49 - UFRJ	12.00
Total	350.00

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D2.1	Report on existing sustainable forest management services	45 - TUZVO	Report	Public	6

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D2.2	First report on environmentally sustainable, resilient forest	19 - CMCC F	Report	Public	9
D2.3	Report on SILVANUS formal assessment methodology	34 - LETS	Report	Public	12
D2.4	Report on environmentally sustainable, resilient forest	25 - AUA	Report	Public	24
D2.5	Final report on SILVANUS formal assessment methodology	34 - LETS	Report	Public	30

Description of deliverables

D2.1.: Report on existing sustainable forest management services and formalisation of functional specification requirements: The deliverable will summarise the functionalities, features, and market scope of forest management services. [M6]

D2.2: First report on environmentally sustainable, resilient forest models: The deliverable will summarise the activities of the WP (i) review of forest landscape models for the pilot demonstration sites; (ii) the climate sensitive forest models; (iii) historical review of forest resilience to wildfires and (iv) systematic methodology for participatory process [M9]

D2.3: Report on SILVANUS formal assessment methodology: The deliverable will outline the formal assessment methodology to be adopted for Phase A, B and C outcome evaluation [M12]

D2.4: First report on environmentally sustainable, resilient forest models: Will revise D2.2, following the activities carried out on the demonstration of Phase A, B and C activities [M24]

D2.5: Final report on SILVANUS formal assessment methodology: The deliverable will publish the finalised version of formal assessment methodology to be adopted in the second iteration of pilot demonstration activities. [M30]

D2.1 : Report on existing sustainable forest management services [6]

Report on existing sustainable forest management services and formalisation of functional specification requirements: The deliverable will summarise the functionalities, features, and market scope of forest management services. [M6]

D2.2 : First report on environmentally sustainable, resilient forest [9]

D2.2: First report on environmentally sustainable, resilient forest models: The deliverable will summarise the activities of the WP (i) review of forest landscape models for the pilot demonstration sites; (ii) the climate sensitive forest models; (iii) historical review of forest resilience to wildfires and (iv) systematic methodology for participatory process [M9]

D2.3 : Report on SILVANUS formal assessment methodology [12]

The deliverable will outline the formal assessment methodology to be adopted for Phase A, B and C outcome evaluation [M12]

D2.4 : Report on environmentally sustainable, resilient forest [24]

D2.4: First report on environmentally sustainable, resilient forest models: Will revise D2.2, following the activities carried out on the demonstration of Phase A, B and C activities [M24]

D2.5 : Final report on SILVANUS formal assessment methodology [30]

D2.5: Final report on SILVANUS formal assessment methodology: The deliverable will publish the finalised version of formal assessment methodology to be adopted in the second iteration of pilot demonstration activities. [M30]

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Participatory process methodology established. CASD management board setup	45 - TUZVO	6	D2.1 D10.1
MS2	Platform assessment framework released. Completion of organisational deployment of the platform	37 - ASFOR	12	D2.3 D8.1
MS4	2nd version of integrated platform release	3 - INTRA	36	D8.3
MS6	Final product release	3 - INTRA	42	D8.5, D10.5

Work package number ⁹	WP3	Lead beneficiary ¹⁰	8 - SIMAVI
Work package title	Culture of deterrence and prevention against wildfires based on sustainable forest management services		
Start month	3	End month	36

Objectives

The objective of this workpackage is to develop tools, methodologies and technologies to promote the culture of deterrence and prevention against wildfires. The outcome of the WP will result in Phase A: Preparedness and prevention solutions developed through interdisciplinary stakeholder consensus. The following specific objectives are being addressed in the WP:

- to formalise the semantic description of different forest landscape models and threats posed by wildfires
- to study the impact of forest fire ignition considering the topographic and landscape drivers
- to identify the sources of wildfire ignition resulting from actions such as human negligence, arson, weather patterns, climate services among others
- to release a mobile application for stakeholder engagement for promoting fire safety and prevention strategies

The components developed in the work package will be incorporated into the SILVANUS platform, developed in WP4 and WP5, and integrated in WP8.

Description of work and role of partners

WP3 - Culture of deterrence and prevention against wildfires based on sustainable forest management services [Months: 3-36]

SIMAVI, PEGASO, INTRA, DELL, EDP, ADP, CTL, SYNC, EAI, ITTI, MDS, EXUS, MD, HB, CERTH, UASVG, UISAV, PUI, SGSP, PNRT, FptSMURD, ASFOR, KEMEA, HRT, AHEPA, PSTE, HVZ

T3.1 Formalisation of sustainable and resilient forest management knowledge model [Lead: EAI; Participants: Z&P, INTRA, DELL, SIMAVI, EDP, ADP, CTL, ITTI, CERTH, UASVG, PNRT, AHEPA; Duration: M1-M30; D3.1]: The goal of the task is to build a SILVANUS ontology-based semantic model, based on the biodiversity and fire danger index (T2.3), that seamlessly integrates several standard vocabularies for describing (geographic) knowledge (as outlined in PA2, based on AFO). The semantic framework will extend the database of ‘certainty of knowledge’ on the cause of wildfire. The systematic categorisation from EFFIS includes six (6) such categories.

- The task will address challenges in the currently used metadata standards, the description of the domain itself is covered, but information on the content of the dataset is insufficient. Such information is commonly described through free text fields (e.g., the dataset lineage in ISO 19115/19119). However, free text fields cannot be used by intelligent search algorithms. Neither do currently used standards offer a language to describe models and their model input/output attributes (EAI, CTL, INTRA, DELL, EDP, ITTI, CERTH, UASVG, PNRT)
- Ergo, meta-data standards are insufficient to provide the basis for the clearinghouse functionality required to support the Trees4Future research infrastructure. To tackle the limitations in describing datasets, models and their attributes, the Common Reference Framework concepts have been abstracted to broaden the Framework’s applicability to the Clearinghouse. This considers the requirements derived from use cases, and additionally provides the functionality to be able to conceptually link datasets and models via a description of the characteristics of both the dataset content and the input/output attributes of models. To this end, existing datasets need to be ingested and augmented by project-specific biodiversity data. The model will be further enhanced in T5.3 to include other sources of data (DELL, SIMAVI, EDP, ADP, AHEPA).

T3.2 Forest fire ignition models [lead: SIMAVI; Participants: PEGASO, ADP, CTL, ITTI, UASVG, PUI, PNRT, SMURD, KEMEA; Duration: M6-M36; D3.2]: The objective of this task is to study the impact of forest fire ignition models considering the climatic, topographic and landscape drivers.

- The task will specifically emphasize the impact of anthropic activity that significantly influences the fire ignition frequency (PEGASO, ADP, UASVG, PUI, PNRT, SMURD, KEMEA).
- The task will deliver quantification of fire ignition probability occurrence and frequency against Negative Binomial Hurdle models. Several other metrics (AUC, prediction accuracy, RMSE, and the Pearson correlation coefficient) will also be used to quantify the causes and frequency of fire ignition (EDP, ADP, PEGASO, CTL, ITTI)
- The task will include the outcome of T2.4 to include the historical causes of regional fire including human negligence, power faults, arson and external weather conditions (PUI, PNRT, SMURD)

T3.3 Preparation and pre-planning activities for wildfire response [Lead: SGPS; Participants: SIMAVI, EDP, ADP, SYNC, ITTI, UASVG, PUI, SMURD, ASFOR, KEMEA; Duration: M6-M36; D3.2, D3.4]: The objective of the task is to propose a systematic methodology for the preparation and pre-planning activities to be carried out upon the ignition of forest fires.

- The training methodology will include the operational knowledge of technologies developed in WP4 and WP5 for the deployment of timely interventions against the spread of wildfires (SGPS, SYNC, PUI, SMURD, ASFOR, KEMEA).
- Additionally, the task will formalise the new protocols developed in the project with the existing practices adopted by the first responders across different geographical regions (SIMAVI, EDP, ADP, ITTI, UASVG).

T3.4 AR/VR content curation for training firefighters [Lead: SIMAVI; Participants: INTRA, EDP, EXUS, SGPS, PUI, SMURD, KEMEA, HVZ; Duration: M6-M36; D3.2, D3.4]: The objective of the task is to design the AR/VR interfaces in close consultation with the practitioners to deliver training for tackling forest fires.

- The interface design and development will be carried out in consultation with a wide range of stakeholders that will be able to share feedback on the current best practices often used to lay the foundation for the design of next generation immersive and interactive interfaces (INTRA, EXUS, SGPS, PUI, SMURD).
- The task will also enable the usage of AR/VR headsets to identify the challenges upon encountering dynamic behaviours of forest fires (SIMAVI, EDP, HVZ).
- Additionally, the task will also implement AR interfaces for smart handheld devices to be used by the intervention team members for enhancing the information availability on the specific event / scenario. In addition, the AR interface will also include specifications for the integration of GIS based navigation systems (SIMAVI, SGPS, PUI, SMURD, KEMEA).
- The project will develop smart handheld devices for one mobile platform for product and service validation. The choice of the mobile platform will be made during the focus group meetings (SI-MAVI).

T3.5 Citizen engagement programme for preventing wildfires [Lead: HB; Participants: INTRA, SIMAVI, EDP, ADP, SYNC, EAI, ITTI, MDS, MD, UASVG, UISAV, SGPS, PUI, SMURD, ASFOR, KEMEA, HRT, PSTE, AHEPA; Duration: M3-M36; D3.3, D3.6]: The goal of the task is to engage with citizens, towards improved awareness about fires, related risks, as well as prevention and safety measures in order to establish and nurture social and cultural attitudes and practices that lead to reduced fire hazards caused by human negligence or actions.

- The task will develop innovative communication strategies for (a) dissemination of knowledge about environmental assessment, climate conditions and weather forecast patterns and (b) improved engagement of citizens in forest regions to take steps towards forest protection (HB, EDP, ADP, SYNC, MD, UASVG).
- These strategies will also take into account the sociocultural framework of the region and the characteristics of the local communities to ensure maximum reach and involvement (SGPS, PUI, SMURD, ASFOR, KEMEA, HRT, PSTE, AHEPA).
- The task will also develop methodologies to aggregate feedback and information gathered from end-users and relevant stakeholders. The methodology developed in this task will be implemented in T3.6 and T4.4, as a mobile application customised across different regions participating in the trials (as outlined in WP9) (EAI, ITTI, MDS, UASVG).

T3.6 Mobile application for citizen engagement [Lead: MDS; Participants: SIMAVI, EDP, SYNC, ITTI, HB, UISAV, SGPS, SMURD, HRT; Duration: M6-M42; D3.3, D3.6]: The goal of the task is to develop a smart handheld application for citizen engagement.

- The application will include features such as safety notifications, regional regulations across Europe and global communities for fire prevention and ability to interface with wireless communication infrastructure during the event of a forest fire (MDS, SIMAVI, HB, UISAV, SGPS, HRT).
- The mobile application will also support the exchange of information on the state of forest for bio-diversity analysis and will enable stakeholders to launch targeted competition to promote awareness on the forest ecological conversation initiatives (MDS, SIMAVI, SYNC, ITTI).
- The use of mobile application will be promoted in collaboration with CSA project. The platform will undertake a flagship role in promoting the dissemination activities and collection of feedback from stakeholders. (EDP, SYNC, HB, SGPS, SMURD, HRT)

Participation per Partner

Partner number and short name	WP3 effort
1 - PEGASO	2.00

Partner number and short name	WP3 effort
3 - INTRA	16.00
7 - DELL	6.00
8 - SIMAVI	84.00
9 - EDP	32.00
10 - ADP	8.00
13 - CTL	14.00
14 - SYNC	16.00
15 - EAI	14.00
16 - ITTI	30.00
18 - MDS	14.00
20 - EXUS	12.00
22 - MD	6.00
24 - HB	16.00
26 - CERTH	6.00
29 - UASVG	13.00
30 - UISAV	18.00
31 - PUI	16.00
32 - SGSP	22.00
35 - PNRT	8.00
36 - FptSMURD	10.00
37 - ASFOR	6.00
38 - KEMEA	7.00
39 - HRT	6.00
40 - AHEPA	4.00
42 - PSTE	3.00
44 - HVZ	6.00
Total	395.00

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D3.1	First report on the formal specification of sustainable	15 - EAI	Report	Public	9
D3.2	Planning and delivery of training activities – Phase 1	8 - SIMAVI	Report	Public	18

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D3.3	First release of citizen engagement methodology	24 - HB	Demonstrator	Public	18
D3.4	Planning and delivery of training activities – Phase 2	8 - SIMAVI	Other	Public	36
D3.5	Final report on SILVANUS culture of deterrence	24 - HB	Other	Public	36

Description of deliverables

D3.1: First report on the formal specification of sustainable and resilient forest management knowledge model: Report on the activities carried out in formalising the semantic framework developed within the project. The various ignition models resulting from six (6) categories namely (i) unknown; (ii) natural; (iii) accidental; (iv) negligence; (v) deliberate and (vi) re-kindled will be addressed. [M9]

D3.2: Planning and delivery of training activities, Phase 1 for fire fighters: Report on the curation of training activities delivered to the fire fighters along with the specification of AR/VR content developed. The modelling of fire dynamics will be achieved in consultation with the environmentalists, ecologists and forest management personnel involved in the project. [M18]

D3.3: First release of citizen engagement methodology and mobile application: Report on the citizen engagement methodology. The use of innovative services such as online questionnaire, demographic target group selection, consultation with the environmentalists and feedback from advisory board members will all be analysed. [M18]

D3.4: Planning and delivery of training activities, Phase 2 for fire fighters: The deliverable will revise D3.2 and further report on the activities carried out in the project for delivering training activities to the end-users. [M36]

D3.5: Final report on SILVANUS culture of deterrence and prevention against wildfires: The final deliverable of the WP will consolidate the activities of the project and highlight the level of public awareness delivered by SILVANUS to the general public across eight (8) EU three (3) non-EU pilot locations. [M42]

D3.1 : First report on the formal specification of sustainable [9]

D3.1: First report on the formal specification of sustainable and resilient forest management knowledge model: Report on the activities carried out in formalising the semantic framework developed within the project. The various ignition models resulting from six (6) categories namely (i) unknown; (ii) natural; (iii) accidental; (iv) negligence; (v) deliberate and (vi) re-kindled will be addressed. [M9]

D3.2 : Planning and delivery of training activities – Phase 1 [18]

D3.2: Planning and delivery of training activities, Phase 1 for fire fighters: Report on the curation of training activities delivered to the fire fighters along with the specification of AR/VR content developed. The modelling of fire dynamics will be achieved in consultation with the environmentalists, ecologists and forest management personnel involved in the project. [M18]

D3.3 : First release of citizen engagement methodology [18]

D3.3: First release of citizen engagement methodology and mobile application: Report on the citizen engagement methodology. The use of innovative services such as online questionnaire, demographic target group selection, consultation with the environmentalists and feedback from advisory board members will all be analysed. [M18]

D3.4 : Planning and delivery of training activities – Phase 2 [36]

D3.4: Planning and delivery of training activities, Phase 2 for fire fighters: The deliverable will revise D3.2 and further report on the activities carried out in the project for delivering training activities to the end-users. [M36]

D3.5 : Final report on SILVANUS culture of deterrence [36]

D3.5: Final report on SILVANUS culture of deterrence and prevention against wildfires: The final deliverable of the WP will consolidate the activities of the project and highlight the level of public awareness delivered by SILVANUS to the general public across eight (8) EU three (3) non-EU pilot locations. [M36]

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS3	1st version of integrated platform released	3 - INTRA	18	D8.2
MS4	2nd version of integrated platform release	3 - INTRA	36	D8.3
MS6	Final product release	3 - INTRA	42	D8.5, D10.5
MS10	Final training delivered	8 - SIMAVI	36	D3.4 submitted
MS13	All applications validated (AR/VR, Mobile app) and public awareness delivered	8 - SIMAVI	42	D3.3 and D3.5 submitted

Work package number⁹	WP4	Lead beneficiary¹⁰	19 - CMCC F
Work package title	Advanced detection capabilities for early-stage detection of wildfires		
Start month	3	End month	36

Objectives

The main aim of the work package is to collect, aggregate and pre-process data coming from heterogeneous sources, including: EO satellite data, outputs from weather and climate models, social media, in-situ IoT devices, UAVs and UGVs.

- To develop data collection, aggregation and pre-processing of information obtained from earth observation repositories based on the semantic representation framework developed in T3.1
- To implement advanced navigation systems to control the path of ground vehicles.
- To automate UAV deployment for remote sensing and early-stage detection of fire ignition patterns and threats.
- The components developed in the work package and WP5 will form the core of the SILVANUS platform, which is integrated in WP8.

Description of work and role of partners

WP4 - Advanced detection capabilities for early-stage detection of wildfires [Months: 3-36]

CMCC F, PEGASO, TRT, FINC, ATOS IT, DELL, EDP, 3MON, s. r. o., CTL, EAI, ITTI, VMG, EXUS, RINI, WUT, HB, CERTH, UISAV, KEMEA, AMIKOM, CSIRO

T4.1 Data collection, aggregation and pre-processing of earth observations [lead: DELL; Participants: PEGASO, FINC, ATOS IT, 3MON, CTL, EAI, ITTI, CMCC F, EXUS, CERTH; Duration: M3-M36; D4.1, D4.5]: The goal of the task is to identify and select the existing European EO repositories (i.e. Copernicus DIAS, Eumetsat EUMETCast, GEOSS, ESA Earth Online, etc.) that could provide observed data and products to be used for the identification and assessment of forest fires, and implement software services to interface with such EO repositories in order to extract, store and process the necessary heterogeneous media and metadata.

- Specifically, for nowcasting forecast (0-3 hours) the weather data and products from Eumetsat platform (<https://www.eumetsat.int/what-we-monitor/weather>) will be analysed. The nature of heterogeneity will be attributed to the various modalities of information aggregated from several disparate EO sources (CMCC F, EXUS, CERTH).
- The project will develop a set of wrappers that will collect the desired data from the corresponding sources and perform an integration and harmonization process before storing the data into the SILVANUS Cloud platform (PEGASO, CTL, DELL, FINC, ATOS IT, ITTI).
- Data mining and AI techniques will be used to select and obtain data (filtering/pre-processing) that are the most suitable for forest fire prevention and identification. Our platform will analyze the data in order to automatically detect relationships/rules between and facilitate their semantic connection (this is important in the case where the same data is retrieved by multiple sources). Additionally, innovative data annotation, curation and preparation methods will be developed, as well as data fusion approaches (when necessary) specifically designed to improve the precision of AI-based models. (DELL, CTL, EAI, EXUS, CERTH)
- The solution will use the SILVANUS model, enhanced in T5.3, as an intelligent metadata index into the unstructured heterogenous data stored on the platform, and other third-party platforms (CMCC F, DELL, FINC, ATOS IT).

T4.2 Tailored Weather/Climate models output for forest fire threat risk assessment [lead: CMCC F; Participants: PEGASO, FINC, ATOS IT, 3MON, ITTI, CERTH, KEMEA; Duration: M3-M36; D4.1, D4.5]: In this task high quality and reliable data from weather forecast models will be provided to support analysis for fire prediction in the short-term range (up to 72 hours).

- Data will be provided using several NWP models (ECMWF, COSMO, etc.) characterized by different forecast ranges and horizontal resolution, depending on the features of the pilot cases. Moreover, in addition to the aforementioned methods, statistical tools will be selected and used to optimize the model results and remove locally the model bias and to further downscale the spatially and temporal data (PEGASO, CMCC F, FINC, ATOS IT, ITTI)
- For the seasonal time scales, probabilistic forecasts of fire danger indexes will be provided using ensemble seasonal forecasts produced by the C3S operational multimodel prediction system. The skill of the C3S forecasts will be improved by applying some recently developed sub-sampling techniques, which have been shown to significantly enhance the results of the forecasts. Such consolidated techniques will be applied after having tailored them to the specific pilot case considered. The sub-sampling approach will be further strengthened and complemented by the design and development of novel; additional techniques of subsampling based upon physics-informed ML/AI methods (WUT, 3MON, CERTH).

- Additionally, the possibility of using observed data to verify the very early part of the seasonal forecast (first 10 to 15 days) will be used to diagnose the initial forecast trajectory of each ensemble member and, again by using ML techniques trained on the C3S reforecast database, algorithms will be produced to eliminate from the ensemble those trajectories which are heading toward the “wrong” sectors of the real-world climate attractor (CMCC F, CERTH, 3MON, ATOS IT).

T4.3 Data collection, aggregation and pre-processing of in-situ devices [Lead: CTL; Participants: PEGASO, FINC, ATOS IT, DELL, 3MON, ITTI, CMCC F, RINI, WUT, UISAV; Duration: M3-M36; D4.1, D4.5]: The goal of the task is to develop a distributed data architecture, software protocols and services to interface with IoT devices (environmental sensors, CCTV cameras, ...) installed within the forest.

- The task will support the carriage of information from IoT devices, the availability of media data will be streamed through IP network and therefore network security protocols will be implemented. The architecture deployed at the edge will be capable of translating high-velocity data streams aggregated from the service endpoints to generate time-bound events. The edge computing infrastructure will act as event producers that will facilitate data filtering and post messages to high-speed messaging queues (such as Apache Kafka) (CTL, FINC, DELL, HIT)
- Innovative Edge Micro Data Centres (EMDCs) will be utilised to distribute ML/AI high performance computing, typically only found in central data centres, and deploy them close to the incidence of the forest fire. The EMDCs can be hermetically sealed, which makes them ideally suited for deployment to hazardous environments, typically in forward mobile command centres (ITTI, CMCC F, RINI, WUT, UISAV)
- Configuration of data sources, pre-processing/aggregation of data, and the application of standard security mechanisms will be features supported by the developed solution. Such algorithms will become the key part of the data collection component because the derived data will be stored and processed in the Cloud for the management of the incident (PEGASO, UISAV, CTL, CMCC F).

T4.4 Social media sensing and concept extraction [lead: CERTH; Participants: DELL, CTL, EAI, ITTI, WUT, HB, UISAV, AMIKOM; Duration: M6-M42; D4.2, D4.5]: This task will focus on the collection of citizen observations from social media, in particular Twitter, about possible fire incidents, in order to contribute to early-stage detection of wildfires. Specific keywords, accounts and areas of interest will be defined in collaboration with the end users for the retrieval of valuable social media data.

- These criteria will formulate queries for the Twitter API and tweets will be collected in real time. The task will also involve the extraction of concepts from textual as well as visual content. In the first case, Named Entity Recognition will be applied on Twitter text to detect location-related concepts and geotag the corresponding tweets (CERTH, CTL, EAI, HB)
- In the latter, a Deep Convolutional Neural Network will extract visual concepts, such as flames, smoke, etc., from Twitter images, so as to indicate potential fire events in user photos (CERTH, ITTI, DELL, AMIKOM)
- Finally, this task will include machine learning techniques for the automatic classification of social media posts as relevant or irrelevant to fire disasters, trained on manually annotated data (CERTH, UISAV).

T4.5 UGV monitoring for wildfire behaviour [Lead: CSIRO; Participants: TRT, ATOS IT, DELL, 3MON, VMG, RINI, UISAV; Duration: M6-M36, D4.3, D4.5]: The objective of the task is to develop unmanned, automated, ground robots, capable of collecting vital information on the behaviour of wildfires. Exposure to the hazardous and chaotic fire environment, rather than to the fire itself, is the most significant cause of injury and death in fires. The reachability of precise information in real-time on the conditions directly at the centre of the fire ground is a crucial factor in the guidance of rescue actions together with feasible counterplans. Unfortunately, the firefighting environments are normally hard to reach and restricted in accessibility by obstacles, tumbledown architectures and visibility by smoke, dangerous gasses or dust.

- The specification of the ground vehicle design and implementation will adopt the use of an advanced hydraulic system to enable navigation across complex terrains. The ground vehicles will be equipped with multi-spectral sensors capable of sensing beyond the visible spectrum (CSIRO, TRT, 3MON, RINI).
- Additionally, the aerial vehicles (T4.6) and ground vehicles will coordinate data collected in a GPS-less environment to establish baseline reference for the spread of wildfires and will be coordinated into teams, taking into account specificities and capabilities of each kind of agent, and the path optimization of the ground robots (TRT, ATOS IT).
- The onboard analytics component will reduce the latency of complex computation and lead to synchronisation of raw data and metadata extracted from the sensor signals (including video streams).
- The computational component integrated within the ground vehicle will address the challenge of optimising deep-learning network models using two main technologies namely (i) neural network compression and (ii) linearisation of network attributes for computational deployment (VMG).
- The task will also implement an advanced high-dimensional visualisation toolkit to identify the redundant neurons during computation. The outcome of the task will result in more than 15% reduction in the computational complexity

of deep-learning models, which will be demonstrated in low-cost computation devices such as Nvidia Jetson (VMG, UISAV, CSIRO).

T4.6 UAV deployment for remote sensing and identification of wildfire [lead: TRT; Participants: PEGASO, ATOS IT, DELL, EDP, WUT, UISAV, KEMEA; Duration: M6-M36, D4.4, D4.5]: The activities of the task are structured into the following sub-tasks.

- The task will develop a remote sensing aerial platform capable of being autonomously piloted with the main advantage of providing on-demand monitoring services faster than the current approaches of using satellite images, manned aircraft and remotely controlled drones (TRT, UISAV).
- Furthermore, the use of autonomous drones will facilitate minimizing human intervention in risky wildfire zones. To develop a fully autonomous system, the task will develop a distributed leader-follower coalition formation model to cluster a set of drones into multiple coalitions that collectively cover the designated monitoring field. The coalition leader is a drone that employs observer drones potentially with different sensing and imaging capabilities to hover in circular paths and collect imagery information from the impacted areas. The objectives include: i) to cover the entire fire zone with a minimum number of drones, and ii) to minimize the energy consumption and latency of the available drones to fly to the fire zone (PEGASO, TRT, ATOS IT, DELL, EDP, HIT).
- The aerial platforms will be equipped with multi-spectral imaging systems for the collection of continuous media streams. The spectral variation will extend beyond visible range to include infrared range. The task will include the determination of the coalition of drones to be used, based on the specificities and dimension of the task to be performed, and the capabilities (payload, autonomy, speed...) of the UAVs (WUT, KEMEA, EDP, HIT).

Participation per Partner

Partner number and short name	WP4 effort
1 - PEGASO	14.00
4 - TRT	38.00
5 - FINC	14.00
6 - ATOS IT	28.00
7 - DELL	32.00
9 - EDP	12.00
12 - 3MON, s. r. o.	20.00
13 - CTL	22.00
15 - EAI	24.00
16 - ITTI	22.00
17 - VMG	12.00
19 - CMCC F	38.00
20 - EXUS	6.00
21 - RINI	20.00
23 - WUT	11.00
24 - HB	4.00
26 - CERTH	36.00
30 - UISAV	22.00
38 - KEMEA	3.00
47 - AMIKOM	6.00
48 - CSIRO	12.00

Partner number and short name	WP4 effort
Total	396.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D4.1	Demonstration of data collection, aggregation of EO, weather/climate models and in-situ environmental sensors	19 - CMCC F	Demonstrator	Public	18
D4.2	Demonstration of social media analytics for localising the origin of wildfire ignition	26 - CERTH	Demonstrator	Public	18
D4.3	Demonstration of ground vehicle navigation to and from frontline wildfire spread	48 - CSIRO	Demonstrator	Public	18
D4.4	Autonomous piloting of UAV fleet and coordination for remote sensing and identification of wildfire ignition	4 - TRT	Demonstrator	Public	24
D4.5	Report on SILVANUS advanced detection capabilities	19 - CMCC F	Demonstrator	Public	36

Description of deliverables

D4.1: Demonstration of data collection, aggregation of Earth Observations, weather/climate models and in-situ environmental sensors for forest fire risk/threat assessment: Demonstration of interface implementation to collect data and subsequent pre-processing capabilities to quantify the forest fire risk/threat assessment. [M18]

D4.2: Demonstration of social media analytics for localising the origin of wildfire ignition: Showcase the training of multi-modal deep-learning algorithms in processing images, textual data and geo-spatial information to accurately identify the fire origin. [M18]

D4.3: Demonstration ground vehicle navigation to and from frontline wildfire spread: Demonstration of the functional capabilities of the ground vehicles, which are deployed to collect information from the front of line of wildfires. [M18]

D4.4: Autonomous piloting of UAV fleet and coordination for remote sensing and identification of wildfire ignition: The deliverable will demonstrate autonomous deployment of aerial vehicles being launched for detecting the ignition of forest fires. [M24]

D4.5: Report on SILVANUS advanced detection capabilities for wildfires: Publication of a consolidated review of all the technologies released within SILVANUS and subsequent improvements being carried out following the demonstration activities as outlined in WP9. [M36]

D4.1 : Demonstration of data collection, aggregation of EO, weather/climate models and in-situ environmental sensors [18]

D4.1: Demonstration of data collection, aggregation of Earth Observations, weather/climate models and in-situ environmental sensors for forest fire risk/threat assessment: Demonstration of interface implementation to collect data and subsequent pre-processing capabilities to quantify the forest fire risk/threat assessment. [M18]

D4.2 : Demonstration of social media analytics for localising the origin of wildfire ignition [18]

D4.2: Demonstration of social media analytics for localising the origin of wildfire ignition: Showcase the training of multi-modal deep-learning algorithms in processing images, textual data and geo-spatial information to accurately identify the fire origin. [M18]

D4.3 : Demonstration of ground vehicle navigation to and from frontline wildfire spread [18]

D4.3: Demonstration ground vehicle navigation to and from frontline wildfire spread: Demonstration of the functional capabilities of the ground vehicles, which are deployed to collect information from the front of line of wildfires. [M18]

D4.4 : Autonomous piloting of UAV fleet and coordination for remote sensing and identification of wildfire ignition [24]

D4.4: Autonomous piloting of UAV fleet and coordination for remote sensing and identification of wildfire ignition: The deliverable will demonstrate autonomous deployment of aerial vehicles being launched for detecting the ignition of forest fires. [M24]

D4.5 : Report on SILVANUS advanced detection capabilities [36]

D4.5: Report on SILVANUS advanced detection capabilities for wildfires: Publication of a consolidated review of all the technologies released within SILVANUS and subsequent improvements being carried out following the demonstration activities as outlined in WP9. [M36]

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS3	1st version of integrated platform released	3 - INTRA	18	D8.2
MS4	2nd version of integrated platform release	3 - INTRA	36	D8.3
MS6	Final product release	3 - INTRA	42	D8.5, D10.5

Work package number ⁹	WP5	Lead beneficiary ¹⁰	7 - DELL
Work package title	Response coordination to contain the spread of wildfire		
Start month	3	End month	42

Objectives

The aim of the WP is to develop technologies to facilitate efficient response coordination in combating the ignition of wildfires, by building accurate and reliable information about fire detection, fire spread and fire weather prediction exploiting latest advances in AI/ML tools, using data from European services for Earth Observation satellites, Weather and Climate models, social media and advanced IoT devices. The activities of the WP will develop a broad range of solutions to be available for appropriate use by the fire fighters. The following specific objectives:

- To deploy big-data framework models for modelling situational awareness on fire danger index.
- To implement decision support system and finalise the communication protocols for exchanging situational awareness between peer mobile command centres.
- The components developed in this work package and WP4 will form the core of the SILVANUS platform, which is integrated in WP8.

Description of work and role of partners

WP5 - Response coordination to contain the spread of wildfire [Months: 3-42]

DELL, PEGASO, INTRA, TRT, FINC, ATOS IT, SIMAVI, EDP, CTL, EAI, ITTI, VMG, CMCC F, EXUS, RINI, WUT, HB, CERTH, UTH, UISAV, ASSET, AHEPA, OIR, TUZVO, AMIKOM

T5.1 Big-data Analytics framework for situational awareness on fire danger index [Lead: DELL; Participants: PEGASO, TRT, FINC, ATOS IT, SIMAVI, EDP, CTL, EAI, ITTI, CMCC F, EX-US, RINI, WUT, CERTH, UISAV, ASSET, TUZVO; Duration: M3-M36; D5.1, D5.3, D5.5, D5.6]: The aim of this task is to develop an advanced data analytics framework for situational awareness on the fire danger index. Two main activities will be carried out in this task.

- The first one is related to the development of a framework that will allow the storage and analyse heterogenous data sources (EO data, weather and climate data, environmental data - from T4.1-4.3). This activity will focus on the development of the programming interface that will enable data selection and pre-processing to be used in the training of deep-learning models and other machine learning algorithms. This activity will address two key challenges related to the bigdata aggregation from heterogeneous data sources namely the frequency of data generation (velocity) and biases, noise (veracity), by developing innovative data services that includes in-memory processes, parallel computing architectures and data integrity models (PEGASO, DELL, FINC, ATOS IT, SIMAVI, EDP, EAI, ITTI, EXUS, TUZVO).
- The second activity is related to the development and evaluation of AI/ML algorithms to build in-information about fire detection, fire spread and fire weather prediction, based on data coming from heterogeneous sources (EO, in-situ sensors, weather/climate models). The framework will explore different AI/ML approaches (e.g., random forests, decision trees, deep-learning) and will develop and test different algorithms adapting and customizing existing frameworks, such as TensorFlow, Keras, PyTorch, RAPIDS, XGBoost. Furthermore, frameworks such as Kubeflow will be considered in order to facilitate the development and deployment of AI/ML algorithms on cloud and/or on the edge infrastructure. Data-driven prognostics will be developed using (deep) ML. The bottleneck of obtaining ‘run-to-failure’ data, will be tackled by the use of an approximate model of the system sufficiently simple, yet complex enough to appropriately describe main cause-effect cases. In this way, the participants in this task will: Diagnose the nature and cause of the threats; Elaborate an approximate model of the system; obtain a “cause and effect” data set from simulation of the model with the threats as inputs and the subsequent performance of the system as outputs; to train machine learning algorithms with such a data set; and to implement the envisioned models. Finally, these AI algorithms could be evaluated using a scenario-based approach (Monte-Carlo method) by using a simulation engine to generate relevant input parameters for both real and hypothetical situations (CMCC F, CTL, RINI, UISAV, ASSET).

T5.2 Semantic framework for information fusion [Lead: CTL; Participants: PEGASO, DELL, EDP, EAI, VMG, CMCC F, EXUS, HB, UISAV, ASSET, AMIKOM; Duration: M3-M36; D5.5, D5.6]: Based on the models developed within WP3 and following up on the data aggregation activities in WP4, this task is aimed at delivering a unified, scalable, and holistic semantic framework for information fusion that will generate an RDF-based unified semantic knowledge graph (KG) for decision support from diverse and heterogeneous sources (UAVs, UGVs, cameras, sensors, citizen science, etc.).

- The resulting semantic model will deliver a unified view of the available information, allowing various applications to run on-top, e.g., large-scale analytics and predictions. Based on ontological inference and rule-based reasoning, new

knowledge will be derived from asserted facts, facilitating the interlinking of entities and events in the KG and leading to augmented decision support (PEGASO, CTL, EAI, VMG, AMIKOM).

- Additionally, the evolving incoming data (e.g., positions of high temperature zones vs. fire-fighters) will be annotated with background contextual information, which can also support multilingual terms for the same ontological concept, allowing real-time decision support and efficient on-the-fly re-source allocation, to improve the accessibility and understanding of information in the semantic model (CTL, DELL, EDP, CMCC F, EXUS, HB, UISAV, ASSET).

T5.3 Real-time monitoring of wildfire behaviour in temporal space for response coordination [Lead: CTL; Participants: DELL, EDP, VMG, CMCC F, EXUS, RINI, UTH, ASSET, AHEPA, OIR, AMIKOM; Duration: M6-M36; D5.3, D5.6]: The objective of the task is to develop real-time monitoring dashboard for visualising the spread of wildfires within the landscape models.

- The outcome of the task will define metrics which can deliver intelligence to the response coordinator to evaluate the threat of the spreading fire and thus undertake mitigation actions for the deployment of resources. The task will consider different forest models identified in the project to deliver the necessary intelligence for the response coordinator. The development of predictive analytics for monitoring the evolution of threats will take place in two stages. The first stage will generate micro-predictive models that will leverage the advances in the field of AI, deep learning, and statistical analysis tools to model the possible scenarios of threat evolution based on the severity of fire and the amount of biofuel available within the region. The second level will perform a time-analysis on the results of the micro-predictive models to develop real-time multi-granular temporal events that will be utilised to generate a sequence of alternative threat models also referred to as “what-if” scenarios (CTL, EDP, VMG, CMCC F, EXUS, RINI, ASSET, AMIKOM).
- Additionally, UTH, AHEPA, OIR and DELL will cooperate to define a set of KPIs that will be adopted to perform the envisioned monitoring activities for detecting the impact of wildfires on the response teams and citizens in the nearby area. The discussed KPIs will be adopted to identify the short- and long-term impact on the health status of people during and after a wildfire. The short-term impact is significant to decide the presence of the response teams in the area of a wildfire. Predictive analytics will be adopted upon the medical knowledge provided by AHEPA, the environmental conditions and the ‘type’ of each incident to decide the ‘spatio-temporal’ aspects of the presence of humans in the frontline. The target is to detect the safe areas and avoid negative consequences on first response teams. The platform will adopt the necessary data coming from various resources (e.g., external resources, static environmental sensors, wearable sensors for first responders, unmanned vehicles, etc). The monitoring activities will be continuous during an incident and the outcomes will be communicated to other modules of the platform in order to inform field commanders (UTH, AHEPA, DELL).

T5.4 Data toolkit for decision support system [Lead: INTRA; Participants: ATOS IT, DELL, EDP, CTL, VMG, CMCC F, RINI, UTH, ASSET, AHEPA, OIR, AMIKOM; Duration: M9-M42; D5.3, D5.5, D5.6]: The objective of the task is to develop an analytic algorithm, which can process high-speed, high-volume signals captured by SILVANUS sensors deployed across the forest.

- The task will develop temporal association models that enable cross-correlation among distributed sensor networks, which includes the data collected from earth observation repositories, environmental sensors and other forms of devices (ATOS IT, DELL, INTRA, EDP, CMCC F).
- The task will also develop algorithms and methodologies that effectively combine disparate knowledge resources into a single framework leveraging upon the information fusion algorithms reported in the literature including (i) data association, (ii) state estimation, and (iii) decision fusion. In addition, the task will also explore the applicability of Bayesian models for associating temporally sparse data points aggregated from environmental sensors deployed in the forest. The effectiveness of the algorithms will be analysed through Monte-Carlo simulation techniques.
- The task will also focus on the resource allocation of response teams in the field (e.g., assign additional teams to a specific area, etc). This depends on the evolution of the incident and the current status of the available response teams. Our aim is to perform an optimization process for the coverage of the area under consideration and the use of the available resources upon the data collected by our monitoring components. Hence, the proposed platform will be aligned with the real needs maximizing the adopted mitigation actions (INTRA, CTL, VMG, AMIKOM)
- Additionally, our decision making will deal with the prediction of the affected areas and the modelling of the surroundings in order to be able to deliver evacuation paths for the affected people, which will have functional synergies with some of the outcomes in T5.3. The map of the area will be the basis for detecting the appropriate routes for evacuation if necessary. Our algorithms will take into consideration population and underlying geospatial data in order to avoid proposing evacuation paths that will be overcrowded (this happened in the past with severe consequences for the affected people, e.g., wildfires in the Mati area, Attica, Greece) (UTH, AHEPA, OIR).

T5.5 Wireless communication infrastructure setup using SDR [Lead: RINI; Participants: WUT, ASSET; Duration: M6-M42; D5.2, D5.6]: The task will deliver a communication platform “MESH in the sky” that emerges from the need to improve the distance range, efficiency, size, cost and security of existing UAV data links. The SDR based systems are

used on large UAV's; however, today there is no solution on the market for small, medium and large UAVs, operating at high speed and over long distances. Moreover, waveforms proposed for 5G systems are not directly applicable to UAV downlink systems. The proposed SILVANUS system will be burst based, meaning the amplifier will need to be switched on only when there is data. This requires the RF board interfacing with FPGA to switch at the right time – this ultimately gives a power saving over continuous transmission where PA is always on. This system proposes adaptive power (in addition to adaptive modulation), so when a drone is near the pilot, it can switch to lower power (say 100 mW and to 1W when it is far away.) These unique features will allow dramatic saving on power consumption and, as a result, increase in flight time of UAVs. The communication infrastructure setup will be used to exchange information between the command centre to the frontline fire fighters, coordinate controls for UAVs and UGVs. The granular predictions on the spread of wildfire will be constantly communicated to the frontline firefighter to enhance safety of operations. The technology will be validated by WUT and ASSET.

Participation per Partner

Partner number and short name	WP5 effort
1 - PEGASO	8.00
3 - INTRA	20.00
4 - TRT	14.00
5 - FINC	12.00
6 - ATOS IT	14.00
7 - DELL	42.00
8 - SIMAVI	6.00
9 - EDP	7.00
13 - CTL	42.00
15 - EAI	14.00
16 - ITTI	12.00
17 - VMG	22.00
19 - CMCC F	22.00
20 - EXUS	30.00
21 - RINI	50.00
23 - WUT	16.00
24 - HB	8.00
26 - CERTH	6.00
27 - UTH	24.00
30 - UISAV	20.00
33 - ASSET	20.00
40 - AHEPA	8.00
41 - OIR	8.00
45 - TUZVO	2.00
47 - AMIKOM	24.00
Total	451.00

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D5.1	Demonstration of big-data framework for situation awareness on fire danger index	19 - CMCC F	Demonstrator	Public	21
D5.2	Demonstration of MESH in the sky communication infrastructure	21 - RINI	Demonstrator	Public	21
D5.3	Demonstration of SILVANUS decision support system for response coordination	3 - INTRA	Demonstrator	Public	24
D5.4	Semantic information fusion framework	13 - CTL	Demonstrator	Public	30
D5.5	Demonstration of SILVANUS decision support system for response coordination Final version	3 - INTRA	Demonstrator	Public	36
D5.6	Report on implementation specification on communication protocols for coordinating response	21 - RINI	Report	Public	42

Description of deliverables

D5.1: Demonstration of big-data framework for situation awareness on fire danger index: The deliverable will showcase the technical integration of big-data framework elements for the development of situational awareness on the threat of forest fire. [M21]

D5.2: Demonstration of MESH-in the sky communication infrastructure: Demonstration of the set-up of on-demand wireless communication being deployed in the sky with the help of drones, that will act as mobile routers to enable communication exchange between distributed deployment of mobile command centres, first responders and the public. [M21]

D5.3: Demonstration of SILVANUS decision support system for response coordination: The deliverable will demonstrate the implementation of SIVANUS decision support system integrating the different algorithms being developed in the WP for real-time monitoring of wildfires. [M24]

D5.4: Semantic information fusion framework: The deliverable will demonstrate the final version of the semantic information fusion framework and will present: (a) the final semantic knowledge graph for decision support; (b) the rule-based reasoning mechanism; (c) the dynamic aspects of the framework relevant to evolving, multilingual ontology concepts. [M30]

D5.5: Demonstration of SILVANUS decision support system for response coordination: The deliverable will demonstrate the outcome of this WPs activities. [M36]

Report on implementation specification of communication protocols for coordinating response: The deliverable will report on the implementation specification of communication protocols adopted within SILVANUS to facilitate situational awareness with the rest of the mobile CC [M42]

D5.1 : Demonstration of big-data framework for situation awareness on fire danger index [21]

D5.1: Demonstration of big-data framework for situation awareness on fire danger index: The deliverable will showcase the technical integration of big-data framework elements for the development of situational awareness on the threat of forest fire. [M21]

D5.2 : Demonstration of MESH in the sky communication infrastructure [21]

D5.2: Demonstration of MESH-in the sky communication infrastructure: Demonstration of the set-up of on-demand wireless communication being deployed in the sky with the help of drones, that will act as mobile routers to enable communication exchange between distributed deployment of mobile command centres, first responders and the public. [M21]

D5.3 : Demonstration of SILVANUS decision support system for response coordination [24]

D5.3: Demonstration of SILVANUS decision support system for response coordination: The deliverable will demonstrate the implementation of SIVANUS decision support system integrating the different algorithms being developed in the WP for real-time monitoring of wildfires. [M24]

D5.4 : Semantic information fusion framework [30]

D5.4: Semantic information fusion framework: The deliverable will demonstrate the final version of the semantic information fusion framework and will present: (a) the final semantic knowledge graph for decision support; (b) the rule-based reasoning mechanism; (c) the dynamic aspects of the framework relevant to evolving, multilingual ontology concepts. [M30]

D5.5 : Demonstration of SILVANUS decision support system for response coordination Final version [36]

D5.5: Demonstration of SILVANUS decision support system for response coordination: The deliverable will demonstrate the outcome of this WPs activities. [M36]

D5.6 : Report on implementation specification on communication protocols for coordinating response [42]

Report on implementation specification of communication protocols for coordinating response: The deliverable will report on the implementation specification of communication protocols adopted within SIL-VANUS to facilitate situational awareness with the rest of the mobile CC [M42]

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS3	1st version of integrated platform released	3 - INTRA	18	D8.2
MS4	2nd version of integrated platform release	3 - INTRA	36	D8.3
MS6	Final product release	3 - INTRA	42	D8.5, D10.5
MS8	Initial platform and core components delivered	7 - DELL	18	Delivery of D4.1, D5.1 and D5.2
MS11	Final platform and core components delivered	7 - DELL	36	Delivery of D5.3, D5.4 and D5.5

Work package number ⁹	WP6	Lead beneficiary ¹⁰	47 - AMIKOM
Work package title	Enhanced resilience programme for forest management through restoration and adaptation		
Start month	1	End month	42

Objectives

The objectives of this WP are to analyse and promote ecological policies to rehabilitate forests following the neutralisation of wildfires. The rehabilitation strategy will consider the impact of forest fire on the soil, environment and regional requirements, as well as local communities.

- to review the current adaptation of ecological resilience programme across eight (8) EU member states and three (3) non-EU regions
- to develop models of restoration considering the impact and severity of the wildfire incorporating the community resiliency and community continuity aspects for the affected populations.
- to promote soil rehabilitation strategy through data analysis following chemical structure composition to contribute towards the EU legal framework for climate-related risks.

Description of work and role of partners

WP6 - Enhanced resilience programme for forest management through restoration and adaptation [Months: 1-42]

AMIKOM, FINC, ADP, 3MON, s. r. o., AUA, IST, LETS, PNRT, FptSMURD, ASFOR, KEMEA, HRT, PSTE, FRS MB, HVZ, TUZVO, Plamen

T6.1 Ecological resilience programme [Lead: AMIKOM; Participants: FINC, AUA, IST, LETS, PNRT, KEMEA, HRT, FRB MSR, HVZ, PLAM, TUZVO; Duration: M1-M30; D6.1, D6.4]: The concept of resilience provides a framework for assessing the response of ecosystems to changing pressures.

- The task will develop a regional programme for each of the stakeholder represented in the consortium to adopt a resilience programme strategy (AMIKOM, LETS, PNRT, HRT, FRB MSR, HVZ).
- The resilience programme developed in the task will focus on the ecological balance that includes factors such as spatial resilience, pattern and process interactions and their variability and relationships among ecological and spatial resilience to support the natural habitat and species (AMIKOM, PLAM, TUZVO, IST, AUA, FINC).

T6.2 Models of resilience process adopted towards forest restoration [lead: AMIKOM; Participants: DELL, AUA, IST, LETS, PNRT, ASFOR, FRB MSR, HVZ, PLAM; Duration: M3-M36; D6.2, D6.4]: The objectives of land management, conservation biology, and restoration ecology have focused on maintaining or re-establishing historical conditions.

- The task will undertake activities to study and develop afforestation policies that enrich the state of forests to the historical context. The temporal impact of global climate change conditions will be considered in the restoration programme (AMIKOM, DELL, AUA).
- The restoration policy framework will be formulated on the premise that species, communities, and ecosystems will be best prepared to cope with new or variable conditions if their environment is within the historical range of variability to which they are adapted (DELL, AUA, IST, LETS, PNRT, ASFOR, PLAM).

T6.3 Soil rehabilitation strategy through data analysis [Lead: AUA; Participants: FINC, LETS, PNRT, ASFOR, AMIKOM; Duration: M6-M42; D6.2, D6.4]: The task consists of following two sub-tasks

- The aim of the task is to evaluate the impact of forest fire on the hydrology and soil physical properties analysed through chemical process. The analysis will consider the severity of the forest fire, the longevity of the fires and the causes of the fire ignition along with spread of forest fires (AUA, LETS, PNRT, ASFOR, AMIKOM).
- These external factors will be systematically analysed within the task to develop a systematic plan for the restoration activities (FINC, AUA, ASFOR, AMIKOM).

T6.4 Continuous monitoring of rehabilitation strategies [Lead: AUA; Participants: ADP, 3MON, LETS, PNRT, AMIKOM; Duration: M6-M42; D6.4]: The goal of the task is to implement continuous monitoring systems and self-assessment toolkits upon inspection to generate an analysis that will quantify the impact of restoration policies being adopted. The geographic profile and the landscape management processes will be considered within the task. All partners contribute to the objective of the task.

T6.5 Privacy and societal impact assessment [Lead: KEMEA; Participants: FINC, 3MON, AUA, LETS, PNRT, SMURD, ASFOR, HRT, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM; Duration: M9-M42; D6.3]: The objective of the task is to develop an overarching strategy for data protection and ethical compliance for regulations.

- (i) Data protection: The first objective of this task is to highlight the fact that personal data will be processed when processing information on human activity. This kind of data obviously falls into the scope of the Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (GDPR hereafter). Indeed, SILVANUS will have to balance security on one side and data protection on the other. In this prospective, the project might develop a system which create a reversible pseudonymization of the personal data processed. This system might consist in creating a trusted third party (TTP). This all work will be performed by adopting the “privacy by design” methodology. The second objective will be the determination of guidelines when processing personal data in matter of security (KEMEA, 3MON, AUA, LETS, PNRT, SMURD, ASFOR, HRT, FRB MSR, HVZ, PLAM).

- (ii) Directive NIS: Directive (EU) 2016/1148 of the European Parliament and of the Council of 6 July 2016 concerning measures for a high common level of security of network and information systems across the Union has been adopted starting from the statement that “network and information systems and services play a vital role in society”. Additionally, the participatory methodology developed in T2.1 will be further employed to enable feedback from stakeholders on social acceptance for technology intervention in combating against wildfires (TUZVO, AMIKOM, KEMEA, FINC).

T6.6 Contribution to EU legal framework for climate-related risks [Lead: KEMEA; Participants: ADP, AUA, LETS, SMURD, HRT, PSTE, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM; Duration: M9-M42, D6.5]:

- The goal of the task is to formulate the key findings of the project to be translated into a working draft. In collaboration with the CSA action, the outcome of the project will be included in the position papers to be released jointly by the projects funded within the programme. Although the European Union does not have a common forest policy, since the nineties with the Regulation (EEC) No 2158/92 of 23 July 1992 on protection of the Community forests against fire, the bloc has established a normative framework and a series of measures to ensure the protection of forests and forestry. Given the increasing risk posed by wildfires to the safety of citizens and environment in Europe, the European Commission has recently created rescEU, a reserve that will complement national assets and will be managed by the European Commission in order to support countries hit by disasters such as forest fires. The key dimensions of this strategy are ensuring stronger collective response and improving prevention and preparedness capacities at European level (KEMEA, ADP, AUA, LETS, SMURD, HRT).

- The task will also evaluate evidence-based approach on the previously reported models such as representative concentration pathways (adopted by Intergovernmental Panel on Climate Change (IPCC)) for the impact of forest fires. The C4MIP as part of the CMIP (Coupled Model Inter-comparison Project) provided a set of earth system models, involving the carbon cycle. Among these were included models that infer CO₂ emissions based on atmospheric CO₂ concentrations targets. More recently, mixed models were developed using a combination of simulation climate and socio-economic models (KEMEA, PSTE, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM).

Participation per Partner

Partner number and short name	WP6 effort
5 - FINC	18.00
10 - ADP	2.00
12 - 3MON, s. r. o.	8.00
25 - AUA	32.00
28 - IST	4.00
34 - LETS	18.00
35 - PNRT	15.00
36 - FptSMURD	4.00
37 - ASFOR	5.00
38 - KEMEA	14.00

Partner number and short name	WP6 effort
39 - HRT	6.00
42 - PSTE	3.00
43 - FRS MB	12.00
44 - HVZ	12.00
45 - TUZVO	6.00
46 - Plamen	12.00
47 - AMIKOM	48.00
Total	219.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D6.1	Review of ecological resilience programme across EU	47 - AMIKOM	Report	Public	18
D6.2	Report on SILVANUS resilience programme for forest management, v1	47 - AMIKOM	Report	Public	24
D6.3	Report on privacy and societal impact assessment of technology Interventions	38 - KEMEA	Report	Public	30
D6.4	Report on SILVANUS resilience programme for forest management	47 - AMIKOM	Report	Public	36
D6.5	Final report on SILVANUS resilience programme and contribution to EU legal framework on climate change	38 - KEMEA	Report	Public	42

Description of deliverables

D6.1: Review of ecological resilience programme across EU: The deliverable will report on the ecological resilience programme being adopted across EU by respective regional authorities towards rehabilitation and restoration of forests. The study will consider the impact of wildfires upon natural resources and methodologies to be adopted for the restoration of ecological balance within burnt area. [M18]

D6.2: Report on SILVANUS resilience programme for forest management, v1: Report on the overarching activities carried out within the WP to address the challenges related to forest resilience. The methodology to be adopted within the scope of continuous monitoring of rehabilitation strategies will also be reported. [M24]

D6.3: Report on privacy and societal impact assessment of technology interventions: The deliverable will review the technologies developed in the project against the privacy and societal impact assessment for wide scale adoption of SILVANUS solutions across EU and beyond. [M30]

D6.4: Report on SILVANUS resilience programme for forest management, v2: Report on the second iterative outcome of resilience programme being formalised within the project. [M36]

D6.5: Final report on SILVANUS resilience programme and contribution to EU legal framework on climate change: Report on the SILVANUS resilience programme along with the evaluation of rehabilitation strategy outcome as adopted across different geographical regions. [M42]

D6.1 : Review of ecological resilience programme across EU [18]

D6.1: Review of ecological resilience programme across EU: The deliverable will report on the ecological resilience programme being adopted across EU by respective regional authorities towards rehabilitation and restoration of forests. The study will consider the impact of wildfires upon natural resources and methodologies to be adopted for the restoration of ecological balance within burnt area. [M18]

D6.2 : Report on SILVANUS resilience programme for forest management, v1 [24]

D6.2: Report on SILVANUS resilience programme for forest management, v1: Report on the overarching activities carried out within the WP to address the challenges related to forest resilience. The methodology to be adopted within the scope of continuous monitoring of rehabilitation strategies will also be reported. [M24]

D6.3 : Report on privacy and societal impact assessment of technology Interventions [30]

D6.3: Report on privacy and societal impact assessment of technology interventions: The deliverable will review the technologies developed in the project against the privacy and societal impact assessment for wide scale adoption of SILVANUS solutions across EU and beyond. [M30]

D6.4 : Report on SILVANUS resilience programme for forest management [36]

D6.4: Report on SILVANUS resilience programme for forest management, v2: Report on the second iterative outcome of resilience programme being formalised within the project. [M36]

D6.5 : Final report on SILVANUS resilience programme and contribution to EU legal framework on climate change [42]

D6.5: Final report on SILVANUS resilience programme and contribution to EU legal framework on climate change: Report on the SILVANUS resilience programme along with the evaluation of rehabilitation strategy outcome as adopted across different geographical regions. [M42]

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS3	1st version of integrated platform released	3 - INTRA	18	D8.2
MS4	2nd version of integrated platform release	3 - INTRA	36	D8.3
MS6	Final product release	3 - INTRA	42	D8.5, D10.5



Work package number⁹	WP7	Lead beneficiary¹⁰	25 - AUA
Work package title	Policy recommendations on environmental sustainability and forest restoration		
Start month	1	End month	42

Objectives

The aim of the WP is to develop policy recommendations on forest landscape restoration considering the following key principles: (i) focus on entire landscape restoration; (ii) maintain and enhance natural ecosystem within landscapes; (iii) engage stakeholders and support participatory governance; (iv) tailor to the local context using a variety of approaches; (v) restore multiple functions for multiple benefits; (vi) manage adaptively for long-term resilience.

- to review and propose models for the assessment of quantitative and qualitative aspects of forest resilience to analyse governance models for forest restoration

Description of work and role of partners

WP7 - Policy recommendations on environmental sustainability and forest restoration [Months: 1-42]

AUA, PEGASO, Z&P, EDP, ADP, SYNC, PUI, LETS, FptSMURD, ASFOR, KEMEA, HRT, AHEPA, PSTE, FRS MB, HVZ, TUZVO, Plamen, AMIKOM, UFRJ

T7.1 Methodologies for post fire ecosystem restoration [Lead: AUA; Participants: PEGASO, EDP, SYNC, Z&P, PUI, LETS, SMURD, ASFOR, HRT, FRB MSR, HVZ, PLAM, TUZVO, UFRJ; Duration: M1-M42; D7.1, D7.2, D7.3]: The objective of this task is to develop methodologies for the impact assessment of wildfires upon the forests. More specifically,

- the impact of wildfires upon the agriculture sector and the long-term strategy for the restoration of burnt areas to the natural habitat will be investigated. An approach for combining short- with long-term restoration processes, in accordance to environmental, weather, financial and other resource-related factors, will be defined (AUA, ASFOR, LETS, PUI).
- For short-term restoration, erosion control is key for preventing secondary damage such as landslides and sediment runoff in burned areas. Long-term restoration is necessary to renew forest functions such as timber production, water conservation, ecosystem conservation, and recreation for residents. The use of chemical analysis to study the environmental impact of wildfire upon the natural resources (such as water, air and soil) will also be carried out (EDP, SYNC, Z&P, LETS, HRT).
- The post-fire ecosystem restoration process will also consider the biodiversity index of the region prior to the wildfire to ensure that the restoration process considers the relocation of respective animals to their natural habitat (UFRJ, TUZVO, PLAM, HVZ).

T7.2 Models for the assessment of quantitative and qualitative aspects of forest resilience [lead: AUA; Participants: PEGASO, SYNC, Z&P, PUI, LETS, SMURD, ASFOR, KEMEA, HRT, HVZ, PLAM, TUZVO, AMIKOM, UFRJ; Duration: M1-M42; D7.1, D7.2, D7.3]: The aim of the task is to develop and extend models for the assessment of quantitative and qualitative aspects of forest resilience.

- The activity in this task will review the models published in the literature, including spatial regression techniques using Ordinary Least Squares (OLS) and Geographic Weight Regression (GWR). The variables to be used will involve fire severity, measured through the Composite Burn Index (CBI), and a set of environmental variables (topography, post-fire climate, vegetation type, and state after fire) (HVZ, PLAM, TUZVO, AMIKOM, UFRJ, AUA).
- The regeneration dynamics will be measured through the Normalized Difference Vegetation Index (NDVI) obtained from Landsat images (PEGASO, SYNC, Z&P, SMURD, ASFOR, KEMEA, HRT)

T7.3 Governance models for forest restoration [Lead: Z&P; Participants: PEGASO, EDP, ADP, SYNC, AUA, PUI, LETS, ASFOR, KEMEA, HRT, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM, UFRJ; Duration: M1-MX42 D7.1, D7.2, D7.3]: Beyond human negligence, which is a key source of wildfire, the increasing number of reports on deliberate acts of arson suggests that these should be mitigated and regulated through robust governance models across forests. Additionally, the restoration of forests should be promoted through national priorities via the allocation of resources and incentives for forest rehabilitation and restoration. Thus, towards addressing these challenges, the task will carry out activities to develop governance models which consider the regional requirements.

- The key stakeholders in forest restoration are generally foresters or ecologists, who mostly focus on the specific restoration interventions themselves, such as natural regeneration and re-planting indigenous trees. The adopted interdisciplinary approach places emphasis on the interaction between ecological and governance dimensions, which

is critical to the success of forest restoration. This is mainly because forest restoration seeks to balance ecological objectives with human ones, and in consequence decision-making necessarily involves diverse stakeholders (e.g., environmental groups, forest owners, local authorities, rural communities, etc.) with very different interests. In this light, this task will address knowledge gaps and will promote policy measures, supporting institutions responsible for restoration to make and maintain a significant impact (Z&P, PEGASO, EDP, ADP, SYNC, AUA, PUI, LETS).

- The governance models to be proposed in consultation with the stakeholders will be structured across (i) scale, (ii) stakeholders and (iii) context. The methodology will combine desk-based research with case studies across the pilot regions as well as consultation and engagement with local stakeholders within the pilots and also external advisors. The developed governance models will cover at least three domains, namely, i) policy, legal and regulatory frameworks, ii) planning and decision-making processes, and iii) implementation, enforcement and compliance, and they will be evaluated according to a series of principles and criteria, including accountability, effectiveness, efficiency, fairness, participation and transparency (ASFOR, KEMEA, HRT, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM).

T7.4 Policy recommendations for sustainable and resilient forest management services [lead: KEMEA; Participants: PEGASO, EDP, ADP, SYNC, Z&P, AUA, PUI, LETS, SMURD, ASFOR, HRT, PSTE, AHEPA, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM, UFRJ; Duration: M1-M42; D7.1, D7.2, D7.3]: The goal of the task is to develop policy recommendations for forging sustainable and resilient forest management services.

- The policy outline will review the economic investment models required to support the restoration, rehabilitation, and maintainability of the forest landscape (KEMEA, PEGASO, EDP, ADP, SYNC, AUA, PUI, LETS, SMURD, ASFOR, HRT, PSTE, FRB MSR, HVZ, PLAM, AMIKOM, UFRJ).
- Additionally, the task will study innovative forest models that provide protection to the regions both inside and outside of the burnt area. Implementation process guidelines will be defined and published, providing recommendations on best practices for promoting restoration and rehabilitation (KEMEA, LETS, EDP, PSTE, AMIKOM, UFRJ).

Participation per Partner

Partner number and short name	WP7 effort
1 - PEGASO	14.00
2 - Z&P	21.00
9 - EDP	3.00
10 - ADP	4.00
14 - SYNC	28.00
25 - AUA	30.00
31 - PUI	8.00
34 - LETS	16.00
36 - FptSMURD	4.00
37 - ASFOR	4.00
38 - KEMEA	10.00
39 - HRT	8.00
40 - AHEPA	4.00
42 - PSTE	3.00
43 - FRS MB	6.00
44 - HVZ	8.00
45 - TUZVO	24.00
46 - Plamen	16.00
47 - AMIKOM	6.00

Partner number and short name	WP7 effort
49 - UFRJ	16.00
Total	233.00

List of deliverables

Deliverable Number ¹⁴	Deliverable Title	Lead beneficiary	Type ¹⁵	Dissemination level ¹⁶	Due Date (in months) ¹⁷
D7.1	First draft on policy recommendation framework	25 - AUA	Report	Public	18
D7.2	Second draft on policy recommendation framework	25 - AUA	Report	Public	36
D7.3	Final policy recommendation framework	25 - AUA	Report	Public	42

Description of deliverables

D7.1: First draft on policy recommendation framework: The deliverable will report on the current policy guidelines being adopted for forest restoration across EU member states. The deliverable will detail on the EU policy framework on climate services and commitment to restoring biodiversity for the regions affected by wildfires. First results regarding effective governance models that remove barriers in forest restoration will be published. [M18]
D7.2: Second draft on policy recommendation framework: The deliverable will revise D7.1 with focus on the proposal of new governance models for relevant stakeholders. [M36]
D7.3: Final policy recommendation framework: The deliverable will publish a whitepaper on the policy recommendations to promote sustainable forest landscape management. [M42]
D7.1 : First draft on policy recommendation framework [18]
D7.1: First draft on policy recommendation framework: The deliverable will report on the current policy guidelines being adopted for forest restoration across EU member states. The deliverable will detail on the EU policy framework on climate services and commitment to restoring biodiversity for the regions affected by wildfires. First results regarding effective governance models that remove barriers in forest restoration will be published. [M18]
D7.2 : Second draft on policy recommendation framework [36]
D7.2: Second draft on policy recommendation framework: The deliverable will revise D7.1 with focus on the proposal of new governance models for relevant stakeholders. [M36]
D7.3 : Final policy recommendation framework [42]
D7.3: Final policy recommendation framework: The deliverable will publish a whitepaper on the policy recommendations to promote sustainable forest landscape management. [M42]

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS5	CASD operational roadmap launched	45 - TUZVO	36	D9.2 D10.3

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS6	Final product release	3 - INTRA	42	D8.5, D10.5

Work package number⁹	WP8	Lead beneficiary¹⁰	3 - INTRA
Work package title	Platform design specification, interfaces and integration		
Start month	3	End month	42

Objectives

The objective of this WP is to develop an integrated SILVANUS interdisciplinary forest landscape management platform that packages various software components suitable for distribution across pilot organisations participating in the project. The following specific objectives will be addressed within the WP

- to develop SILVANUS architecture specification considering the stakeholder requirements and functional requirements gathered from WP2-WP7
- to allocate continuous integration infrastructure for the integration of SILVANUS software components testing and validation of platform

Description of work and role of partners

WP8 - Platform design specification, interfaces and integration [Months: 3-42]

INTRA, PEGASO, TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, ADP, 3MON, s. r. o., CTL, EAI, ITTI, VMG, MDS, CMCC F, EXUS, RINI, WUT, HB, CERTH, UTH, UISAV, ASSET, KEMEA, AMIKOM, CSIRO

T8.1 Platform architecture specification [Lead: INTRA; Participants: TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, ADP, 3MON, CTL, EAI, ITTI, VMG, MDS, CMCC F, RINI, WUT, CERTH, UTH, UISAV, ASSET, AMIKOM; Duration: M6-M42; D8.1, D8.3]: The objective of this task is to develop a reference architecture for the integration of SILVANUS software components developed in the project. The architecture will also specify integration protocol for interfacing with external sensor resources developed in WP3. The metadata specification will be defined for communication between different software components.

T8.2 Information sharing protocols across first responders and public [Lead: UISAV; Participants: PEGASO, INTRA, FINC, ATOS IT, SIMAVI, ADP, 3MON, EAI, ITTI, MDS, RINI, UTH, ASSET, KEMEA; Duration: M6-M42; D8.2, D8.4, D8.5]: This task will perform the design and development of SILVANUS information sharing protocols. The task will identify the categories of information formats to be standardised based on the dynamic behaviour of forest fires. The exchange of information will be carried out using the wireless communication setup in WP5, which will directly interface with the rest of the response units, including the UAVs and UGVs. The task will liaise with outcome of other projects (refer to Section 1.3.4) for the development of protocols and services to engage with external organisations delivering first responder services for mitigating the spread of forest fires.

T8.3 Information sharing between SILVANUS mobile command centres [lead: FINC; Participants: INTRA, FINC, ATOS IT, SIMAVI, EDP, 3MON, ITTI, RINI, UISAV, ASSET, KEMEA, CSIRO; Duration: M6-M42; D8.2, D8.4, D8.5]: The objective of the task is to enable coordinate discovery and establish secure communication with external installations of SILVANUS platform. The information sharing services will facilitate exchange of incident reports between multiple mobile command centre deployed to tackle the spread of wildfire. The task will adopt the use of industry standards such as TAXII, STIX for the carriage of incident payload across different installation of SILVANUS platform. The task will also implement software services to configure the pre-installed locations and avoid external discovery services for enhanced security.

T8.4 Integration of data services to environmental impact assessment [Lead: FINC; Participants: INTRA, ATOS IT, DELL, SIMAVI, EDP, 3MON, EAI, ITTI, VMG, RINI, ASSET; Duration: M6-M42; D8.2, D8.4, D8.5]: The aim of the task is to develop data services to interface with existing environmental impact assessment toolkit. The parameterised simulation of various scenarios for the ignition and spread of forest fires influenced by the changing weather patterns will be demonstrated. The simulation will consider the GHG emissions and model the short-term and medium-term impact upon the environment.

T8.5 Platform integration [Lead: INTRA; Participants: PEGASO, INTRA, TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, ADP, 3MON, CTL, EAI, ITTI, VMG, MDS, CMCC F, EXUS, RINI, WUT, CERTH, UTH, UISAV, AMIKOM, CSIRO; Duration: M6-M42; D8.2, D8.4, D8.5, D8.6]: This task aims at unifying the outcomes of the developed components and services in WP3-WP6 in order to release the integrated SILVANUS defence platform in two major releases. Task 8.1 will undertake the development of a solid continuous integration plan to guide the integration of the developed software components and services. This integration plan will analyse all software resources (e.g. mechanisms, modules,

components, services) available, and identify, specify and document the integration endpoints amongst these resources. Both inter-module and inter-component integration will be included.

T8.6 Platform testing and validation [Lead: INTRA; Participants: PEGASO, TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, ADP, CTL, EAI, ITTI, VMG, MDS, CMCC F, EXUS, RINI, WUT, HB, CERTH, UTH, UISAV, AMIKOM; Duration: M6-M42; D8.2, D8.4, D8.5]: This task will produce the unit, integration and system tests to achieve seamless coordination and interoperation among the SILVANUS platform components and services in a controlled environment before actual deployment and use by the end users in an operational context.

Participation per Partner

Partner number and short name	WP8 effort
1 - PEGASO	8.00
3 - INTRA	66.00
4 - TRT	12.00
5 - FINC	28.00
6 - ATOS IT	18.00
7 - DELL	16.00
8 - SIMAVI	11.00
9 - EDP	8.00
10 - ADP	4.00
12 - 3MON, s. r. o.	9.00
13 - CTL	4.00
15 - EAI	10.00
16 - ITTI	12.00
17 - VMG	8.00
18 - MDS	8.00
19 - CMCC F	5.00
20 - EXUS	2.00
21 - RINI	11.00
23 - WUT	6.00
24 - HB	1.00
26 - CERTH	5.00
27 - UTH	6.00
30 - UISAV	22.00
33 - ASSET	20.00
38 - KEMEA	2.00
47 - AMIKOM	9.00
48 - CSIRO	6.00
Total	317.00

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D8.1	Report on SILVANUS reference architecture	3 - INTRA	Report	Confidential, only for members of the consortium (including the Commission Services)	9
D8.2	SILVANUS platform release, 1st version	3 - INTRA	Demonstrator	Public	18
D8.3	Report on SILVANUS final reference architecture	3 - INTRA	Report	Confidential, only for members of the consortium (including the Commission Services)	24
D8.4	SILVANUS platform release, 2nd version	3 - INTRA	Demonstrator	Public	36
D8.5	SILVANUS (final) platform release	3 - INTRA	Demonstrator	Confidential, only for members of the consortium (including the Commission Services)	42
D8.6	SILVANUS demonstration	3 - INTRA	Demonstrator	Public	42

Description of deliverables

D8.1: Report on SILVANUS reference architecture: The deliverable will report on the SILVANUS architecture specification, middleware vendor integration, API formalisation and deployment guide-lines for distributing the platform. [M9]

D8.2: SILVANUS platform release (alpha release): The deliverable will demonstrate the alpha release of the project platform leveraging the project outcomes from WP3-WP7. The demonstration will enable the first responders and fire fighters' access to have hands-on experience in engaging with the platform and to enable organisational readiness for the deployment of the platform. [M18]

D8.3: Report on SILVANUS final reference architecture: Following the alpha release of the platform, the architecture specification will be finalised for project component integration. [M24]

D8.4: SILVANUS platform release (beta release): The deliverable will demonstrate the features of the platform in comparison to the alpha release. The platform will be rigorously tested and evaluated against different fire ignition models to be identified across pilot demonstration activities. [M36]

D8.5: SILVANUS (final) platform release: The deliverable will demonstrate the outcome of the integrated platform from the project. [M42]

D8.6: SILVANUS final demonstration: A demonstration to the stakeholder and public will be carried out. [M42]

D8.1 : Report on SILVANUS reference architecture [9]

D8.1: Report on SILVANUS reference architecture: The deliverable will report on the SILVANUS architecture specification, middleware vendor integration, API formalisation and deployment guidelines for distributing the platform. [M9]

D8.2 : SILVANUS platform release, 1st version [18]

D8.2: SILVANUS platform release (alpha release): The deliverable will demonstrate the alpha release of the project platform leveraging the project outcomes from WP3-WP7. The demonstration will enable the first responders and fire fighters' access to have hands-on experience in engaging with the platform and to enable organisational readiness for the deployment of the platform. [M18]

D8.3 : Report on SILVANUS final reference architecture [24]

D8.3: Report on SILVANUS final reference architecture: Following the alpha release of the platform, the architecture specification will be finalised for project component integration. [M24]

D8.4 : SILVANUS platform release, 2nd version [36]

D8.4: SILVANUS platform release (beta release): The deliverable will demonstrate the features of the platform in comparison to the alpha release. The platform will be rigorously tested and evaluated against different fire ignition models to be identified across pilot demonstration activities. [M36]

D8.5 : SILVANUS (final) platform release [42]

D8.5: SILVANUS (final) platform release [lead: INTRA; type: DEM; due: M42]: The deliverable will demonstrate the outcome of the integrated platform from the project.

D8.6 : SILVANUS demonstration [42]

SILVANUS demonstration

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS2	Platform assessment framework released. Completion of organisational deployment of the platform	37 - ASFOR	12	D2.3 D8.1
MS3	1st version of integrated platform released	3 - INTRA	18	D8.2
MS4	2nd version of integrated platform release	3 - INTRA	36	D8.3
MS6	Final product release	3 - INTRA	42	D8.5, D10.5

Work package number ⁹	WP9	Lead beneficiary ¹⁰	37 - ASFOR
Work package title	Large-scale demonstration activiites of project outcomes		
Start month	12	End month	42

Objectives

The objective of this WP is to facilitate continuous evaluation of the SILVANUS attack scenarios across eight (8) pilot demonstration sites from EU member states and three (3) international regions as outlined in Section 1.3.3. The following specific objectives are addressed in this WP:

- to prepare organisation deployment of SILVANUS platform to coordinate Phase A, B and C trials in combating against wildfires.
- to evaluate the impact of wildfire spread across geographic regions to model and emulate the spread of fire for quantifying the performance of detection and response capabilities

Description of work and role of partners

WP9 - Large-scale demonstration activiites of project outcomes [Months: 12-42]

ASFOR, PEGASO, Z&P, INTRA, TRT, FINC, ATOS IT, SIMAVI, EDP, ADP, TP, 3MON, s. r. o., CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, EXUS, RINI, WUT, AUA, CERTH, UTH, IST, UASVG, UISAV, PUI, SGSP, ASSET, FptSMURD, KEMEA, HRT, AHEPA, OIR, PSTE, FRS MB, HVZ, TUZVO, Plamen, UFRJ

T9.1 Organisational readiness for pilot demonstration [lead: ASFOR; Participants: PEGASO, Z&P, INTRA, TRT, FINC, ATOS IT, SIMAVI, ADP, 3MON, CTL, EAI, ITTI, VMG, MDS, CMCC F, EXUS, RINI, WUT, CERTH, IST, TP, SGPS, PUI, ASSET, SMURD, KEMEA, HRT, PSTE, AHEPA, FRB MSR, HVZ, PLAM, TUZVO; Duration: M9-M36]: The two objectives of this task are (i) to ensure the transfer of SILVANUS platform deployment within the first responder premises and (ii) to continuously monitor the data management policies across pilot sites. The task will be responsible for obtaining organisational permissions, identification of resources to perform the Phase A, B and C trials. The processes and procedures adopted for modelling the interdependencies will be documented and will act as a ground truth for the validation of field exercise outcomes. Additional-ly, the task will map all relevant data protection laws and formal regulations and at the time create a comprehensive overview of relevant ethical principles for information aggregated from demonstration regions.

T9.2 Phase A - Trials [Lead: EDP; Participants: PEGASO, Z&P, INTRA, FINC, ATOS IT, ADP, 3MON, CTL, MDS, CMCC F, EXUS, RINI, WUT, CERTH, UTH, IST, TP, UASVG, UISAV, SGPS, ASSET, SMURD, ASFOR, KEMEA, HRT, PSTE, AHEPA, FRB MSR, HVZ, PLAM, TUZVO, UFRJ; Duration: M12-M36]: The objective of the task is to organise the Phase A trials in consultation with the stakeholders. The task will evaluate the effectiveness of citizen engagement pro-gramme and the training activities delivered to the fire fighters. A range of fire ignition scenarios will be emulated.

T9.3 Phase B – Trials [Lead: ASFOR; Participants: Z&P, INTRA, FINC, ATOS IT, SIMAVI, 3MON, EAI, VMG, CMCC F, EXUS, RINI, WUT, UASVG, UISAV, SGPS, ASSET, SMURD, KEMEA, OIR, PLAM, TUZVO; Duration: M18-M39]: The objective of the task is to evaluate the performance of technological interventions developed and deployed for the early-stage detection of wildfire ignition. A range of sensor technologies will be evaluated during the trials (as outlined in WP4). In complementary, upon the detection of wildfire, the response coordination among stakeholders based on the modelling of fire spread behaviour will be assessed (as outlined in WP5). The trial will include the use of UAVs, UGVs, and other aerial platforms for fire suppression.

T9.4 Phase C – Trials [Lead: AUA; Participants: Z&P, INTRA, FINC, EDP, ADP, 3MON, EAI, CMCC F, RINI, WUT, AUA, UISAV, ASSET, SMURD, ASFOR, KEMEA, HRT, PSTE, PLAM, TUZVO, UFRJ; Duration: M24-M42]: Post fire rehabilitation of land will be studied through a sys-tematic setup of respective methodologies. The impact of restoration and adaptation will be analysed based on the wildfire severity and duration, as well as the impact of ecological and biodiversity resili-ence in the agricultural sector.

T9.5 Cross-cutting trials [lead: PUI; Participants: INTRA, TRT, FINC, ADP, 3MON, CTL, SYNC, EAI, ITTI, MDS, CMCC F, Z&P, RINI, WUT, CERTH, UTH, IST, TP, UASVG, UISAV, SGPS, SMURD, ASFOR, KEMEA, HRT, PSTE, AHEPA, FRB MSR, HVZ, PLAM, TUZVO, UFRJ; Duration: M12-M42]: The objective of the task is to setup and demonstrate cross-cutting pilot trials that extends among Phase A, B and C activities. The demonstration scenarios will be outlined in consultation with stakeholders.

T9.6 Pilot outcome assessment and replicability studies [Lead: SGPS; Participants: PEGASO, INTRA, TRT, FINC, ATOS, SIMAVI, ADP, 3MON, CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, Z&P, EXUS, RINI, WUT, CERTH, UTH, IST, TP, UASVG, SGPS, PUI, SMURD, ASFOR, KEMEA, HRT, PSTE, AHEPA, OIR, FRB MSR, HVZ, PLAM, TUZVO, UFRJ; Duration: M15-M42]: The goal is to systematically evaluate the effectiveness of pilot demonstration activities based on the formal assessment methodology.

Participation per Partner

Partner number and short name	WP9 effort
1 - PEGASO	13.00
2 - Z&P	10.00
3 - INTRA	20.00
4 - TRT	6.00
5 - FINC	12.00
6 - ATOS IT	14.00
8 - SIMAVI	7.00
9 - EDP	10.00
10 - ADP	19.50
11 - TP	32.00
12 - 3MON, s. r. o.	8.00
13 - CTL	4.00
14 - SYNC	8.00
15 - EAI	10.00
16 - ITTI	6.00
17 - VMG	7.00
18 - MDS	5.00
19 - CMCC F	12.00
20 - EXUS	4.00
21 - RINI	12.00
23 - WUT	12.00
25 - AUA	4.00
26 - CERTH	8.00
27 - UTH	5.00
28 - IST	18.00
29 - UASVG	9.00
30 - UISAV	5.00
31 - PUI	5.00
32 - SGSP	26.00
33 - ASSET	24.00
36 - FptSMURD	16.00

Partner number and short name	WP9 effort
37 - ASFOR	17.00
38 - KEMEA	8.00
39 - HRT	13.00
40 - AHEPA	9.00
41 - OIR	2.00
42 - PSTE	33.00
43 - FRS MB	16.00
44 - HVZ	12.00
45 - TUZVO	14.00
46 - Plamen	34.00
49 - UFRJ	12.00
Total	521.50

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D9.1	Report on organisational readiness of the pilot setup	37 - ASFOR	Report	Confidential, only for members of the consortium (including the Commission Services)	15
D9.2	Report on first trial period activities for Phase A, B and C	37 - ASFOR	Report	Confidential, only for members of the consortium (including the Commission Services)	27
D9.3	Report on formal assessment of trial period #1	9 - EDP	Report	Public	30
D9.4	Report on second trial period activities for Phase A, B, C	37 - ASFOR	Report	Confidential, only for members of the consortium (including the Commission Services)	39
D9.5	Report on formal assessment of trial period #2	25 - AUA	Report	Public	42

Description of deliverables

D9.1: Report on organisational readiness of the pilot setup: The deliverable will report on the activities carried out pilot demonstration organisations with platform installation. Such activities will include gaining permissions for the pilot demonstrations, IT resources, in-situ sensors, relevant data collected from earth observation and others. [M15]

- D9.2: Report on first trial period activities for Phase A, B and C: The deliverable will report in detail the demonstration activities carried out during the trial period #1 to #3. [M27]
- D9.3: Report on formal assessment of trial period #1 to #3: The deliverable will report on the formal assessment of pilot demonstration outcomes from Phase A, B and C. [M30]
- D9.4: Report on second trial period activities for Phase A, B and C: The deliverable will report in detail the demonstration activities carried out during the trial period #4 to #7. [M39]
- D9.5: Report on formal assessment of trial period #2: The deliverable will report on the formal assessment of pilot demonstration outcomes from Phase A, B and C. [M42]
- D9.1 : Report on organisational readiness of the pilot setup [15]
- D9.1: Report on organisational readiness of the pilot setup: The deliverable will report on the activities carried out pilot demonstration organisations with platform installation. Such activities will include gaining permissions for the pilot demonstrations, IT resources, in-situ sensors, relevant data collected from earth observation and others. [M15]
- D9.2 : Report on first trial period activities for Phase A, B and C [27]
- D9.2: Report on first trial period activities for Phase A, B and C: The deliverable will report in detail the demonstration activities carried out during the trial period #1 to #3. [M27]
- D9.3 : Report on formal assessment of trial period #1 [30]
- D9.3: Report on formal assessment of trial period #1 to #3: The deliverable will report on the formal assessment of pilot demonstration outcomes from Phase A, B and C. [M30]
- D9.4 : Report on second trial period activities for Phase A, B, C [39]
- D9.4: Report on second trial period activities for Phase A, B and C: The deliverable will report in detail the demonstration activities carried out during the trial period #4 to #7. [M39]
- D9.5 : Report on formal assessment of trial period #2 [42]
- D9.5: Report on formal assessment of trial period #2: The deliverable will report on the formal assessment of pilot demonstration outcomes from Phase A, B and C. [M42]

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS7	Pilots have all necessary permits for implementation	37 - ASFOR	15	Status report from pilot owners. D9.1
MS9	First trial period activities for Phase A, B and C	37 - ASFOR	28	D9.2 submitted and published
MS12	Second trial period activities for Phase A, B and C	37 - ASFOR	39	D9.4 submitted

Work package number⁹	WP10	Lead beneficiary¹⁰	22 - MD
Work package title	Dissemination and exploitation		
Start month	1	End month	42

Objectives

This WP sets up and manages the Stakeholder Group and the Advisory Board, and exploits them for preparing efficient training schemes, operational procedures and policy recommendations for sustainable forest management stakeholders. Elaborate and implement effective plans for communication, dissemination, and exploitation for SILVANUS, agreed by all members of the Consortium, to reach all levels of stakeholders and target groups

Description of work and role of partners

WP10 - Dissemination and exploitation [Months: 1-42]

MD, PEGASO, Z&P, INTRA, TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, ADP, TP, 3MON, s. r. o., CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, EXUS, RINI, WUT, HB, AUA, CERTH, UTH, IST, UASVG, UISAV, PUI, SGSP, ASSET, LETS, PNRT, FptSMURD, ASFOR, KEMEA, HRT, AHEPA, PSTE, FRS MB, HVZ, TUZVO, Plamen, AMIKOM, CSIRO, UFRJ

T10.1 – Self-sustainability models for the “Centre for Adaptation Strategies and Development (CASD)” of natural resources [Leader: TUZVO; Participants: PEGASO, INTRA, TRT, FINC, ATOS IT, ATOS SA, DELL, SIMAVI, EDP, ADP, 3MON, CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, Z&P, EXUS, RINI, MD, WUT, AUA, CERTH, UTH, IST, TP, UASVG, SGPS, PUI, ASSET, LETS, PNRT, SMURD, ASFOR, KEMEA, HRT, AHEPA, FRB MSR, HVZ, PLAM, AMIKOM, CSIRO, UFRJ; Duration: M1-42; D10.7]: The objective of the task is to setup a Centre for Adaptation Strategies and Development, a global think tank which will develop regional policies required to rehabilitate the burnt area of the forest. The task will expand upon the setup of SFR-WG to establish a self-sustainability business model using consultancy services along with subscription fees and licensing fee for the resources. Additionally, the task will also continuously monitor technology and market trends that are relevant for the work conducted in the SILVANUS project and whenever a new trend or change in trends is observed, informing all partners on the updated state of the art and when needed triggering timely adaptive actions of the project planning. The update on the market positioning of the SILVANUS sustainable forest management platform services will be fed back to SME organisations and other industrial stakeholders for the development of new business models that cater the needs of the stakeholders. The SILVANUS members will establish liaison with previously funded projects (such as FirEURisk, ADAPT, DecisionES, ENBEL, SIXTHSENSE, PyroLife and not limited to only) to extend invitation for the support of CASD. The members of CSA action will also be invited to establish collaboration and agree on the vision of the CASD activities.

T10.2 – Exploitation of SILVANUS platform services [Leader: ATOS SA; Participants: INTRA, TRT, FINC, ATOS IT, DELL, SIMAVI, EDP, ADP, 3MON, CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, Z&P, EXUS, RINI, MD, WUT, AUA, TP, UASVG, UISAV, SGPS, PUI, ASSET, LETS, ASFOR, KEMEA, HRT, PSTE, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM, UFRJ; Duration: M1-M42; D10.5, D10.6]: The focus of this task is to identify exploitable assets of SILVANUS platform and subsequently formulate individual exploitation strategy by creating specific business models tailored for the disparate stakeholders to whom the technologies bring added value. This task will support partners in the further development of their business plans. SILVANUS will have a market orientation therefore the consortium will identify; (i) value proposition business models for the stakeholders; (ii) the market penetration plans; (iii) financial and sustainability plans, (iv) IPR issues and (v) individual and joint exploitation plans by the consortium partners.

T10.3 – Dissemination and communication across global communities [Leader: PUI; Participants: PEGASO, INTRA, TRT, FINC, ATOS IT, ATOS SA, DELL, SIMAVI, EDP, ADP, CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, Z&P, EXUS, RINI, MD, WUT, HB, UTH, IST, TP, UASVG, UISAV, SGPS, ASSET, LETS, SMURD, ASFOR, KEMEA, HRT, PSTE, AHEPA, OIR, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM, UFRJ; Duration: M1-42; D10.1, D10.2, D10.3, D10.4]: This task will ensure that SILVANUS results will be disseminated to the appropriate target communities, at appropriate times, via appropriate methods considering the need to promote global awareness on fire safety in natural parks and forest regions. The task will develop and promote means to raise awareness amongst interested parties and communities that shall be impacted by SILVANUS outcomes, including the reports on case-studies resulting from human negligence, external weather conditions and installation of critical infrastructure services. The dissemination activities will focus on defining techniques and media as appropriate for fostering project results; targeting specific audiences that can benefit from the SILVANUS results.

T10.4 – Stakeholders' community building and management [Leader: MD; Participants: INTRA, FINC, ATOS IT, ATOS SA, EDP, ADP, CTL, SYNC, ITTI, VMG, MDS, CMCC F, Z&P, EXUS, RINI, MD, WUT, AUA, CERTH, UTH, IST, TP, UASVG, UISAV, SGPS, PUI, ASSET, LETS, PNRT, SMURD, ASFOR, KEMEA, HRT, PSTE, AHEPA, OIR, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM, UFRJ; Duration: M1-42; D10.1, D10.2, D10.3, D10.4]: This task aims at creating and managing the SILVANUS stakeholders community, whose member are experts and stakeholders interested in providing advices and recommendations to SILVANUS, supporting the definition of sustainable forest management framework and overseeing the development of interdisciplinary solutions. An initial list of members is provided in Section 2.2.2. This task also aims creating and managing the Sustainable and Resilient Forest Working Group (SRF-WG), whose member will be mainly public authorities and organisation representatives responsible for forest management, but also other practitioners involved in providing first response support, researchers and technologists, standardization bodies, civil protection, and public authorities. The consortium partners will closely analyse the proper governance and engagement models and rules for this group, with the aim of having them available close to the end of the project. However, this group will represent a wider audience for disseminating project results, but also for getting relevant input and needs for their development (as a sort of extended Advisory Board).

T10.5 – Standards and compliance for interoperability of SILVANUS platform [Leader: LETS; Participants: INTRA, FINC, DELL, SIMAVI, EDP, ADP, 3MON, CTL, SYNC, EAI, ITTI, VMG, MDS, CMCC F, EXUS, RINI, MD, WUT, HB, AUA, CERTH, UTH, IST, TP, UASVG, UISAV, SGPS, PUI, ASSET, LETS, SMURD, ASFOR, KEMEA, HRT, AHEPA, FRB MSR, HVZ, PLAM, TUZVO, AMIKOM, CSIRO, UFRJ; Duration: M1-42; D10.1, D10.2, D10.3, D10.4]: The conceptual design of the SILVANUS sustainable forest management platform will include the analysis of industrial standards that are widely adopted across key stakeholders for enhancing the resilience of forest against wildfire. The activities in this task will continuously review the security market for innovative solutions for monitoring natural resources. The proof-of-concept solution developed in WP3 and WP6 for interfacing with data sources, will be used to promote the interoperability features of the SILVANUS platform.

Participation per Partner

Partner number and short name	WP10 effort
1 - PEGASO	5.00
2 - Z&P	5.00
3 - INTRA	9.00
4 - TRT	7.00
5 - FINC	10.00
6 - ATOS IT	3.00
ATOS SA	15.00
7 - DELL	5.00
8 - SIMAVI	6.00
9 - EDP	5.00
10 - ADP	7.00
11 - TP	10.00
12 - 3MON, s. r. o.	4.00
13 - CTL	6.00
14 - SYNC	8.00
15 - EAI	7.00
16 - ITTI	8.00
17 - VMG	8.00

Partner number and short name	WP10 effort
18 - MDS	6.00
19 - CMCC F	5.00
20 - EXUS	10.00
21 - RINI	9.00
22 - MD	35.00
23 - WUT	5.00
24 - HB	4.00
25 - AUA	7.00
26 - CERTH	3.00
27 - UTH	8.00
28 - IST	4.00
29 - UASVG	10.00
30 - UISAV	5.00
31 - PUI	5.00
32 - SGSP	10.00
33 - ASSET	9.00
34 - LETS	7.00
35 - PNRT	2.00
36 - FptSMURD	4.00
37 - ASFOR	5.00
38 - KEMEA	7.00
39 - HRT	6.00
40 - AHEPA	5.00
42 - PSTE	6.00
43 - FRS MB	9.00
44 - HVZ	5.00
45 - TUZVO	9.00
46 - Plamen	10.00
47 - AMIKOM	10.00
48 - CSIRO	2.00
49 - UFRJ	10.00
Total	360.00

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D10.1	SILVANUS dissemination and community engagement	22 - MD	Report	Public	1
D10.2	Annual report on SILVANUS dissemination activities, v1	22 - MD	Report	Public	12
D10.3	Annual report on SILVANUS dissemination activities, v2	22 - MD	Report	Public	24
D10.4	Annual report on SILVANUS dissemination activities, v3	22 - MD	Report	Public	36
D10.5	Report on forest landscape management services	6 - ATOS IT	Report	Public	36
D10.6	SILVANUS final report on dissemination and exploitation	22 - MD	Report	Public	42
D10.7	Self-sustainability business plan for Centre for Adaptation Strategies and Development (CASD)	22 - MD	Report	Confidential, only for members of the consortium (including the Commission Services)	42

Description of deliverables

D10.1: SILVANUS dissemination and community engagement strategy: Report on the broad strategies identified by consortium partners. The deliverable will also assign project representatives as liaisons to engage with rest of the IA project and represent project views in CSA action. [M1]

D10.2: Annual report on SILVANUS dissemination activity, v1: The deliverable will report on the participation of SILVNUA consortium across key dissemination events including industrial showcases as outlined in Section 2.2 [M12]

D10.3: Annual report on SILVANUS dissemination activities, v2: The deliverable will revise D10.2 with the participation of events between M12 to M24 [M24]

D10.4: Annual report on SILVANUS dissemination activities, v3: The deliverable will revise D10.3 with the participation of events between M24 to M36 [M36]

D10.5: Report on forest landscape management services: Report on the market niche and provide a comparative assessment of project outcomes. [M36]

D10.6: SILVANUS final report on dissemination and exploitation roadmap: Report on the consolidated activities carried out by the project members. Identification of key assets [M42]

D10.7: Self-sustainability business plan for Centre for Adaptation Strategies and Development (CASD): Report on the business plan for the self-sustainability of CASD. [M42]

D10.1 : SILVANUS dissemination and community engagement [1]

D10.1: SILVANUS dissemination and community engagement strategy: Report on the broad strategies identified by consortium partners. The deliverable will also assign project representatives as liaisons to engage with rest of the IA project and represent project views in CSA action. [M1]

D10.2 : Annual report on SILVANUS dissemination activities, v1 [12]

D10.2: Annual report on SILVANUS dissemination activity, v1: The deliverable will report on the participation of SILVNUA consortium across key dissemination events including industrial showcases as outlined in Section 2.2 [M12]

D10.3 : Annual report on SILVANUS dissemination activities, v2 [24]

D10.3: Annual report on SILVANUS dissemination activities, v2: The deliverable will revise D10.2 with the participation of events between M12 to M24 [M24]

D10.4 : Annual report on SILVANUS dissemination activities, v3 [36]

D10.4: Annual report on SILVANUS dissemination activities, v3: The deliverable will revise D10.3 with the participation of events between M24 to M36 [M36]

D10.5 : Report on forest landscape management services [36]

D10.5: Report on forest landscape management services: Report on the market niche and provide a comparative assessment of project outcomes. [M36]

D10.6 : SILVANUS final report on dissemination and exploitation [42]

D10.6: SILVANUS final report on dissemination and exploitation roadmap: Report on the consolidated activities carried out by the project members. Identification of key assets {M42}

D10.7 : Self-sustainability business plan for Centre for Adaptation Strategies and Development (CASD) [42]

D10.7: Self-sustainability business plan for Centre for Adaptation Strategies and Development (CASD): Report on the business plan for the self-sustainability of CASD. [M42]

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification
MS1	Participatory process methodology established. CASD management board setup	45 - TUZVO	6	D2.1 D10.1

Work package number⁹	WP11	Lead beneficiary¹⁰	1 - PEGASO
Work package title	Ethics requirements		
Start month	1	End month	42

Objectives

The objective is to ensure compliance with the 'ethics requirements' set out in this work package.

Description of work and role of partners

WP11 - Ethics requirements [Months: 1-42]

PEGASO

This work package sets out the 'ethics requirements' that the project must comply with.

List of deliverables

Deliverable Number¹⁴	Deliverable Title	Lead beneficiary	Type¹⁵	Dissemination level¹⁶	Due Date (in months)¹⁷
D11.1	H - Requirement No. 1	1 - PEGASO	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D11.2	POPD - Requirement No. 2	1 - PEGASO	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3
D11.3	NEC - Requirement No. 3	1 - PEGASO	Ethics	Confidential, only for members of the consortium (including the Commission Services)	3

Description of deliverables

The 'ethics requirements' that the project must comply with are included as deliverables in this work package.

D11.1 : H - Requirement No. 1 [3]

Templates of the informed consent/assent forms and information sheets (in language and terms intelligible to the participants) must be kept on file.

D11.2 : POPD - Requirement No. 2 [3]

The host institution must confirm that it has appointed a Data Protection Officer (DPO) and the contact details of the DPO are made available to all data subjects involved in the research. For host institutions not required to appoint a DPO under the GDPR a detailed data protection policy for the project must be kept on file.

D11.3 : NEC - Requirement No. 3 [3]

Details on the materials which will be imported to/exported from the EU must be kept on file.

Schedule of relevant Milestones

Milestone number ¹⁸	Milestone title	Lead beneficiary	Due Date (in months)	Means of verification

1.3.4. WT4 List of milestones

Milestone number ¹⁸	Milestone title	WP number ⁹	Lead beneficiary	Due Date (in months) ¹⁷	Means of verification
MS1	Participatory process methodology established. CASD management board setup	WP10, WP2	45 - TUZVO	6	D2.1 D10.1
MS2	Platform assessment framework released. Completion of organisational deployment of the platform	WP2, WP8	37 - ASFOR	12	D2.3 D8.1
MS3	1st version of integrated platform released	WP3, WP4, WP5, WP6, WP8	3 - INTRA	18	D8.2
MS4	2nd version of integrated platform release	WP2, WP3, WP4, WP5, WP6, WP8	3 - INTRA	36	D8.3
MS5	CASD operational roadmap launched	WP7	45 - TUZVO	36	D9.2 D10.3
MS6	Final product release	WP1, WP2, WP3, WP4, WP5, WP6, WP7, WP8	3 - INTRA	42	D8.5, D10.5
MS7	Pilots have all necessary permits for implementation	WP9	37 - ASFOR	15	Status report from pilot owners. D9.1
MS8	Initial platform and core components delivered	WP5	7 - DELL	18	Delivery of D4.1, D5.1 and D5.2
MS9	First trial period activities for Phase A, B and C	WP9	37 - ASFOR	28	D9.2 submitted and published
MS10	Final training delivered	WP3	8 - SIMAVI	36	D3.4 submitted
MS11	Final platform and core components delivered	WP5	7 - DELL	36	Delivery of D5.3, D5.4 and D5.5

Milestone number¹⁸	Milestone title	WP number⁹	Lead beneficiary	Due Date (in months)¹⁷	Means of verification
MS12	Second trial period activities for Phase A, B and C	WP9	37 - ASFOR	39	D9.4 submitted
MS13	All applications validated (AR/VR, Mobile app) and public awareness delivered	WP3	8 - SIMAVI	42	D3.3 and D3.5 submitted

1.3.5. WT5 Critical Implementation risks and mitigation actions

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
1	Partner leaves consortium	WP1	Reassignment of tasks to other consortium partners has been agreed among the consortium partners with respect to the project planning as outlined. If the partner possesses an expertise or capability that is unique in the consortium and essential for the execution of the project, the consortium will seek an alternative new partner. In this case, an amendment of the Grant Agreement is required
2	Requirement of additional resources for implementing the project activities	WP1	The coordinator will carry out a detailed planning in constant consultation with all consortium partners. Internal reporting structure outlined in Section 3.2 where task leaders will report to WP leaders and consolidated on a timely basis in periodic meetings. The partners are committed to allocate the necessary resources since the start of the project and have already secured the required man-effort required to execute the project
3	Partner unable to effectively work with other partners and/or stakeholders	WP1	Effective communication and co-operation skills are key skills of REMEDY consortium (as outlined in Section 3.3). Additionally, all the consortium has long-standing successful collaboration track record as presented in Table 3. The SILVANUS consortium has already exchanged information with prospective bid proposers for Sub-topic 2 (CSA) and have agreed on mutual collaboration towards organising industrial showcase events
4	Non-compliance with legal and ethical considerations	WP1, WP6	SILVANUS partners will engage in close collaboration to ensure that common legal and ethical goals are achieved during the project. To that goal, SILVANUS has allocated resources and personnel in WP1, led by KEMEA. Compliance with legal and ethical consideration for the deployment of technological intervention in combating against wildfires will be of paramount importance for sustainable deployment of scientific outcomes
5	Failure of involved stakeholders to commit with project objectives	WP1, WP10, WP11, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	Engagement and promotion of benefits of the project in terms of innovation and societal benefits (as outlined in Section 2.2). The consortium has already established strong links with relevant stakeholders representing a diverse interdisciplinary stakeholder. The SC members will support strengthening of the position of SILAVNUS with the relevant stakeholders
6	Conceptual weakness of SILVANUS	WP8	The inherent interdisciplinary nature of SILVANUS presents a complex software engineering task. The consortium has already agreed upon the design and implementation

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
			of loosely- coupled software components that support ‘cloud’; ‘near-edge’ data analytics;
7	Delay in the deployment of SILVANUS platform	WP8, WP9	The project adopts a continuous validation of the scientific framework and has clearly outlined the various phases of each testbed validation results. The partners are committed towards the delivery of the framework to be installed within each of the pilot demonstration site
8	Stakeholder ignore results	WP10, WP9	A strong engagement of stakeholders from interdisciplinary field of research and technical expertise are envisaged from the start of the project. Intensive dialogues and interaction sessions and workshops are planned and scheduled to identify challenges, requirements and build innovative scenarios for containing the spread of wildfires. The projects’ open communication plan with many of its dissemination activities will ensure opening to broader audiences
9	Limited Impact	WP1, WP10, WP11, WP2, WP3, WP4, WP5, WP6, WP7, WP8, WP9	The consortium brings together 50 partners from fifteen (15) EU three (3) non-EU representing Australia, Indonesia, and Brazil. The project consortium partners will liaise with CSA project and support networking events to maximise the impact. Additionally, setting up on CASD to be self-sustainable will be leveraged to deliver high impact across four (4) continents represented in the consortium
10	The knowledge model developed in T3.1 and implemented in T5.2 is critical to the successful integration of the SILVANUS platform components	WP3, WP5	The intention is to expand on existing relevant ontologies, rather than developing new ontologies from scratch. This will significantly speed up the implementation of the ontologies for the project and provide a single knowledge base for all components in the project, giving a common vocabulary for each component in the system. So, the vocabulary will be a prior to the main development of the components.
11	SILVANUS may not integrate well with other similar wildfire management systems	WP3, WP5	SILVANUS will actively reach out to other similar projects and organizations with a view to agreeing on a common knowledge interchange API, and ideally a common knowledge model. If all initiatives can agree on a common model early in their development cycle, the chances of successful interoperability will be significantly enhanced.
12	The various components of WP4 and WP5 must be complimentary and form a cohesive whole	WP4, WP5, WP8	Intentionally there is a high degree of overlap between the partners in WP4, WP5 and WP8. During the development of the proposal it was clear that a significant number of technical partners had similar opinions on the core technologies that could be used and the methods for integrating them. Some of the partners have worked together on similar large integration

Risk number	Description of risk	WP Number	Proposed risk-mitigation measures
			projects. This will be built on during project development so that the platform evolves as a cohesive whole, rather than a set of disparate components. It may be beneficial to run joint work package coordination meetings between WP4 and WP5, feeding in to WP8
13	Not taking the necessary permissions on-time for conducting the trials	WP9	The design of the trials in itself already takes into account this risk. Task 9.1 is dedicated to organizational readiness and the taskforce will make use of a proactive approach in order to mitigate this risk. In addition, adjustments to the final design of the pilots are possible and will be taken into account during project implementation.
14	Potential force majeure lockdown measures prevent demonstration activities implementation	WP9	Efficient and effective internal communication within the taskforce, as well as with relevant local stakeholders will ensure an adequate timing of activities in order to limit the negative impact of such a risk

1.3.6. WT6 Summary of project effort in person-months

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	Total Person/Months per Participant
1 - PEGASO	53	4	2	14	8	0	14	8	13	5	✓	121
2 - Z&P	36	8	0	0	0	0	21	0	10	5		80
3 - INTRA	2	12	16	0	20	0	0	66	20	9		145
4 - TRT	2	6	0	38	14	0	0	12	6	7		85
5 - FINC	2	6	0	14	12	18	0	28	12	10		102
6 - ATOS IT	4	6	0	28	14	0	0	18	14	3		87
· ATOS SA	0	0	0	0	0	0	0	0	0	15		15
7 - DELL	2	0	6	32	42	0	0	16	0	5		103
8 - SIMAVI	2	18	84	0	6	0	0	11	7	6		134
9 - EDP	2	6	32	12	7	0	3	8	10	5		85
10 - ADP	2	6	8	0	0	2	4	4	19.50	7		52.50
11 - TP	2	2	0	0	0	0	0	0	32	10		46
12 - 3MON, s. r. o.	2	5	0	20	0	8	0	9	8	4		56
13 - CTL	2	6	14	22	42	0	0	4	4	6		100
14 - SYNC	2	14	16	0	0	0	28	0	8	8		76
15 - EAI	2	10	14	24	14	0	0	10	10	7		91
16 - ITTI	2	4	30	22	12	0	0	12	6	8		96
17 - VMG	2	12	0	12	22	0	0	8	7	8		71
18 - MDS	2	2	14	0	0	0	0	8	5	6		37
19 - CMCC F	2	18	0	38	22	0	0	5	12	5		102
20 - EXUS	2	3	12	6	30	0	0	2	4	10		69
21 - RINI	2	6	0	20	50	0	0	11	12	9		110
22 - MD	2	10	6	0	0	0	0	0	0	35		53

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	Total Person/Months per Participant
23 - WUT	2	4	0	11	16	0	0	6	12	5		56
24 - HB	2	8	16	4	8	0	0	1	0	4		43
25 - AUA	2	17	0	0	0	32	30	0	4	7		92
26 - CERTH	2	6	6	36	6	0	0	5	8	3		72
27 - UTH	2	2	0	0	24	0	0	6	5	8		47
28 - IST	2	2	0	0	0	4	0	0	18	4		30
29 - UASVG	2	6	13	0	0	0	0	0	9	10		40
30 - UISAV	2	6	18	22	20	0	0	22	5	5		100
31 - PUI	2	4	16	0	0	0	8	0	5	5		40
32 - SGSP	2	6	22	0	0	0	0	0	26	10		66
33 - ASSET	2	12	0	0	20	0	0	20	24	9		87
34 - LETS	2	6	0	0	0	18	16	0	0	7		49
35 - PNRT	2	5	8	0	0	15	0	0	0	2		32
36 - FptSMURD	2	6	10	0	0	4	4	0	16	4		46
37 - ASFOR	2	6	6	0	0	5	4	0	17	5		45
38 - KEMEA	18	6	7	3	0	14	10	2	8	7		75
39 - HRT	2	6	6	0	0	6	8	0	13	6		47
40 - AHEPA	2	6	4	0	8	0	4	0	9	5		38
41 - OIR	0	8	0	0	8	0	0	0	2	0		18
42 - PSTE	2	4	3	0	0	3	3	0	33	6		54
43 - FRS MB	2	6	0	0	0	12	6	0	16	9		51
44 - HVZ	2	6	6	0	0	12	8	0	12	5		51
45 - TUZVO	2	24	0	0	2	6	24	0	14	9		81
46 - Plamen	2	6	0	0	0	12	16	0	34	10		80
47 - AMIKOM	2	4	0	6	24	48	6	9	0	10		109
48 - CSIRO	2	2	0	12	0	0	0	6	0	2		24

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	Total Person/Months per Participant
49 - UFRJ	2	12	0	0	0	0	16	0	12	10		52
Total Person/Months	199	350	395	396	451	219	233	317	521.50	360		3441.50

1.3.7. WT7 Tentative schedule of project reviews

Review number¹⁹	Tentative timing	Planned venue of review	Comments, if any
RV1	20	Brussels or remote (tbc)	
RV2	32	Brussels or remote (tbc)	
RV3	42	Brussels or remote (tbc)	

1. Project number

The project number has been assigned by the Commission as the unique identifier for your project. It cannot be changed. The project number **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

2. Project acronym

Use the project acronym as given in the submitted proposal. It can generally not be changed. The same acronym **should appear on each page of the grant agreement preparation documents (part A and part B)** to prevent errors during its handling.

3. Project title

Use the title (preferably no longer than 200 characters) as indicated in the submitted proposal. Minor corrections are possible if agreed during the preparation of the grant agreement.

4. Starting date

Unless a specific (fixed) starting date is duly justified and agreed upon during the preparation of the Grant Agreement, the project will start on the first day of the month following the entry into force of the Grant Agreement (NB : entry into force = signature by the Agency). Please note that if a fixed starting date is used, you will be required to provide a written justification.

5. Duration

Insert the duration of the project in full months.

6. Call (part) identifier

The Call (part) identifier is the reference number given in the call or part of the call you were addressing, as indicated in the publication of the call in the Official Journal of the European Union. You have to use the identifier given by the Commission in the letter inviting to prepare the grant agreement.

7. Abstract

8. Project Entry Month

The month at which the participant joined the consortium, month 1 marking the start date of the project, and all other start dates being relative to this start date.

9. Work Package number

Work package number: WP1, WP2, WP3, ..., WPn

10. Lead beneficiary

This must be one of the beneficiaries in the grant (not a third party) - Number of the beneficiary leading the work in this work package

11. Person-months per work package

The total number of person-months allocated to each work package.

12. Start month

Relative start date for the work in the specific work packages, month 1 marking the start date of the project, and all other start dates being relative to this start date.

13. End month

Relative end date, month 1 marking the start date of the project, and all end dates being relative to this start date.

14. Deliverable number

Deliverable numbers: D1 - Dn

15. Type

Please indicate the type of the deliverable using one of the following codes:

- R Document, report
- DEM Demonstrator, pilot, prototype
- DEC Websites, patent filings, videos, etc.
- OTHER
- ETHICS Ethics requirement
- ORDP Open Research Data Pilot
- DATA data sets, microdata, etc.

16. Dissemination level

Please indicate the dissemination level using one of the following codes:

- PU Public
- CO Confidential, only for members of the consortium (including the Commission Services)
- EU-RES Classified Information: RESTREINT UE (Commission Decision 2005/444/EC)
- EU-CON Classified Information: CONFIDENTIEL UE (Commission Decision 2005/444/EC)
- EU-SEC Classified Information: SECRET UE (Commission Decision 2005/444/EC)

17. Delivery date for Deliverable

Month in which the deliverables will be available, month 1 marking the start date of the project, and all delivery dates being relative to this start date.

18. Milestone number

Milestone number: MS1, MS2, ..., MSn

19. Review number

Review number: RV1, RV2, ..., RVn

20. Installation Number

Number progressively the installations of a same infrastructure. An installation is a part of an infrastructure that could be used independently from the rest.

21. Installation country

Code of the country where the installation is located or IO if the access provider (the beneficiary or linked third party) is an international organization, an ERIC or a similar legal entity.

22. Type of access

- TA-uc if trans-national access with access costs declared on the basis of unit cost,
- TA-ac if trans-national access with access costs declared as actual costs, and
- TA-cb if trans-national access with access costs declared as a combination of actual costs and costs on the basis of unit cost,
- VA-uc if virtual access with access costs declared on the basis of unit cost,
- VA-ac if virtual access with access costs declared as actual costs, and
- VA-cb if virtual access with access costs declared as a combination of actual costs and costs on the basis of unit cost.

23. Access costs

Cost of the access provided under the project. For virtual access fill only the second column. For trans-national access fill one of the two columns or both according to the way access costs are declared. Trans-national access costs on the basis of unit cost will result from the unit cost by the quantity of access to be provided.

History of changes

Date	Section – Description of change	Justification
06.07.2021	CMCC SRL partner profile updated with CMCC F.	The activities of CMCC SRL are subsumed by the parent organisation, CMCC F.
09.07.2021	WP Leadership assignments and Extension of Advisory board members (including from Baltic countries).	To address the shortcomings of the ESR.
	Section 3.4.1 – A detailed breakdown of the equipment/consumable is included.	As per request.
	Remove reference to HITACHI.	Indicate the consortium expertise in complementing HITACHI's expertise in developing deep-learning algorithms for visual analysis.
	HITACHI partner profile removed.	Following the withdrawal request.
	CVs of VMG personnel updated.	Partner request.
	WUT partner profile revised.	Partner request.
	PIU CVs updated.	Partner request.
	Updates to spelling and other grammatical correction.	Editor changes.
	ASSET CVs updated.	Partner request.
	PNRT CVs updated.	Partner request.
	KEMEA CVs updated.	Partner request.
	HRT CVs, infrastructure updated.	Partner request.
	AdP legal name change revised, CVs updated.	Partner request.
13.07.2021	RINI CVs updated.	Partner request.
	ATOS Linked Third Party updated.	Partner request.
21.07.2021	Revision of Section 3.4.1 cost breakdown, specifically for equipment.	As requested.

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1 Excellence

SILVANUS is envisaged to develop a platform for an environmentally sustainable and climate resilient forest management in consultation with the stakeholders. The interdisciplinary project enablers categorised across Phase A, B and C activities are presented in Figure 1. The technical and scientific innovation will encompass the ability to process large volume of heterogeneous data sources to deliver real-time insights into forest status.

Phase A: The Prevention and Preparedness activities will include the continuous evaluation of the fire danger index metrics supported on advanced computer-based mathematical models. Subsequently, stakeholder engagement activities will deliver advanced training programme for the

frontline fire fighters with the use of virtual reality and augmented reality (VR/AR) content. Moreover, mobile applications, built within SILVANUS, will gather insights on the citizens, awareness about dangers of forest fires and their global impact on climate change. In addition, developed Cloud services for communities and companies - e.g. Utilities - will foster new strategies for fire prevention by minimizing interaction between critical infrastructure and surrounding vegetation. Finally, activities in Phase A will also include a detailed review of the EU legislative regulations on environmental protection and policies adopted by the regional public administration authorities. The project will adopt the use of participatory process framework for stakeholder engagement to maximise the impact of information gathered within the project.



Figure 1 – Technical building blocks and interdisciplinary enablers for environmentally sustainable and resilient forest management.

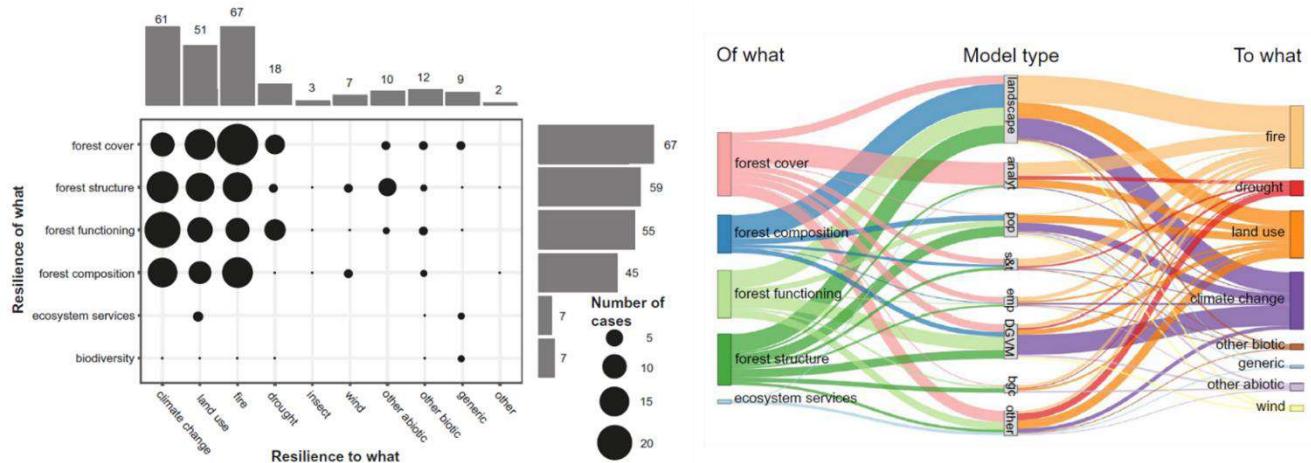


Figure 2 – Forest resilience simulation models.¹

Phase B: Detection and Response activities will include: the development of an ICT platform that offers advanced capabilities for the first responders (fire fighters, medical response teams, public administration authorities and other relevant stakeholders); the development of a mechanism to detect ignition of forest fire, model the spread of fire considering the impact from climate and weather services and coordinate a response among the mobile command centres to effectively and efficiently subdue and contain the spread of forest fire. The technological innovation in the protection of first responders will include knowledge gathered from Earth Observation repositories, granular predictive models of weather and climate conditions, use of autonomous systems to obtain insights on the spread of fire. The implementation of high-level mission-critical command centre will enable the practitioners to identify critical regions to deploy resources with maximum impact.

Phase C: Restoration and Adaptation activities will build on recent innovations in simulation models that address the need for evaluating the forest resilience to fires, as well as other factors (climate change, human land use, droughts, etc.) based on their impact on natural resources. An example of such modelling is presented in Figure 2.

The use of Earth Observation (EO) provides alternative ways to collect wildfire information. EO technologies using both space and surface networks, have demonstrated not only their maturity, but their critical role in supporting fire managers, first responders and risk managers by providing effective tools to predict severe fire danger conditions, rapidly map natural hazards, and assess impacts. Although there is an increasing amount of spatial data and information on wildfires from different sources and often collected at the national, regional and global levels, there is currently no international initiative to amalgamate and harmonize such information, and to distribute it to users worldwide.

Research investigation into the spread of wildfires² indicate the need for a global strategy to combat against the increasing impact of wildfires that extends beyond the regional effects to global climate change. From a perspective of fire ecology or risk to infrastructures, the intensity of a fire, its severity (its ecosystem impacts) and its spatial patterns (degree of patchiness) may be more important than the total area burned. For example, the degree of vegetation consumption, the depth of burning into the organic and mineral soil, and the proximity of areas less affected



Figure 3 - GWIS system

¹ <https://onlinelibrary.wiley.com/doi/10.1111/geb.13197>

² <https://royalsocietypublishing.org/doi/10.1098/rstb.2015.0345>

or not by fire are key in determining the length of time for a burned area to ‘recover’³⁴. The notion that fire intensity and severity have increased in recent years pervades media reports and some of the literature⁵. Whether or not this is the case is not easy to ascertain given that these parameters and associated trends are much more difficult to determine compared with the area burned. All else being equal, fire intensity can indeed be expected to increase with air temperature⁶, and it can be deduced that areas experiencing higher atmospheric temperatures in the fire season associated with global warming would experience more intense fires. For example, the catastrophic 2009 Black Saturday fires of Victoria (Australia) were reportedly associated, among other factors, with unprecedented high atmospheric temperatures (since measurements began) and fire intensity⁷s.

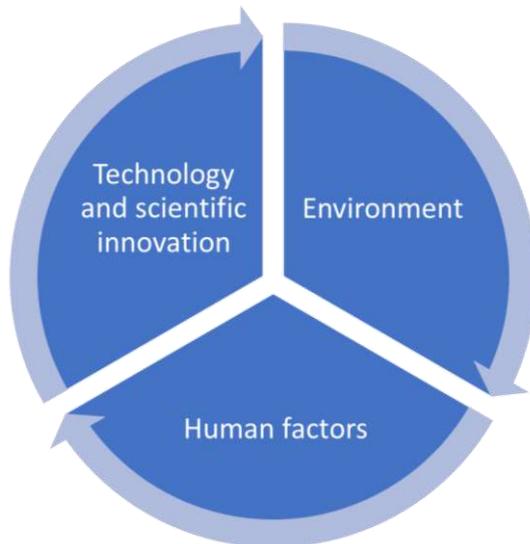
Strategic challenge: The development of an integrated technological and information platform providing technological and decision-making support in preparedness, response and recovery phase of wildfire management cycle and increasing the human, environment and economy resilience to wildfires.

1.1 Project Objectives

SILVANUS Innovation: The consideration of human factors in confluence with physical phenomenon impact on forest fires and the use of technological and scientific innovation for forest management is the main innovation of the project. According to the harmonised classification scheme of fire causes in the EU adopted for the European Fire Database of EFFIS⁸ states six sources. These include (i) unknown; (ii) natural; (iii) accident; (iv) negligence; (v) deliberate and (vi) rekindle. Addressing the need to encompass all six causes of wildfire ignition, the SILVANUS project will model the impact of human factors in confluence with physical phenomena.

The first innovation will address the modelling of ecological environment for sustainable forest management requires the development of structured knowledge models that support the collection and formalisation of a biodiversity profile for a specific geographic region. In Europe it is noted that the main cause of biodiversity loss is land-use change. Among the causes of negligence, agriculture burning, and waste management has been identified as a key contributor. Such issues of wildfire ignition causes will be studied and analysed across the selected field demonstrations within the consortium from 11 countries (8 EU member states and 3 international countries), representing a total area of $47,504 \times 10^4$ sq. meters of forest area within Europe. Changes in biodiversity are due to three basic ecological processes⁹ [10]: 1) invasion of exotic plants, 2) progressive succession as a part of the ecological process, and 3) retrogressive succession due to natural and anthropogenic pressures on ecosystems.

Assessment of changes in biodiversity or the state of biodiversity will be evaluated using functional traits and groups along with structural indicators such as Essential Biodiversity Variables (EBV)¹⁰. For example, invertebrate richness in the soil and plant litter is a good indicator of the presence of a rich diversity in the ecosystem. Studies by Nally and Fleishman¹¹ have shown that identification and analysis of the behaviour of relatively few indicator species in a community can predict the variation in 89% of the species in the community. Keystone species on the other hand are responsible for the sustenance of the community in its present form. Any change in the abundance and distribution of the keystone species will lead to an irreversible change in the ecosystem functioning and structure, in terms of species composition, hence affecting biodiversity. One of the possible ways of characterizing keystone species in the forest ecosystem is through the assessment of competitiveness of the species along the successional gradient and focusing on their role,



³ The concept of the ‘post-fire recovery window’ or ‘window of disturbance’ can be viewed as the time it takes for ecosystem properties such as biomass, biodiversity, soil characteristics or the hydrological balance to return to a pre-fire status.

⁴ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3263421/>

⁵ <https://science.sciencemag.org/content/349/6254/1280>

⁶ J. R. Weir, ‘Fire weather’, *Conduct. Prescr. Fires A Compr. Man.*, 2009.

⁷ http://royalcommission.vic.gov.au/finaldocuments/summary/PF/VBRC_Summary_PF.pdf

⁸ https://effis.jrc.ec.europa.eu/media/cms_page_media/42/LB-NA-25-923-EN-N.pdf

⁹ <https://www.dovepress.com/identification-and-protection-of-terrestrial-global-biodiversity-hotspots-peer-reviewed-fulltext-article-RRBS>

¹⁰ Weaver JC. Indicator species and the scale of observation. *Cons Biol.* 1995;9:939–942.

¹¹ Mac Nally R, Fleishman E. A successful predictive model of species richness based on indicator species. *Cons Biol.* 2004;18:646–654

which supports or contributes in maintenance of the existing vegetation type¹². The SILVANUS project will undertake additional investigation into the development of a biodiversity index considering the historical context of the geographic region. The environmental analysis will be a part of Phase A and Phase C activities to enable continuous monitoring of forest resources and develop appropriate measures to nurture balanced rehabilitation and growth of nature.

The second innovation of the SILVANUS project is the engagement of all relevant stakeholders, including environmental scientists, forest conservationists, regional councils, fire fighters, first responders and technology providers, agricultural scientists, and citizens. The project will develop a citizen science programme to engage with diverse communities and avail the effectiveness of semantic technologies to facilitate knowledge sharing among stakeholders. The knowledge developed in the project will be used to enhance preparedness for combating wildfires, response coordination and rehabilitation activities. The development of an advanced semantic engine component will build on the ontology structure and will facilitate multi-lingual representation of biodiversity and ecological analysis models. The human factor consideration will include the impact of negligence and the ability to share information on the identification of safety violations. The project will incorporate the use of advanced deep-learning and machine learning algorithms for concept extraction and perform contextual filtering of large-scale vocabulary of information resulting in timely alerts for the respective authorities to deploy personnel resources proactively.

The third innovation envisaged within the project relates to the development and evaluation of a sustainable forest management toolkit for Phase B activities (Detection and Response). The sustainable forest management toolkit will leverage the knowledge gathered on the geographical context to build advanced visualisation maps for both training activities and scenario planning along with the deployment of technologies to detect wildfires. The SILVANUS project will bring forward several solutions (refer to Section 1.3.1), which include the setup of wireless communication infrastructure, and the use of drones to perform surveillance and undertake mitigation actions. Additionally, the use of onboard data analytics with low-cost computational components capable of performing video stream analytics at the edge will extend the longevity of the drone flight time. Complementing the edge computing capability, the use of Earth Observation data analytics¹³ supported using Copernicus dataset¹⁴ will be subsequently analysed in the cloud using big-data framework integrated with data fusion components.

SILVANUS Approach: The project innovation and the overall approach adopted for the development of scientific platform catering to the needs and demands of interdisciplinary stakeholders is presented in Figure 4. The multi-stakeholder project platform is conceived to deliver the high-impact intervention in addressing the challenges outlined in Phase A, B and C. The challenge of continuously monitoring the forest infrastructure is achieved with the use of sensors (static environmental sensors and mobile sensors being deployed in response to incident reports). The information collected from such distributed sensor systems are then subsequently processed at both cloud platform and/or near-edge solutions. While Phase A and Phase C data collection, assessment and monitoring will take place in the cloud, the need for (near-) real-time analysis on the behaviour and spread of wildfire will be continually analysed at the near-edge computational infrastructure. The complexity of inherent data modelling and ingestion of complex stream of continuous and sparse data collected from various sources of end-devices will be processed within the platform.

¹² Tripathi RS, Law P. Keystone species: the concept, their ecological significance and determining their keystone status. Environments. 2006;12(3). Available from: http://isebindia.com/05_08/06-07-2.html. Accessed March 27, 2015

¹³ <https://eodatascience.com/>

¹⁴ <https://www.copernicus.eu/en>

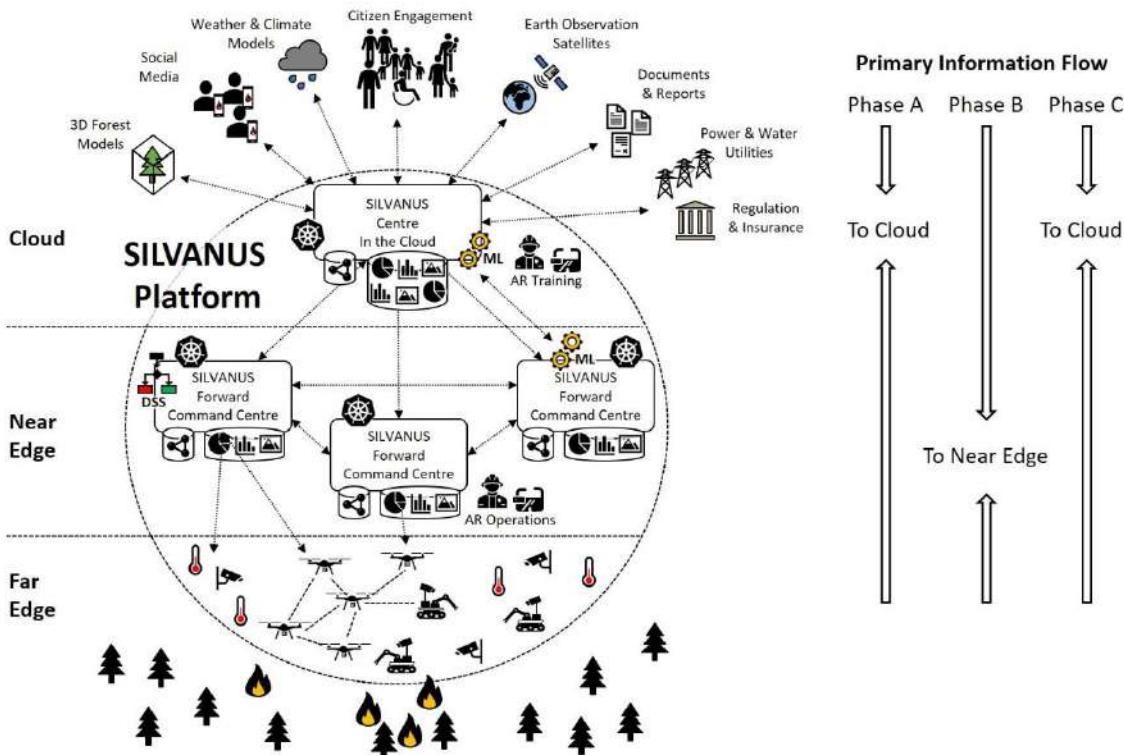


Figure 4 - SILVANUS project approach

SILVANUS Results: The project outcomes are systematically categorised into outputs which will be integrated and demonstrated within the platform across each of the pilot scenarios (as outlined in Section 1.3.3). The following results will form the basis for the development of formal assessment methodology for the evaluation of effectiveness of the platform. Each of the project outcomes are categorised into different phases in combating against the spread of wildfires.

- **Phase A: Prevention and preparedness**

- Formalisation of environmental biodiversity profile for each geographical region
- Specification or fuel distribution and structure profile for each geographical region
- Self-assessment toolkit for environmental modelling
- Quantifiable ecological assessment of biodiversity within natural parks and landscape protected areas
- Continuous monitoring of fire danger index against accidental and malicious fires using satellite and sensor data
- Algorithms to model impacts of wildfires on climate change, environment, and economy
- Enhancement of wildfire prevention and management tactics methodologies and procedures using the progressive ICT tools
- Training handbook for fire fighters on the safety regulations for the deployment of technologies
- Upgrade of existing wildfire alerting systems
- Increasing public/citizen awareness – alerting system via a Citizen engagement toolkit (mobile application) for signalling accidental fires and activate mitigation strategies
- Prophylactic wildfire prevention strategy, where areas at high risk of wildfire can be treated and protected from ignitions throughout the peak fire season.

- **Phase B: Detection and Response**

- Deployment of wireless sensors for early detection of fires
- Deployment of mechanical platform (including Unmanned Aerial Vehicles (UAVs), Unmanned Ground Vehicles (UGVs)) for continuous surveillance and early- stage situational awareness
- Wireless communication infrastructure for coordinating first responders
- Aerial platform equipped with innovative multi-spectral sensors and payload capacity for fire mitigation
- Coordination between UGVs and UAVs for modelling the fire behaviour influenced by external environmental factors
- Advanced algorithms to perform onboard stream analytics using edge computation
- Modelling of granular and incremental weather pattern changes using data analytics

- Integration of different platforms with existing ICT solutions/platforms in a specific region
- Decision support system for resource deployment and management
- **Phase C: Restoration and adaptation**
 - Building knowledge base containing the geographical data, national forest inventory data, fire-fighter's data scientific knowledge, scientific knowledge, technical reports, whitepapers.
 - Development of the forest and landscape management alternatives for specific regions considering the information on biodiversity index and ecological site classification and including the forest growth models
 - Application of Decision Support System (DSS) tool for alternatives assessment and finding the optimal management approach for a specific region/area considering the stakeholder's requirements.
 - Development of fire management alternatives for a specific region and DSS for assessment of the alternatives.
 - Soil rehabilitation strategy
 - Restoration roadmap of natural resources

1.1.1 Measurable Objectives

Strategic objective: The overarching objective of the project is to design, implement and validate the SILVANUS sustainable forest management platform and methodologies for monitoring and protecting natural resources. The technical and scientific innovation will develop novel methodologies in monitoring and analysing ecological growth of natural resources to complement the analysis of biodiversity models. The environmental monitoring framework developed within SILVANUS will; be supplemented with cutting-edge technologies for the early-stage detection and response coordination of wildfire. Finally, the SILVANUS platform will offer support for rehabilitation, restoration, and adaptation of natural forest growth.

To achieve the strategic objective, the project will undertake interdisciplinary technical and scientific innovation activities that caters to the needs of key stakeholders including environmentalists, conservationist, technology providers, utilities, forest administration authorities and local communities. The platform is envisaged to be designed to support the knowledge base of interdisciplinary teams, with the integration of linguistic toolkit based on semantic technologies. The SILVANUS project recognises the different sources of wildfire which are listed in Table 2. These causes of ignition will be studied across the pilots in eleven (11) countries along with the evaluation of the mitigation actions demonstrated respectively as outlined in Section 1.3.3. The overall mission of SILVANUS will be realised through specific objectives of the project as outlined in Table 1. Each of the KPIs will be systematically demonstrated as outlined in Section 1.3.3, describing the pilot scenarios.

Table 1 - Specific objectives of SILVANUS

Phase A [Prevention and Preparedness] – Objectives	
PA1: Environmental and ecological mapping and assessment of forest regions within project demonstrations	
Challenge: Ecologists and practitioners have conventionally used forest plots or transects for monitoring changes in attributes of forest condition over time. However, given the difficulty in collecting such data, conservation practitioners frequently rely on the judgment of foresters and forest users for evaluating changes. The challenges of data collection process have been broadly categorised into the following three main topics: (i) <i>Measurement uncertainties</i> ¹⁵ , e.g., low statistical power due to insufficient observations, difficulties in making physical measurements, inappropriateness of measurements, and natural variability in organic responses to stress; (ii) <i>Conditions of observation</i> , e.g., spatiotemporal variability in climate and ecosystem structure, differences between natural and laboratory conditions, and differences between tested or observed species and species of interest for risk assessment; (iii) <i>Inadequacies of models</i> , e.g., lack of or knowledge concerning underlying mechanisms, failure to consider multiple stresses and responses, extrapolation beyond the range of observations, and instability of parameter estimates.	Innovation: Addressing these challenges, the SILVANUS project will develop an intuitive visualisation toolkit in consultation with the ecologists [TUZVO, AUA, ASFOR, ASSET] to accurately map the natural resources observed within the forest to the project platform. The toolkit will be modelled to capture the wide-spread geographic profile of SILVANUS consortium partners [PUI, LETS, KEMEA, HVZ, PLAMEO, EDP] from across eight (8) EU and three (3) non-EU countries. The environmental and ecological assessment toolkit will consider different forms of vegetation including agriculture land. HB will design the consultation methodology to engage

¹⁵ <https://www.ncbi.nlm.nih.gov/books/NBK236182/>

with the stakeholders, while AMIKOM will contribute to the development of processing satellite imagery of monitoring forests. UASVG will contribute to the development of environmental threat levels.

KPIs	<ul style="list-style-type: none"> • $47,504 \times 10^4$ sq. meters of area analysed and mapped • At least 15 regional demonstration sites to be analysed within the project from eight (8) EU and three (3) non-EU countries. • > than 4 forest models' adaptations to be studied and reviewed for ecological impact assessment
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PA2: Development of a semantic framework to formalise the stakeholder involvement in sustainable forest management

Challenge: AFO¹⁶ is suited for content description in subjects such as agriculture, forestry, food, environment, game and fisheries, and biology. The ontology has over 5000 concepts and includes also the concepts of the Finnish General Ontology because they are interlinked and the upper hierarchy of AFO is based on YSO concepts. The ontology has also group concepts (for hierarchical and part-of purposes). Each AFO-concept has only one preferred label per language and concepts may have one or several entry terms. The natural resources include large amounts of data categorised into land, mineral geology, water resources, environment, seas and islands, hydrometeorology, climate change, survey and mapping and remote sensing. The need for data management, data integration and semantic search is essential and developing a domain ontology for natural resources and environment helps to solve these problems.

Innovation: Building on past expertise, the SILVANUS project will further extend existing established ontologies and knowledge representation formalisations [HB, CTL, CERTH, CMCC, DELL, UISAV], in order to deliver a sophisticated semantic framework, extending the categorisation of fire ignition events. The semantic framework will integrate and standardise the data formats aggregated from the use of innovative technologies, including the use of IoT devices, computer vision systems and signal processing components (see Subsection 1.4.5). Additionally, these concepts will be further customised to address the geographic profiling of regional and national priorities to enable subsequent data analytics, processing, decision support, as well as training and communication [EXUS, SIMAVI, SBGS, FRB MSR]. The aim is to establish a terminological link between PA1 and PA3, to map respective semantic content to ontologies. AMIKOM, TUZVO and FSB-MSR will contribute to the design, development, and regional customisation of the knowledge model as required to support national priority on combating against wildfires.

KPIs	<ul style="list-style-type: none"> • At least three (3) publications to promote the extension of Agriculture and Forestry Ontology to model wildfire events resulting from common causes • Based on the recently established ontology evaluation metrics from Ontology Summit'13¹⁷: (a) Satisfy at least 75% of qualitative ontology evaluation metrics; (b) Achieve at least 5% over the baseline for quantitative ontology evaluation indicators.
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PA3: Development of fire danger index profile management system based on environmental, ecological and biodiversity models

Challenge: Fire danger rating systems are used to assess the potential for bushfire occurrence, fire spread and difficulty of fire suppression. Typically, fire danger rating systems combine meteorological information with estimates of the moisture content of the fuel to produce a fire danger index. Fire danger indices are used to declare fire bans and to schedule prescribed burns, among other applications. In the literature there are several reports published on the accurate calculation of the fire danger index. Each model is an increasing function of both temperature and wind speed and a decreasing function of relative humidity, which is in accord with our expectation that hot, dry and windy conditions should lead to increased risk of fire. Wind is the most critical meteorological factor affecting fire potential and is one of the main components determining the rate and direction of spread of a fire. Wind aids combustion by causing the flames to lean over closer to unburnt fuel, supplying the fire with oxygen and carrying away moist air which would otherwise restrict the amount of heat available to ignite unburnt fuel.

Innovation: The project will undertake investigations on the development of new methodologies for the computation of fire danger index, following the deployment of distributed environmental sensors [SGSP, CTL, UASVG, TUZVO] and the use of data from weather models. The dynamic variation of chemical composition and the nutrients in the soil structure will be taken into consideration for the development of a fire danger index. The project outcomes will extend the reported measure such as, ECMWF Probabilistic model provides four fire danger indices: (1) FWI Extreme Forecast Index (FWI EFI), (2) FWI Shift of Tails (FWI SOT), (3) Fine Fuel Moisture Content

¹⁶ <https://www.kiwi.fi/display/AFO/AFO+-+Natural+resource+and+environment+ontology>

¹⁷ <http://ontologforum.org/index.php/OntologySummit2013>

Extreme Forecast Index (FFMC EFI) and (4) Fine Fuel Moisture Content Shift of Tails (FFMC SOT). CMCC will exploit the expertise on modelling environmental data to build a fire danger risk index.

KPIs	<ul style="list-style-type: none"> Modelling of seasonal weather forecast models for at least three (3) transitional seasons from eight (8) EU and three (3) non-EU regions. Interfaces established with at least four (4) external earth observation data repositories and global climate repositories Development of fire danger index to be customised for at least 3 forest model categories based on spatio-temporal distribution of vegetation and biodiversity constraints.
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PA4: Implement Culture of risk prevention among project stakeholders and preparedness campaign on fire danger index and preparedness announcements

Challenge: Every year, millions of square kilometres of forest land are lost due to fires, disturbing not only ecological life but also threatening the people living nearby. Some 15 percent of the fires, however, factory practices and only 1 percent is caused by nature such as lightning adding that 80% of forest fires originate from human error. The remaining 20% of the wildfire causes are attributed to other causes resulting from environmental conditions, weather patterns and human actions such as arson, agriculture burning, etc.¹⁸. According to data from the European Forest Fires Information System (EFFIS), EU had more than 400.000 ha affected by fires

Innovation: Addressing the critical need to develop and promote the culture of safety and prevention among the stakeholders, the project will launch a public campaign in collaboration with the practitioners [HB, ATOS, SGSP, AMIKOM] paving the way for project results dissemination. The campaign will be aligned with the demonstration activities planned within the project to showcase the effectiveness of the solution. The project will strive to achieve high visibility among the relevant stakeholders in promoting safety regulations as recommended by national authorities. The communication toolkit will adopt the use of citizen science programme to ensure broad awareness and active public engagement. FINC will contribute with the linguistic toolkit that offers intelligent communication to the relevant stakeholder on the threat of fire and risk assessment of specific geographic regions. UASVG in collaboration with TUZVO and PLAME will launch public campaign toolkit with support from HB and ATOS on promoting awareness about the risk of wildfire and prevention strategies. KEMEA will contribute through its collaboration and close connection with several Greek municipalities. MDS will contribute to the development and release of a mobile application for regional utilisation by EU citizens. UISAV will integrate its crowd sourcing EmerPoll platform as a part of the citizen engagement toolkit. FRB, will promote the project outcomes through organisation of community events in crisis management and fire rescue actions, along with activities focussed on capacity building, education to stakeholders.

KPIs	<ul style="list-style-type: none"> Social media engagement for forest management authorities, landowners, public authorities and visitors of eight (8) pilot sites (as outlined in Section 1.3.3) through at least three (3) platforms. Promotion of citizen engagement activities and use of citizen-engagement-toolkit through 500 local authorities. Extend invitations to external stakeholder advisory group from the list of past projects (refer to Table 3) Citizen-engagement-tool-kit assessment by at least 200 engaged users. At least 2000 members consulted through public forum for the evaluation of public campaign
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PA5: Define training activities designed to improve safety and preparedness of firefighters in combating wildfire

Challenge: Firefighters are under great pressure to respond to emergency incidents effectively while operating subject to time and resource constraints. Minutes and seconds saved on emergency response times could be enough to save lives and forests. In addition to this, optimal resource allocation is very important to address difficult situations with limited manpower given the stochastic nature of a potential emergency in terms of incident numbers, location, timing and duration. VR technology and scenario-based training using computational intelligence have been identified as key solutions in delivering firefighter training.¹⁹ and facilitating decision making under risk uncertainty.²⁰ Although many works can be found for applying AI and ML in discrete topics (e.g., text mining, video processing, etc.), very useful for first responders, the holistic modelling of critical events and critical infrastructure based on AI has not been extensively researched in the literature. Critical events (e.g., large-scale fires) are difficult to manage from the perspective of emergency management due to their complexity, size, and the number of stakeholders involved. The use of VR technology allows firefighters to train for incidents that cannot

¹⁸ <https://www.dailysabah.com/environment/2019/07/08/forest-fires-mainly-caused-by-human-negligence>

¹⁹ <https://www.auganix.org/us-fire-administration-encourages-the-use-of-virtual-reality-for-firefighter-training/>

²⁰ https://link.springer.com/chapter/10.1007/978-3-319-90315-6_5

easily be replicated or may be very costly to recreate and helps to eliminate the hazards involved in live training. VR makes for an ideal solution for this sort of training, as the technology can be used for both individual and group learning using 360° media (2D and 3D), as well as for creating realistic immersive environments and experiences for those participating, all whilst maintaining a very acceptable level of safety. The tech can also be used for virtual meeting spaces and Q&A sessions, adding a further layer of interactivity to more classroom-style learning experiences.

Innovation: Complementing the existing products available on the market, the SILVANUS training programme for first responders will review the national protocols for the deployment of response coordination and develop intuitive scenarios that include the use of innovative technologies such as UAVs, UGVs, computational intelligence and communication infrastructure for the detection of wildfires. Scenario based training will be used as a method of tactics training to create emergency management scenarios within virtual environments²¹, allowing simultaneously the development of crisis resource management skills, including problem solving, situation awareness, resource utilization and leadership. The training simulations offered using AR/VR content platform will emulate the challenges of dynamic behaviour of wildfires and will integrate the outcome of PA3 to evaluate the preparedness of the fire fighters. Additionally, the firefighters will be trained to pilot the unmanned aerial platforms in conjunction with the ground robots. The training exercise will also include explicit reference to the need to establish robust communication to coordinate the response in a safe manner. SIMAVI and EXUS will contribute the technical platform to be validated by ASFOR, SMURD, HVZ, FRB-MSR. The training pedagogical assessment will be carried out by SGSP, with contributions from UISAV and VFZ. KEMEA will provide the training material and procedures, developed in the H2020 SWIFTERS project, with the purpose of facilitating First Responders in mastering the skills on UAV operations and using swarms of drones for disaster response. UISAV will leverage its crowd-sourcing EmerPoll platform to distribute, collect and aggregate data from stakeholders based on semi-structured data polls as well as provide situational awareness and a context-based information distribution.

KPIs	<ul style="list-style-type: none">• Training programme will emulate at least five (5) different scenarios for the modelling of wildfires• A minimum of six (6) training sessions and workshops to be organised for first responders in crisis management and disaster resilience• Invitation to at least 20 external experts will be shared with the community for effectiveness evaluation of the training programme.• A minimum of 50 first responders and fire fighters to be trained in the usage of SILVANUS platform
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PA6: Provide modelling methodologies of wildfire impact on regional areas

Challenge: The recent research interest in the development and advancement of global climate models (ranging from General Circulation to more complex Earth System models) has been a priority following the 2015 Paris agreement. Such models include mathematical formulation of consolidated physical principles governing the atmosphere and its interactions with oceans and lands, and demonstrated to well reproduce, although with different skill among variables, observed features of past to recent climate evolution, thus enabling considerable confidence on future climate projections. In parallel, many models have been formulated, implemented and validated to reproduce forest dynamics as key element of the earth system biophysical and biogeochemical cycles, hybrid among empirical and physically based and thus with some drawbacks due to excessive simplification and input data need, respectively. Besides single-model studies, an example of impact multi-model experiment is the ISI-MIP initiative, where a number – although limited - of bias-corrected climate simulations allow feeding forest(biome) models at local/regional(global) scale to study impacts on terrestrial vegetated ecosystems, taking into account management. Translation of such model outcomes into a sort of forest vulnerability to fires is still missed in terms of possible consequent impacts on GHG and thus on climate, which can be supported by IPCC guidelines and TIER-1 level approaches.

Innovation: Taking advantages of above climate and forest multi-model experiments and initiatives, and of existing skills in the consortium in terms of forest modelling, the SILVANUS project will exploit outputs of current climate experiments (Seasonal Prediction Systems or CMIP as downscaled in products like CORDEX²² or IS-MIP) to emulate the climate- and management-driven impact on forest vulnerability which, combined with indices of climate-driven hazards of fire occurrence (e.g. from PA3), will allow extrapolating a range of likely effects of fire on climate in terms of CO2-eq emissions from burned areas and fuel biomass consumption values adopting IPCC methodologies, at the level (TIER 1 or 2) allowed by the detail of available data. Additionally, statistical models will be developed by considering different scenarios, building on the worst-case outcomes for the ignition

²¹ <https://www.sciencedirect.com/science/article/pii/S0306437918304277>

²² <https://cordex.org/>

and spread of wildfires across multiple geographic regions. CMCC in collaboration with ITTI, EXUS and UISAV will lead the effort on the modelling development.

KPIs	<ul style="list-style-type: none"> Historical data analytics for at least three (3) year period to be analysed for the development of scenarios and impact modelling affected by wildfires across EU regions Predictive algorithms to be evaluated against the worst-case scenarios of past wildfire events from at least six (6) geographic regions across the world
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Phase B [Detection and Response] – Objectives

PB1: Define the conditions for Unmanned aerial vehicles use for fire risk assessment and payload capacity for early response

Challenge: Wildfires, on average, spread at a rate of 14 miles an hour once they have been ignited according to a National Geographic report²³. Tackling such a spread by firefighters requires accurate monitoring of real-time situation which often is not possible to obtain on foot. There is an increasing reliance on the use of aerial vehicles for monitoring the spread of wildfire.

Innovation: Addressing the demands of the spread of wildfire, the SILVANUS project will bring forward indigenous development of drone solutions that are deemed safe, equipped with advanced sensing capabilities including the use of multi-spectral imaging system, signal processors and wireless communication infrastructure (PB6). The aerial platforms will be equipped with onboard data analytics (PB2) and establish coordination with autonomous ground robots (PB5) to enable accurate aggregation of situational awareness modelling the spread of wildfires. TRT, will lead the activity on autonomous flight path management to be controlled and monitored by the command centre. Additionally, the computational processing of information collected from the UAVs will be addressed by the technical solutions from ATOS, UISAV, 3MON to be evaluated in demonstration activities by PUI, FRB-MSR and SGSP. UISAV will apply its multi-robot swarm coverage and coordination approach. HB and KEMEA will provide guidance for ethical compliance on the use of UAVs in surveillance and response missions.

KPIs	<ul style="list-style-type: none"> > 15% increase in the flight time compared to the current market standards based on low-cost on-board data analytics integrated within the platform At least 5 additional sensor technologies (based on multi-spectral sensing) integrated within the aerial platform in complement with current market standards
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PB2: Apply and assess onboard computation of high-speed multi-spectral imaging using neural network compression

Challenge: Smoke detection is very important for preventing forest fires at an early stage. The current market standards adopt the use of visible spectrum analysis in the RGB domain, the video and image processing algorithms are severely affected by the background dynamic information, three limitations exist in these technologies, i.e., lower anti-interference ability, higher false detection rate, and the difficulty to distinguish fire smoke from fog. Additionally, the computational complexity of performing image and video processing requires large resources, which are often lacking in the mobile platforms (both aerial and ground vehicles).

Innovation: the project will have a leading role in the design and development of advanced visual computational units based on the compressed neural networks processing multi-spectral imaging sequences. The project will evaluate the different distances among the bins to enable efficient distinction between spectrograms. The feature extraction process will include the use of highly complex deep-learning networks which are compressed and require less computational resources. The project will develop objective metrics to distinguish between fog, water and smoke to enable real-time processing of the input multispectral video sequences. The algorithms will be evaluated against the market solutions for reducing the false alarm rate in forest fire detection. The edge computing analytics will be led by DELL, with contributions from ATOS, VMG and CTL. The wireless communication infrastructure will be setup by RINI. The metadata extracted from the processing of continuous stream data will be used to instantiate the event models of semantic repository formalised in PA2.

KPIs	<ul style="list-style-type: none"> > 20% reduction in the power requirement for computing multispectral image and video sequences Integration of processing at least 5 different streams of data in parallel for fire detection A reduction of more than 40% in the false alarm rate for fire detection.
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PB3: Introduce Multi-modal big data frameworks for processing earth observation datasets

Challenge: How to capture reliable, valuable and accurate information in massive data is one of the most significant research topics nowadays²⁴. Traditional data fusion techniques include probabilistic fusion (e.g., Kalman Filter and its extensions, Sequential Monte Carlo, Markov Chain Monte Carlo, etc.), evidential belief reasoning

²³ <https://www.nationalgeographic.com/environment/natural-disasters/wildfires/>

²⁴ <https://ieeexplore.ieee.org/document/7975553>

fusion (e.g., Dempster-Shafer theory and complexity reduction approaches), fuzzy set theory-based fusion and rough set theory-based fusion²⁵. Data fusion challenges (e.g. data imperfection, data inconsistency, data confliction, data alignment/correlation, data type heterogeneity, fusion location, and dynamic fusion) indicate that raw data cannot be processed without normalisation. In addition to the data processing capabilities developed and deployed for tackling fires in real-time, there is a critical need to develop big-data framework architecture to aggregate and process remote sensing datasets. The historical archive of the data resources obtained from earth observation sources such as Copernicus and open earth data repositories requires innovation to handle the inherent heterogeneous data formats.

Innovation: Addressing the critical need to develop big-data framework, the project will adopt the use of open-source tools and components to build a data analytics suite, based on computational intelligence practices, capable of supporting the aggregation, storage and retrieval of large volume of content. Combining data fusion concepts with Machine Learning aims at addressing data fusion challenges effectively with respect to criteria such as efficiency, quality, stability, robustness and extensibility. The project will use data sets from the Copernicus repository for the project's pilot locations (refer to Section 1.3.3.). Additionally, the analysis will extend to include non-EU regions which are often severely affected by wildfires (i.e., Australia, Indonesia and Brazil) to derive actionable insights from these regions. Stakeholders from these countries will help establish an international coalition to engage with regional experts in the development of data analytics components. The infrastructure setup required for the complex computations will be provided by ATOS supported by DELL, CMCC and UISAV. The allocation of large-scale resources will be extended to the consortium partners for the execution and experimentation of complex algorithms capable of analysing earth observation datasets.

KPIs	<ul style="list-style-type: none">Extraction of insights on fire danger index measurement based on objective computation of environmental parameters such as aerosol index, corrected reflectance imagery, land surface reflectance, land surface temperature, weather data and presence of sulphur dioxideIngest 13 spectral bands at a global scale with a high revisit frequency rendering it a vital data source for land use land cover monitoring, atmospheric correction and cloud/snow separationReduced latency of more than 24% for computation through the adoption of graph modelling and temporal data analytics
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PB4: Use and evaluate micro-predictive analytics for modelling granular changes fire patterns

Challenge: Modelling has become an essential tool in forest fire research and has demonstrated the capacity to minimise fatalities by forecasting fire behaviour. Wildfires are often driven by complex physical and chemical processes, operating on vastly different scales (i.e., from meters to kilometres) and depending on coupling between nonlinear phenomena such as turbulence in the lower part of the atmospheric boundary layer, topography, vegetation, and fire itself (chemical reactions, radiation heat transfer, and degradation of the vegetation).

Innovation: Addressing the need to develop a near real-time high-fidelity fire and smoke propagation forecasting, the project will develop a temporally evolving micro-predictive analytics engine that is capable of processing high-speed data ingested from environmental sensing to predict fire behaviour. This engine will ingest real-time key measurements and use processing knowledge accumulated from the deployment of multispectral sensing drones (PB1, PB2), to build a reliable wildfire forecaster. The modelling of fire behaviour will be carried out in high performance computing (HPC) infrastructure, with reduced latency for delivering model parameters to the command centre. The outcome of the activity will result in the modelling of several fire behaviour metrics, including fire spread, intensity, likelihood, and ecological risk must be analysed for multiple treatment alternatives. The effect of treatments on wildfire impacts will be considered at multiple scales. The key contributions will result from the expertise of CTL, supported by DELL, CMCC and UISAV.

KPIs	<ul style="list-style-type: none">Computation of millisecond prediction fire behaviour model parameters.Data processing latency reduced more than 15% on 40msecond frequencyGeospatial mapping of external weather patterns for the identification of high-risk zones
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PB5: Assess the use of robotic ground vehicles to gather situational intelligence of wildfire behaviour

Challenge: The recent innovation in the development of advanced robotics systems has resulted in the reduction of fatalities of firefighters in combating wildfires. However, the complexity of the natural terrain and the swiftly changing wildfire behaviour necessitates further developments in the design and development of advanced robots capable of navigating complex terrains. Additionally, there is a lack of coordination between the autonomous agents being deployed to combat wildfires, resulting in lack of synchronised knowledge in the command centre.

²⁵ <https://www.sciencedirect.com/science/article/pii/S1566253511000558>

Innovation: Addressing these challenges, SILVANUS will build upon existing products within consortium (COLOSSUS robot from 3MON²⁶) high-grade unmanned remotely controlled robots which will be demonstrated to navigate complex terrains. The remotely controlled ground vehicles will provide higher resilience against smoke and fog, and higher coordination of data streams with the data collected from the aerial platform. As for the aerial platform, the robots will be equipped with sensors for mapping terrain and environment along with additional sensing capabilities that include the use of multispectral imaging systems. A communication link will assure co-ordinated information exchange with the other SILVANUS system components. CSIRO will lead the activity on ground robot development with the ability to navigate uneven terrain and collect vital source of information from the wildfire frontline. Additionally, DELL and CTL will contribute to the development of IoT processing gateway supported by FRB-MSR, SGSP and UISAV. 3MON will adapt the COLOSSUS multi-purpose support vehicle robot for interventions in places with a high risk of danger, with versatile use in forest fires context.

KPIs	<ul style="list-style-type: none"> • > 80% reduction in the deployment of firefighter personnel to the forefront of wildfire • > 80% resilience in navigating natural terrain • A reduction of more than 15% computational complexity in processing information stream.
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PB6: Evaluate the application of wireless sensor network mesh to aggregate distributed sensor data (from aerial and ground vehicles)

Challenge: Communication plays a key role in the coordination of different personnel and autonomous agents in combating wildfires. As part of the critical infrastructure, the reliability of telecommunication services in the region of wildfire is expected to be minimal at best.

Innovation: The project will deliver a communication platform in the sky that emerges from the need to improve the distance range, efficiency, size, cost and security of existing UAV data links. The wireless communication sensor network developed by RINI will be extended for the pilot demonstration activities. The proposed SILVANUS system will be **burst based**, meaning the amplifier will need to be switched on only when there is data. This requires the RF board interfacing with FPGA to switch at the right time – this ultimately gives a power saving over continuous transmission when the power adapter is always on. This system proposes **adaptive power** (in addition to adaptive modulation), so when a drone is near the pilot, it can switch to lower power (say 100 mW and to 1W when it is far away.) These unique features will allow **dramatic savings on power consumption** and, as a result, **increase in flight time of UAVs**. RINI will be supported by WUT through their internal research activity on the development of Software Defined Radio (SDR) communication network.

KPIs	<ul style="list-style-type: none"> • Support for high-speed drones beyond 100m/sec • Datalink connectivity up to 75km and GMSK modulation for narrow band transmissions for distances exceeding 100km
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PB7: Test advanced protective gear for protection of frontline fighters, embedded with communication services

Challenge: Safety of fire fighters both during the fire mitigation and long-term impact on health play a crucial role. Despite the increasing advances in the field of IoT devices and wearable solutions, several challenges still exist that limit the application of such solutions being integrated within the fire fighter protective gear. Such limitations could be attributed to the operating environment often experienced by the fire fighters, with high degree of heat and moisture along with the perspiration experienced by the fire fighters.

Innovation: Addressing these challenges, the SILVANUS project will build on the expertise of end-users [SGSP, FRB-MSR] to evaluate the effectiveness of solutions available in the market and will extend the protective gear with the integration of multiple commodity Bluetooth sensors integrated by DELL. The health metrics collected from the fire fighters will be fused and analyses by ML algorithms. The experimental analysis of the COTS model will be shared with the community and evaluate the effectiveness of the solutions being developed.

KPIs	<ul style="list-style-type: none"> • At least three (3) supplier solutions to be evaluated for the integration of wearable devices • Feedback from at least five (5) different suppliers to be obtained.
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PB8: Apply and evaluate intelligent data modelling to estimate impact on environment, effects on human and disruption to critical infrastructure services for response coordination

Challenge: Strategic deployment of limited resources to curtail the spread of wildfires plays a critical and crucial role in preventing the spread of fire. To achieve this objective, it is critical to develop services on impact assessment of the wildfire to the ecological balance, biodiversity and effects of people in the region. Currently, there is no single point of service that delivers the holistic impact assessment for the regional authorities to undertake actions required to optimise resource deployment.

²⁶ <https://3mon.sk/roboty/robot-colossus/>

Innovation: Addressing the lack of such service, the project aims to develop an impact assessment based on scenario models and leverage on the availability of computational resources to build 3D visual interface based on the expertise of VMG. The interactive visualisation of the impact assessment will deliver real-time modelling of the fire behaviour along with ecological and biodiversity analysis. Additionally, EXUS will contribute to the development of risk assessment with CTL and HB formalising the threat using a semantic framework. In particular, data mining techniques and artificial intelligence algorithms will be combined for identifying the most significant risk factors, finding correlations in the available multi-dimensional datasets, as well as facilitating decision-making for threat-detection, clustering and risk-level prediction purposes. Considering thus risk assessment's results, the risk prioritization and the recommendation of an optimal risk response strategy could be examined by experts. SGSP and FRB-MSR will evaluate the risk assessment scenario and offer stakeholder relevant stakeholder consultation.

KPIs	<ul style="list-style-type: none"> • Development of 3D visual interface to be exported to at least two (2) rendering platforms • Support for at least four (4) forms of interactive annotations within the 3D visual interface to be offered to the crisis management personnel.
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PB9: Development of Crisis management tool

Challenge: During the extinction of a fire, the collaboration of different stakeholders is critical for fast extinction, minimization of forest loss, but also for protecting human lives, properties, infrastructures, and biodiversity. As in every disaster case, the accurate assessment of the situation on the ground, the efficient allocation of first responders and material resources, the clear assignment of roles and responsibilities, and the facilitation of communication between desk and field officers is essential.

Innovation: Our objective is to develop a Crisis Management Tool which considers information from various sources during a forest fire, provides a graphical interface for situation assessment, helps to coordinate task assignment, and provides optimal suggestions for actions (e.g., firefighters and vehicles to allocate). The Crisis Management Tool will be based on the tool developed in the frame of the INGENIOUS project and will be adapted to the tasks required for the extinction of forest fires. In particular, the tool aims at improving first responder's daily deployment through machine learning and optimization algorithms. It will be a tool based on AI to prepare stakeholders to cope with crises which are complex, unpredictable, and which need fast tactical and operational decision making under uncertainty and stress. Stochastic modelling, multi-criteria decision analysis and evolutionary optimization algorithms will be used to construct such a toolbox by simultaneously taking advantage of efficient simulation scenarios (e.g., baseline, optimistic and pessimistic scenarios) and efficient data mining techniques for finding hidden patterns and correlations in multi-dimensional datasets. Furthermore, fuzzy rule-based inference approaches combining expert knowledge with data science practices will support the tasks of gathering and organizing knowledge about emergency management situations, as well as generating conceptual models, related to fragments of crisis/emergency scenarios. Based on cooperation of large-scale, high-resolution, numerical simulations and observation quantitative and qualitative data, the crisis management tool aims at providing proactive measures to support disaster operations immediately after a disaster/crisis occurrence. TUZVO in collaboration with PLAME and 3MON will evaluate the functional specification for the end-users and operational requirements. TRT along with ITTI will lead the activity on crisis management toolkit development, supported by EXUS through the extraction of actionable insights from the data analysis. The situational awareness component complemented with the predictive analysis and the information fusion solution will deliver the end-users the required real-time alert levels on estimated spread of wildfire to optimise resource deployment in safe and effective manner. 3MON will leverage and integrate the resource monitoring and dispatch features of its GINA framework.

KPIs	<ul style="list-style-type: none"> • Monitoring of field resources deployed within a 5km distance • At least 10 forms of alert levels for Phase A, Phase B and Phase C criteria as defined in the requirements • Legacy system interface with at least four (4) different modalities (such as APIs, file systems, process integration).
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Phase C [Restoration and Adaptation] – Objectives

PC1: Development of biodiversity index for monitoring the effectiveness of restoration and adaptation process

Challenge: Assessments of forest biodiversity - the diversity within forest species, between species and of forest ecosystems - are essential if forest resources are to be effectively conserved and sustainably managed²⁷. Assessments are needed to provide information necessary to support biodiversity-related decision-making in forest policy

²⁷ <http://www.fao.org/3/y4001e/Y4001E09.htm>

and management. However, assessment of forest biodiversity presents several challenges. First, because of the complexity of biodiversity, information about it needs to be assembled and expressed based on simplified variables, typically in the form of indicators. Second, since decisions relating to forests are made on a variety of scales, biodiversity data and indicators need to be aggregated across different scales for monitoring and reporting purposes. The Global Forest Resources Assessment 2000 (FRA 2000) incorporated some key indicators intended to contribute towards a better understanding of the status and trends in forest biological diversity, specifically relating to the naturalness, protection status and fragmentation of forest ecosystems. In addition to estimates of forest area and changes in forest cover, FRA 2000 provided statistics on the proportion of forest area incorporated within protected areas, the distribution of forest area by ecological zone and the number of endemic and threatened species for seven species groups.

Innovation: Addressing these requirements, the SILVANUS sustainable forest management platform will integrate components to monitor the growth of forest regions in compliance with the biodiversity index and the ecological balance assessment. The measurements collected will be analysed by the consortium partners for each individual region demonstrated in the project across eight (8) EU and three (3) non-EU countries. The rehabilitation activity will be led by ASSET with the support for pilot demonstrators AdP, ASFOR, LETS, PNRT, HRT, TUZVO.

KPIs	<ul style="list-style-type: none"> • Biodiversity index development of six (6) EU member state regions • Self-assessment survey of at least 20 pilot sites from the six (6) member states to model the natural habitat of forest environment
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PC2: Implement continuous report on natural forest inventory during rehabilitation

Challenge: Following the curtailment of wildfire, there is a critical need to be able to accurately monitor forest cover and quality of rehabilitation activities. Forest monitoring is defined by the International Union of Forest Research Organizations (IUFRO) as the regular and periodic measurement of certain parameters of forests (physical, chemical, and biological) to determine baselines to detect and observe changes over time. Effective monitoring is essential for sustainable forest management (SFM). An important distinction exists between monitoring and auditing, which are complementary components of a monitoring system. Monitoring can be defined as the ongoing assessment of the technical, environmental and social performance and impacts of management. A monitoring system is a way of steering and organizing monitoring so that it is efficient and easy to implement. Monitoring systems vary in sophistication – they may use simple measuring tool sandpaper-based recording, or they may involve advanced electronic equipment. Without robust statistics, understanding the loss of biodiversity and reduction of carbon sequestration capacity that results from deforestation becomes much more difficult. With the wide range of definitions for what counts as forest and diversity of methods of measuring forest cover, national data collection methods have never been standardised.

Innovation: Addressing these requirements, the SILVANUS sustainable forest management platform will integrate components to monitor the growth of forest regions in compliance with the biodiversity index and the ecological balance assessment. The measurements collected will be analysed by the consortium partners for each individual region demonstrated in the project across eight (8) EU member states and three (3) International countries. The rehabilitation activity will be led by ASSET with the support for pilot demonstrators AdP, ASFOR, LETS, PNRT, HRT, TUZVO

KPIs	<ul style="list-style-type: none"> • Continuous survey recorded on a half-yearly cycle. • Reports on the natural forest inventory published to advisory board members.
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PC3: Implement soil rehabilitation strategy through advanced data analytics

Challenge: The effect of fire on individual soil physical properties depends on the inherent stability of the soil property affected and the temperatures to which the soil is heated during a fire. The physical mechanisms responsible for heat transfer into soil is required to be analysed along with the temperatures that develop during different severities of burning in several wildland ecosystems. Important physical characteristics in soil that are affected by soil heating include: texture, clay content, soil structure, bulk density, and porosity (amount and size). Physical properties such as wettability and structure are affected at relatively low temperatures, while quartz sand content, which contributes to texture, is affected least and only at the most extreme soil temperature. The effects of the rehabilitation treatments on soil nutrients, water content, and plant recovery is a slow process and requires monitoring of at least 2 years following treatment establishment.

Innovation: The project will undertake assessment activities to study the effects of rehabilitation treatments on plant-available soil nitrogen and potential nitrate leaching using ion exchange resin (IER) bags. The scientific research in the development of chemical composition to expedite the restoration process to return the forest to its natural state will be analysed. Chemical composition such as 1:1 mixture of cation (Sybron Ionic C-249, Type 1

Strong Acid, Na⁺ form, Gel Type) and anion (Sybron Ionic ASB-1P Type 1, Strong Base OH⁻ form, Gel Type) will be considered along with other rehabilitation processes. The soil rehabilitation will be monitored under spectrograph analysis. The activity will be led by UGSBV supported by LETS, ASSET, ASFOR and AUA on the soil rehabilitation that is suitable for both forest rehabilitation and to support agricultural activities.

- KPIs**
- Report on soil rehabilitation strategy published across six (6) EU member state locations.

PC4: Restoration roadmap for natural resources

Challenge: Despite several publications reported on the impacts of wildfire on the natural resources, there is a lack of coherent strategy that could be globally adopted for restoration of natural habitat.

Innovation: The outcome of project activities will lead to the development of a restoration roadmap for the growth of natural resources. The reforestation/restoration programs and policies investigated in the studies had mixed socioeconomic effects on local livelihoods depending on other variables, such as availability of off-farm jobs, household characteristics, land productivity, land tenure, and markets for forest products and ecosystem services. Despite the existence of a number of rigorous frameworks that can be used to determine the economic feasibility of forest restoration projects from a public perspective, the most common framework applied at the project level consists of crude calculations of financial efficiency associated with the natural resources contained within the forest. The lack of financial models that quantify the intangible benefits for the community and region through the introduction of biodiversity balance and ecological analysis has been largely ignored. Addressing the lack of such models, the project will undertake an extensive and exhaustive study on environmental benefits to several cross-sectoral industries to promote forest rehabilitation. An example of such industries includes agricultural sector, tourism and construction industry that relies on wood harvested from the forests.

- KPIs**
- Inventory of natural forest released from eight (8) EU and three (3) non EU regions.

Demonstration objectives

DO1: Creation of demonstration scenarios and establishment of real-world drills for the evaluation of SILVANUS project outcomes.

The project will construct six scenarios often attributed to be the cause of wildfire namely (i) human negligence; (ii) natural; (iii) deliberate; (iv) accident; (v) unknown and (vi) rekindle. Each of the scenarios will be further elaborated in detail considering the regional needs and requirements. In addition, the expertise and experience of bringing together key activities and projects from international collaborators will be subsequently considered for the exhaustive assessment of SILVANUS project outcomes.

- KPIs**
- Formalisation of at least 6 complementary scenarios to reflect upon different causes of wildfires

DO2: Engagement of stakeholders at periodic intervals to evaluate the outcomes adopting agile methodologies

With 16 practitioners in the SILVANUS consortium, the project activities will be monitored by the end-users from the requirements generation to the final pilot validation. The project will adopt a continuous deployment strategy to enable long time monitoring of the project activities across each of the three phases in the project. The preparedness and training activities offered to the end-users will be complemented by the citizen science engagement programme to promote safety regulations in the prevention of wildfires (Phase A). As a complement, the development of Phase B activities will enable monitoring of regional pilot sites for long period to analyse the ecological changes resulting in the changes to the state of forests. Finally, the rehabilitation activities will be monitored over a period of at least two years yielding statistically significant data for extrapolating reliable source of data in the development of sustainable forest management roadmap.

- KPIs**
- At least 20 external experts to be invited to oversee the pilot demonstration activities as outlined in Section 1.3.3.

DO3: Organisation of at least three large-scale pilots for the systematic evaluation of the project outcomes

The SILVANUS consortium is committed to promote the technology readiness levels of key outcomes through practical demonstrations organised across European countries and international partnership. For each of the pilots, a list of scenarios and the scope of the pilot has been identified (refer to Section 1.3.3). In addition, for each pilot site, a flagship phase demonstration has been identified which will showcase the technological developments carried out in the project. Phase A, Phase B and Phase C. In addition to these flagship initiatives, other trials will organise cross-cutting demonstrations that combines a part of the different phases. Such a balanced approach between flagship initiatives and the cross-cutting demonstration activities will reliably showcase the performance of the SILVANUS components that caters to the needs of relevant stakeholders.

- KPIs**
- Two cycles of Phase A, Phase B and Phase C pilots organised in an agile manner as outlined in Section 1.3.3

DO4: Study of economic impacts of burnt area within forest regions

Complementary to the technological impact assessment, the demonstration activities will also consider the economic impact of burnt region on the interdependent industries namely agriculture, tourism, construction industry, insurance and financial services. The economic impact assessment study will be further used to demonstrate the effectiveness of the SILVANUS platform in preventing the spread of fire, thus enriching the wealth of the region. The case-studies generated from the demonstration will be used to promote the platform for commercial uptake in the industry.

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|-------------|--|
| KPIs | <ul style="list-style-type: none"> Publication of four (4) reports on the economic impact assessment during the project life cycle. |
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Outreach, dissemination, exploitation and CSA coordination objectives

[Contribution from all partners]

ODE1: Establishment of a global alliance from at least four continents to exchange knowledge and best-practice methodologies in combating forest fires.

The project led by practitioners and firefighters, will contribute towards the creation of a global strategic alliance. The consortium partners will take an active role in promoting regulations against forest fires, realising the need to tackle the global challenge in collaboration with the regional organisations to limit the global impact of wildfires. The risk of wildfires increases in extremely dry conditions, such as drought, and during high winds. Wildfires can disrupt transportation, communications, power and gas services, and water supply. They also lead to a deterioration of the air quality, and loss of property, crops, resources, animals and people. Wildfires and volcanic activities affected 6.2 million people between 1998-2017 with 2400 attributable deaths worldwide from suffocation, injuries, and burns, but the size and frequency of wildfires are growing due to climate change²⁸. Hotter and drier conditions are drying out ecosystems and increasing the risk of wildfires. Wildfires also simultaneously impact weather and the climate by releasing large quantities of carbon dioxide, carbon monoxide and fine particulate matter into the atmosphere. The resulting air pollution can cause a range of health issues, including respiratory and cardiovascular problems. Another significant health effect of wildfires is on mental health and psychosocial well-being. The following KPIs will be achieved in collaboration with the CSA action.

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|-------------|---|
| KPIs | <ul style="list-style-type: none"> At least 4 continent representatives to be represented in the SILVANUS global strategic alliance network A minimum of 35 internationally reputed experts to be members of the global strategic alliance A minimum of 10 fields of expertise to be represented within the alliance including practitioners, conservationists, technologists, scientists. A minimum of 20 case reports to be analysed by the experts in the network for the identification of causes, response assessment and lessons learnt |
|-------------|---|

ODE2: Industrial showcases to promote the project outcomes

The SILVANUS project outcomes (as outlined in Figure 5) will be promoted across several industrial showcases, where the use of forest resource management will be promoted through open competitions with external participants. The showcase will include the innovation of data aggregation process from the deployment of hardware sensors, collection of environmental data, supported by the ingestion of earth observation data sources complemented with the capability to interface with digital devices and edge devices for data collection. The development of sustainable forest management platform will cater to the demands and needs of relevant stakeholder including environmentalists, conservationists, academic researchers from interdisciplinary domains and finally technology providers. As a high-TRL platform, the demonstration activities carried out in the project will launch commercial services based on the industrial showcases. A detailed list of industrial showcases is presented in Section 2.2

- | | |
|-------------|---|
| KPIs | <ul style="list-style-type: none"> > 6 industrial showcases in which SILVANUS outcomes will be promoted. > 8 project platform features to be demonstrated across industrial showcases. At least 5 stakeholder community representatives to be invited for the industrial showcase events Coordinate and organise at least 4 co-located demonstration activities with the CSA project. |
|-------------|---|

ODE3: Dissemination of academic and scientific results of the project

The scientific innovation of the SILVANUS project will rely on the development of an advanced interdisciplinary platform that brings together complex data analytics and AI algorithms to monitor natural resources and protect forests against accidental and environmental fires. The technologies integrated within the project platform such as advanced communication protocols, dynamic service discovery protocols and heterogeneous data management will be published in peer-reviewed journals and conferences. Also, the project outcomes will be promoted across interdisciplinary research journals supported by international partners. A detailed list of dissemination channels is presented in Section 2.2.

²⁸ https://www.who.int/health-topics/wildfires#tab=tab_1

KPIs	<ul style="list-style-type: none"> • > 12 scientific papers to be published in peer-reviewed journals and conferences. • > 3 demonstrations at co-located workshops and conferences. • At least 3 joint reports published in collaboration with interdisciplinary partnership of SILVANUS consortium.
ODE4: Evaluate commercial impact and SME growth	
KPIs	<ul style="list-style-type: none"> • > 4 external SMEs to be included in the advisory board • > 5% increase in new job creation • An estimate of 10% revenue growth on the exploitation of project assets beyond the project duration. • An overall 5% increase in revenue attributing to the scientific knowledge developed within the project.

1.2 Relation to the work programme

The topic of the call addressed by **SILVANUS** is **LC-GD-1-1-2020 (IA)** as shown in the following table:

Specific challenge
“The Green Deal explicitly calls to “reduce the incidence and extent of forest fires”. [...] fires have killed hundreds of persons and ravaged forests and Natura 2000 sites not only in Southern Europe, but increasingly also in Central, Eastern and Northern Europe.”
Forest fires are a global challenge to be tackled in collaboration with regional organisations to limit the global impact of wildfires. The risk of wildfires increases in extremely dry conditions, such as drought, and during high winds. Between 2000 and 2017, the impact of forest fires in the European Union has been assessed in terms of environmental, human and economic losses. According to the European Forest Fire Information System (EFFIS), approximately 480 000 ha have burned per year, accounting for a total of 8.5 million ha of forest land. 611 fire-fighters and civilians have tragically lost their lives over these 17 years, while the economic impact amounted to more than EUR 54 billion or an estimated EUR 3 billion per year. Following the current pace of economic growth and environmental degradation, the European Commission PESETA II project indicated that the economic impact of forest fires for Greece, Spain, France, Italy and Portugal might increase to over EUR 5 billion per year by 2070-2100.
Contribution: SILVANUS project activities are aimed at promoting awareness on fire safety procedures through citizen engagement toolkit. The methodology developed in the project will be complemented with the release of mobile application for wider use. In addition, the project will also place a high degree of emphasis on the safety of fire fighters with the use of technologies being developed within this IA project. The technology impact assessment framework will include methodologies for monitoring the operations of UAVs and ground robots developed within SILVANUS. The economic impact upon the spread of wildfire will be monitored using advanced detection and response capabilities developed within the project. Collectively, the measures outlined in Phase A and Phase B pilot demonstration activities (refer to Section 1.3.3) will result in reduced incidents and improved safety for fire fighters.
“In addition to the extraordinary socioeconomic impact [...] soil degradation, water scarcity and biodiversity loss.”
The SILVANUS project is committed to promoting the growth of European organisations among the global market in leveraging the estimated growth of the fire protection system. According to MarketsAndMarkets ²⁹ , the global fire protection system market size is expected to grow from USD 67.7 billion in 2020 to USD 95.4 billion by 2025, at a CAGR of 7.1%. The market growth is fuelled by the growth in the construction industry, increasing human and property loss due to fire breakouts, stringent regulations, and rising adoption of wireless technology in fire detection. The fire protection system market for fire analysis is to grow at the highest CAGR from 2020 to 2025.

²⁹ <https://www.marketsandmarkets.com/Market-Reports/fire-protection-systems-market-1018.html>

A fire protection system can work effectively if a proper analysis of events is done. Fire analysis is an integral part of fire protection, which facilitates informed decisions that lead to maximum efficiency. Fire analysis uses fire mapping and analysis software, and fire modelling and simulation software. The growth of this segment can be attributed to the increasing need for sophisticated fire analysis, which helps in proper decision-making and fire prevention. The occurrence of wildfires has become a common sight in the Mediterranean region. These new fire outbreaks have led not only to the loss of millions of hectares of forests and billions of euros but also to the tragic loss of hundreds of human lives. Furthermore, the intensity and number of fires in the “traditional” fire countries have continued to increase. A new development is the occurrence of wildfires in states that were up to now only exposed to such events to a minor extent. Examples include Sweden, Ireland and Germany, for whom wildfires are not a common natural hazard. Fire is frequently a part of a natural cycle within the forests, but the fires we have seen in recent years are no longer natural as human activities influence them. Additionally, restoration of productive, bio-diverse and resilient forests is becoming more and more difficult.

Contribution: The SILVANUS project will actively collaborate with the external experts with research interest in ecological assessment, biodiversity metrics, forest management experts, public administration authorities and NGOs among others. The project will also promote the clustering activities supported by the CSA action.

“Moreover, wildfires are among the first contributors to climate change, [...] accelerating climate change by increased black carbon fall-out on ice/snow and by melting of underlying permafrost.”

Forest fires constitute a serious and increasing threat throughout Europe with emphasis on Greece, Spain, France, Italy and Portugal where over 40,000 fires per year were reported between 2010 and 2016 representing approximately 85% of the burned area in Europe. The surface area affected by fire every year between 2010 and 2017 amounts to 480,000 hectares. Larger and more damaging fires (i.e., ‘megafires’) are challenging the suppression capacities of many wildfire protection programmes across Europe. This trend is the result of disparate policies that can be effective in fire suppression in normal weather conditions but are insufficient to prevent extreme events such as megafires. Climate change is increasing the vulnerability of many forests to wildfires and is also projected to increase the frequency of wildfires in certain regions of the United States³⁰. Long periods of record high temperatures are associated with droughts that contribute to dry conditions and drive wildfires in some areas. **Wildfire smoke** contains particulate matter, carbon monoxide, nitrogen oxides, and various volatile organic compounds (which are ozone precursors) and can significantly reduce air quality, both locally and in areas downwind of fires.

Contribution: SILVANUS will use these models to prevent fire events as described for Phase A objectives (so reducing climate impacts) and, partially for Phase B (that speeding up extinguishing fires reduces climate impacts)

“In addition, large wildfires degrade air quality [...] with short- and long-term impact on human health.”

Smoke exposure increases respiratory and cardiovascular hospitalizations; emergency department visits; medication dispensations for asthma, bronchitis, chest pain, chronic obstructive pulmonary disease (commonly known by its acronym, COPD), and respiratory infections; and medical visits for lung illnesses. It has also been associated with hundreds of thousands of deaths annually, based on an assessment of the global health risks from landscape fire smoke: **(i)** smoky air makes it harder for your lungs to get oxygen into your blood; **(ii)** wildfire smoke can irritate your respiratory system and cause an immune response, which may lead to inflammation that affects other parts of your body; **(iii)** common symptoms include eye irritation, runny nose, sore throat, mild cough, phlegm production, wheezy breathing, or headaches. Such symptoms can usually be managed without medical attention; **(iv)** some people may have more severe symptoms, such as shortness of breath, severe cough, dizziness, chest pain, or heart palpitations; **(v)** smoky air may increase risk of some infections, such as pneumonia in older people and ear infections in children.

For the proposed climate analysis at the continental scale, a high-emission scenario was considered following the corresponding concentration trajectory adopted in the Fifth Assessment Report by the IPCC. The scenario focuses on a Representative Concentration Pathways (RCP) for which radiative forcing increase throughout the 21st century up to reach a high value (an approximate level of 8.5 W per m²) by end of the century. Even among predictions based on the same climate change scenario, different climate models predict variable climate patterns. The fire danger analysis was based on a regional downscaling of five global circulation models by means of three regional climate models (EURO-CORDEX downscaled climate data), with a further refinement of the simulated patterns of temperature and precipitation (bias-adjustment). Combined with the nonlinear relationship between climate and weather-driven fire danger, the variability of the five scenario instances resulted in a nonnegligible uncertainty in the estimated patterns of fire danger. However, considerable agreement among models was found over several European regions where fire danger is predicted to increase.

³⁰ <https://www.cdc.gov/climateandhealth/effects/wildfires.htm>

Contribution: Addressing the critical need for a global call to action, the SILVANUS project with the support of UTH, will conduct a thorough analysis on the health conditions of fire fighters often combating at the frontlines of fire mitigation as well as on citizens in the nearby areas. The health survey will be carried out in collaboration with hospital centres (such as AHEPA, OIR and others) to evaluate the impact of solutions developed in the project.

“In addition, large wildfires degrade air quality [...] with short- and long-term impact on human health.”

Scientists are also examining how the chemical makeup of wildfire smoke might differ from that of smog, which mainly comes from cars and industries. Researchers know that fine particulate matter is harmful, whether it comes from smog or wildfires. “These are very small particles that can penetrate deep into the human lung and cause both irritation and inflammation. But those particles have different compositions, depending on where they came from,” Henderson says. Smoke from burning biomass, or the burning of vegetation, contains hundreds of chemicals, many known to be harmful to human health, according to Henderson. Multiple toxins are released, Panettieri says. “Some of these are particulates. Others are sulphur dioxide, carbon monoxide, and a whole variety of other small molecules that easily pass from the nose to the lungs and into the blood.”

Contribution: The project adopts the use of fire prevention tools and methodologies to promote fire safety (Phase A). In addition, the reduced latency in detection and response coordination will result in swift fire suppression (Phase B), thus overall reducing the pollution levels in air quality. Additionally, the SILVANUS project is solely focussed on the monitoring of safety regulations for fire fighters. Thus, each technology developed in the project for the detection and response coordination is aimed to facilitate the swift collection of critical information on the ignition of wildfire and the effective mitigation strategies to be developed by the command and control centre using UAVs, UGVs, and advanced wireless communication infrastructure. The data driven analytics platform will further complement the need for processing heterogenous data sources and establish coordination among multiple mobile command centres.

“Climate change, certain forestry practices, [...] would sharply increase”

Forests host a dominant part of Europe’s terrestrial biodiversity and contribute significantly to climate change mitigation. Forests remove around 430 million tonnes of atmospheric carbon dioxide and store 13 % of Europe’s greenhouse gas emissions (Nabuurs et al., 2015). Without forests, or in the event of inadequate forest management, these resources and services could be damaged or destroyed. The Food and Agriculture Organization of the United Nations (FAO, 2016) reports that less than 10 % of the forest area is intensively managed plantations. Nevertheless, their role may grow with the incentives offered under new EU policies to manage forests for, for example, regulation of land-based carbon accounting (land use, land use change and forestry) and energy. This means maximising the provision of biomass either from Europe’s forests or, as has already happened, by importing more biomass (e.g. wood pellets from North America). Forest management needs to maintain the resilience of forest ecosystems while avoiding abrupt and destructive changes. However, currently, the information available on forest management practices across Europe is too sparse and unrepresentative to give a reliable overview of the condition of forest-ecosystems and their biodiversity. Furthermore, some national statistics may not include all logging activities, some of which are for domestic heating purposes.

Contribution: The project brings together three (3) pilots from the Mediterranean region (southern Europe) to demonstrate the effectiveness of technological interference. In addition, the cooperation with international organisations suffering from wildfires. SILVANUS will extend support and provide cooperation among the IA projects facilitated through CSA for the development of field exercise activities that are designed to demonstrate the European innovation and competitiveness within the market. Following the forest cast on the growth of forest landscape management activities, the project will promote the technological outcomes of the project. As outlined in Section 2.2, the consortium has already identified a tangible exploitation roadmap to promote the need for forest landscape management for Phase A, Phase B and Phase C of combating wildfires.

“The number of people living near wildland and [...] are likely to become common throughout the whole of Europe.”

Over recent decades, Land Use and Cover Change³¹ (LUCC) trends in many regions of Europe have reconfigured the landscape structures around many urban areas. In these areas, the proximity to land-scape elements with high forest fuels has increased the fire risk to people and property. These Wildland Urban Interface areas (WUI) can be defined as landscapes where anthropogenic urban land use and forest fuel mass come into contact. Mapping their extent is needed to prioritize fire risk control and inform local forest fire risk management strategies. This study proposes a method to map the extent and spatial patterns of the European WUI areas at continental scale. Using

³¹ Mapping regional patterns of large forest fires in Wild land Urban Interface areas in Europe

the European map of WUI areas, the hypothesis is tested that the distance from the nearest WUI area is related to the forest fire probability.

Contribution: Legal and ethical regulations are of highest importance for the successful deployment of technologies and methodologies in preventing and combating against forest fires. In addition, SILVANUS project activities will also include consideration of societal acceptance which is vital to ensure there is a high degree of confidence among the public in adopting the scientific innovation for early stage prevention, detection and response of forest fires. To achieve this objective, the project will develop privacy-impact assessment framework developed by KEMEA. The legal and ethical compliance guidelines will be adopted during the demonstration activities.

The rest of the workprogramme topics are referenced to the Specific Objectives listed in Table 1.

Scope – Subtopic 1 (IA)	
“The new context of extreme wildfires requires [...] cultural and socio-economic aspects with:”	Section 1.1
“research, demonstration and deployment [...] decision support systems for first responders;”	PB1-PB8
“proactive governance, change of forest management practices, [...] play a central role.”	PA1-PA4
“Activities should go beyond the state of the art and previous R&I activities at EU level ^[31] , [...] cooperation is encouraged.”	International partners from AMIKOM, CSIRO, UFRJ
“Actions funded under this call will speed up [...] services (as Copernicus, Galileo and EGNOS).”	PB3
“Innovative means [...] scales (e.g. local/regional /national/cross-border/EU/international).”	DO1-DO4
“The approach should be systemic: [...] and adaptation to climate change.”	Section 1.3.3
“Proposals should consider an Integrated Fire [...] a subset of activities, as described below:”	Section 1.1.1
Phase A: Preparedness and Prevention	
“The integration of environmental, [...] activities may include among others:”	PA4
“supporting the integration of [...] (e.g. rural abandonment and other land use change activities);”	PA2
“improving fire and landscape [...] and services whilst improving biodiversity and resilience;”	PA1
“enhancing access to [...] digital infrastructure and advanced cyber technologies;”	PB3-PB4
“building a common culture on risk [...] with special attention to Wildland Urban Interface areas;”	PA4
“integrating fire safety knowledge [...] fire-resilient buildings and infrastructures;”	PA2
“supporting the integration of wildfire [...] and critical infrastructures in particular;”	PA3
“improve early-warning tools by [...] in forecasting models;”	PA1
“improving the [...] well-being in local communities and first responders;”	PB8
“developing Broad Earth System studies [...] wildfires records and paleoclimate evidence.”	PB3-PB4
Phase B: Detection and Response	
“Anticipation and mitigation of [...] of weather conditions and geographical scenarios.”	PB1-PB5
“measures to stimulate investments from private sector in new technologies for retrofitting and/or developing new detection & response technologies;”	ODE1 and ODE4, PB9
“fast-track research and innovation in space [...] improved scooping, tanking and discharging;”	OD1-OD4
“improving firefighters’ and manned & unmanned [...] efficiently to fires in all conditions;”	PB4
“developing near real-time high-fidelity fire and [...] machine-learning and supercomputing;”	DO1, PB8
“enhancing interoperable and secure incident-management, [...] near real-time transmissions;”	PB1-PB8
“developing strategies, procedures and tools for incident [...] can be efficiently reached;”	DO1-DO4
“enabling better integration of wireless sensors, [...] Operators tracking aerial power lines;”	PB6, PB9
“developing advanced personal monitoring and [...] fire retardants/extinguishing agents;”	PB7, PB9

“developing better training, including virtual reality simulators for air fleet and ground resources;”	PA5
“enabling better and faster estimates of the [...] on water sources and other cascading effects.”	DO2
Phase C: Restoration and Adaptation	
“Proposals should aim at supporting the [...]. Activities may include among others:”	PC1
“evaluating and upscaling the deployment [...] nature-based solutions (NBS);”	PC2-PC3
“advancing and demonstrating systemic and [...] in relation to climate change;”	PC4
“demonstrating sustainable post-fire ecosystem [...] complementary geospatial analysis;”	PC1-PC4
“contributing to the definition of a common EU [...] protection from climate-related risks;”	PC4
“testing and developing public-private cooperation mechanisms to leverage investments from the private sector, including insurance companies in order to stimulate the development of preventive measures and reduce losses from wildfires;”	ODE1, ODE2 and ODE4
“supporting mechanisms and promotion of governance systems for restoration and adaptation through the involvement, coordination, and cooperation of different actors and sectors bridging between national and local administrative levels.”	ODE3, PC1, PA1, DO1-DO4

1.3 Concept and Methodology

The SILVANUS project brings together interdisciplinary research experts to build a platform for an environmentally sustainable forest management. As outlined in Figure 4, the novelty of the project relies in the integration of diverse data sources aggregated from spatio-temporal distributed sensors. A summary of the consortium strength is presented in Section 3.3, with a detailed overview presented in Section 4. Addressing the timely delivery of project objectives, as outlined earlier, the consortium will adopt the use of Agile methodology as presented in Figure 6. The project planning adopts a cyclic approach to engage with stakeholder communities and establish a continuous evaluation methodology. The project timeline is structured into 4 phases namely (i) requirements; (ii) sprint 1; (iii) sprint 2 and (iv) exploitation. All the activities of the project are clustered into workpackages (WP).

- **Specify:** The SILVANUS consortium is strategically formed to bring together interdisciplinary expertise from the relevant stakeholders. At the start of the project, SILVANUS will establish and promote the participatory process through which stakeholder engagement will be established. The stakeholder representation will include experts in biodiversity, ecological resilience studies, forest governance, public administration authorities, critical infrastructure operators through forests, vendors of forest management services, technology providers, hardware vendors in environmental sensor suppliers and drone operators. This expertise will be complemented with crisis management, response coordination to forest fire, resource deployment to the front line in fire suppression, healthcare professionals in monitoring the physical state of fire fighters.

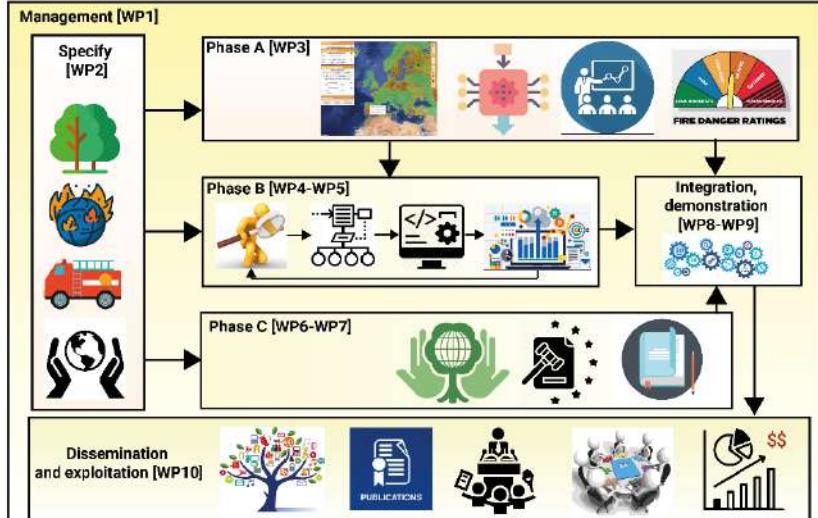


Figure 5 - SILVANUS data workflow management

SILVANUS Innovation [WP2]: The outcome of the specification activity will result in a structured report on the challenges and the current best practices adopted within the forest management services to combat forest fires. The operational procedures from each of the pilot demonstration sites participating within the consortium will be highlighted and interdisciplinary dialogues will be established to exchange processes and procedures among EU and international organisations. The participatory approach will also consider the socio-economic and cultural context resulting in the cause of wildfire. The findings from the participatory approach will be published to the community and disseminated through the coordination with the CSA project to other sister projects identified. The new knowledge generated from the activity will result in drafting the functional requirements for the SILVANUS platform

development. The requirements specification will be adopted in the subsequent project development for Phase A, B and C activities. Key outcomes from the activity are (i) release of forest landscape models for eight (8) demonstration sites from EU member states; (ii) climate sensitive forest models; (iii) 3D visual representation of forest landscape for efficient forest management; (iv) Publication of case-study on historical forest fires approved by advisory board members; (v) SILVANUS platform assessment framework.

- **Phase A [Preparedness and prevention]:** Building on the foundation of participatory process, the project will launch a public consultation to enhance the awareness on wildfire across each of the pilot demonstration sites. The preparedness and prevention strategies will be uniquely identified for each of the six (6) upper categories formalised by “Common Core EU Scheme” in wildfire ignition causes. These categories include (i) Unknown; (ii) Natural; (iii) Accident; (iv) Negligence; (v) Deliberate; (vi) Rekindle. For each of such causes, a set of scenarios will be identified which will be further demonstrated within the Phase B of project activities. The following key technological and methodological outcomes will be achieved in the project.

Sustainable and resilient forest management knowledge model: The systematic categorisation of forest fire ignition will be further enhanced to include the representation of complex data structures. The knowledge model framework will result in the formalisation of data stream interpretation for the information aggregated from the list of data sources identified in Figure 4, including earth observation data sources, weather forecast data, in-situ data sensors, mobile units (UGVs and UAVs), among others. The novelty of the innovation will include the formalisation of temporal representation of data streams. The framework will build on international standards such as ISO/IEC 23000-13: Media Orchestration, to establish synchronisation of both sink and source side data modalities. The knowledge model will also encode operational and organisational procedures in forest management and resilience activities.

Intuitive training exercises: Building on the scenarios outlined in WP2, the design and delivery of training activities will encompass the use of advanced immersive visualisation toolkits, such as AR/VR devices. The content production framework will be further enhanced to carefully curate the scenarios outlined in the project which are commonly encountered by the fire fighters. Additionally, the training activities will also include the measure of preparedness of first responders (such as fire fighters, emergency healthcare professionals and other organisations) to evaluate the effectiveness of the training programme.

Citizen engagement methodology and toolkit: The SILVANUS project places a high degree of reliance on social acceptance for the success of technological intervention to combating wildfire. Following the global awareness on climate change policy since the Paris Agreement in 2016, the project will build on the climate change policy framework to develop a citizen engagement methodology. The methodology will address the key causes of fire ignition resulting from human negligence, accidental fire causes, deliberate causes (such as arson, vandalism) and promote the impact wildfire on global climate. The methodology developed in the project will be subsequently translated into a mobile phone application toolkit and will be launched in the App store for wider use. The Phase A trials planned to be carried out in Portugal, Italy, Slovakia, Croatia will disseminate the availability of the SILVANUS application and thus promote the use of preventive strategies.

- **Phase B [Detection and Response]:** The recent advancements in the field of Artificial Intelligence (AI), machine learning (ML), big-data technologies, cloud computing, edge analytics, UAVs, UGVs, information fusion, granular statistical models and 3D visualisation and environmental sensing using IoT devices will be cumulatively integrated within the platform. The challenge of integrating the diverse data sources and processing the continuous data streams are addressed in twofold.

SILVANUS data acquisition capabilities: The innovation of activities to be achieved in the project are clustered around the frequency of data availability and the acquisition methodology adopted. The project has identified three forms of data sources namely (i) continuous stream of information; (ii) periodic data sources and (iii) sparse data. The categorisation of these data sources is dependent upon the frequency of data availability and the frequency of acquisition process identified in the project. Additionally, the project has also identified the need for data classification based on the fire ignition events (pre-fire ignition, post fire ignition, and post fire suppression). The pre-fire ignition data collection process will implement data interfaces to Copernicus and other Earth Observation data repositories and environmental sensors (with statis installation). Additional data sources for pre-fire ignition models include social media sensing on suspected human negligence, accidental fire causes, agricultural burnings, firecrackers, etc. The post fire ignition data collection interface will implement data ingestion from dynamic sensors which are deployed to perform inspection of suspected fire ignition. The use of aerial platform (UAVs) and ground vehicles (UGVs) will be leveraged to evaluate the effectiveness of the overall data collection process.

Advanced data analytics toolkit: The collection and aggregation of complex data structures are harmonised with the development of semantic information fusion engine. The normalised data sources are mapped upon the forest landscape models developed in WP2 to accurately evaluate the threat of wildfire spread. The risk assessment and mitigation strategy developed for each pilot site demonstration will be activated based on threat to loss of life, loss

of critical infrastructure and biodiversity. The real-time monitoring toolkit will also incorporate health data from frontline fire fighters. The decision support system will customise the machine learning algorithms for modelling the multi-objective optimisation criteria that protects forest against the spread of wildfire. The activity will also implement a mobile command centre an edge enabled computational unit to process and visualise information collected from the field. The dynamic modelling of weather patterns will be accounted in modelling the spread of wildfire and thus will support exchange of information to the frontline firefighters. The project will bring forward innovation in establishing a on-demand communication infrastructure to support communication in the absence of reliable tele-communication service due to wildfire.

- **Phase C [Restoration and adaptation]:** The project activities will focus on the analysis and development of forest restoration activities through the evaluation of forest resilience programme. Considering the regional and local community support available, unique resilience models will be developed in the project for each demonstration location. The rehabilitation strategy will consider the severity of the fire ignition, the damage impacted to biodiversity and the roadmap for establishing ecological balance within the natural habitat. Additionally, strong emphasis on the agricultural resilience to post-fire rehabilitation is considered within the project.

The consolidated project outcomes from Phase A, B and C activities will be consolidated in the release of “Future of Environmentally Sustainable Forest management services – Impact of technology intervention in combating wildfire”. The contributions to the roadmap generation will be requested from participants of previously funded projects as identified in Table 3. In addition, the consortium will launch a flagship initiative for stakeholder consultation. The consortium will collaborate with CSA project to promote the roadmap and consolidate the efforts in showcasing the European competitiveness and commitment to climate action.

- **Integration and demonstration:** The integration of the software and hardware components within SILVANUS platform will be achieved using continuous integration and continuous delivery (CI/CD). The overall architecture specification will adopt the use of open standards for exchanging information between the different integrated components. The platform integration will develop exchange of information between different command centres deployed with a region and thus facilitate exchange of situational awareness state across regions. The platform will be tested and validated prior to the organisational release. One of the key strengths of SILVANUS consortium is the large number of stakeholders involved in the project (from 8 EU member states and 3 international organisations). A detailed description of the pilot site location for all 11 sites is provided in Section 1.3.3, followed by the specific scenarios and the scope of demonstration activities outlined in Section 4 for each demonstration coordinator. The carefully narrated demonstrations will encompass the challenges of Phase A, B and C objectives and will objectively evaluate the outcomes with KPIs outlined in Table 1. The project has envisaged two organisation release of the platform at M12 and M30 with subsequent improvements and updates to be carried out throughout the integration lifecycle.
- **SILVANUS Centre for Adaptation Strategies and development [S-CAS]:** The SILVANUS project bringing together 50 partners is best placed to setup the dissemination and communication activity centre and launch public awareness campaigns building on the citizen engagement programme. Additionally, the consortium is also committed to launch the “S-CAS” office encouraging participation from global community to promote sustainable forest management practices. The diverse stakeholder participation within SILVANUS offers a unique opportunity to establish such an initiative and develop a self-sustainable model. The consortium in discussion with stakeholder will develop governance policies and strategies to promote the centres vision.

1.3.1 Overall approach and methodology

The SILVANUS project brings together interdisciplinary research experts to build a platform for an environmentally sustainable forest management. As outlined in Figure 4, the novelty of the project relies in the integration of diverse data sources aggregated from spatio-temporal distributed sensors. A summary of the consortium strength is presented in Section 3.3, with a detailed overview presented in Section 4. Addressing the timely delivery of project objectives, as outlined earlier, the consortium will adopt the use of Agile methodology as presented in

Figure 6. The project planning adopts a cyclic approach to engage with stakeholder communities and establish a continuous evaluation methodology. The project timeline is structured into 4 phases namely (i) requirements; (ii) sprint 1; (iii) sprint 2 and (iv) exploitation. All the activities of the project are clustered into WP.

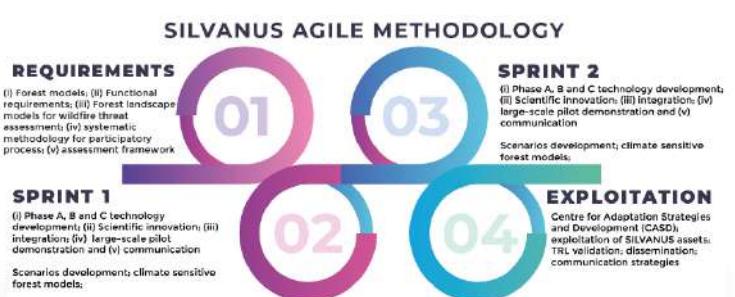


Figure 6 - SILVANUS agile methodology

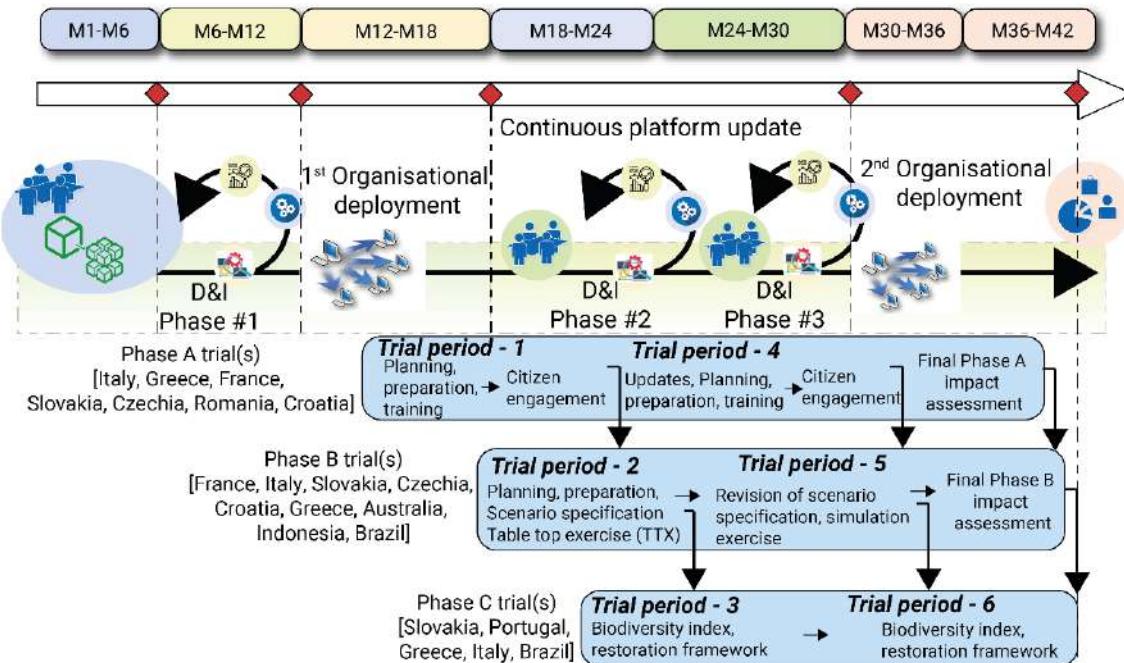


Figure 7 - SILVANUS pilot duration

- In the **requirements phase**, the SILVANUS technical members will actively engage with the stakeholder (WP2). A formal consolidation of forest landscape management tools and components will be identified. A functional requirement of the project platform will be drafted. Additionally, the architecture specification for the component integration will be defined (WP8).
- Sprint 1:** The first cycle will carry out the project's technical activities. Each challenge outlined in the workprogramme is uniquely addressed with each of the WPs. Phase A and B activities are carried out in WP3, WP4 and WP5. Phase C activities are carried out in WP6 and WP7. The outcome of the Sprint 1 will be evaluated through the demonstration activities carried out in WP9.
- Sprint 2:** Following the initial feedback from the stakeholders on the effectiveness of project platform in combating against wildfires, the project will undertake continued innovation to achieve the technical objectives outlined in Table 1. Each of the outcome will be evaluated against the KPIs set forth in the list of specific objectives.
- Exploitation:** Represents the last phase of the project in which the commercial positioning of each project outcome will be addressed. The outcome from the demonstration activities will be further utilised to identify the market niche and position the products developed in the project to be launched in the market. A detailed business plan for both individual components and joint exploitation agreement resulting from the collaboration will be reported.

A more detailed timeline specification of each individual pilot duration is presented in Figure 7. Each demonstration activity includes a planning phase, trial phase and assessment phase, appropriately divided into each time period.

1.3.2 SILVANUS Validation and Pilots

The project innovation carried out will be systematically demonstrated across eight (8) EU and three (3) non-EU sites. An overview of the locations in which the pilot activities are to take place is presented in Figure 8. The six (6) common causes of fire ignitions will be assessed, and dedicated scenarios will be identified for the organisation of technological intervention. In addition to the generic category, the causes listed in Table 2 will be considered. Each pilot demonstration is divided into three main periods namely (i) preparation and organisation; (ii) demonstration; and (iii) assessment evaluation. To achieve the demonstration, the consortium has identified two organisation deployment to be carried out within the consortium. An organisation deployment refers to the base in-

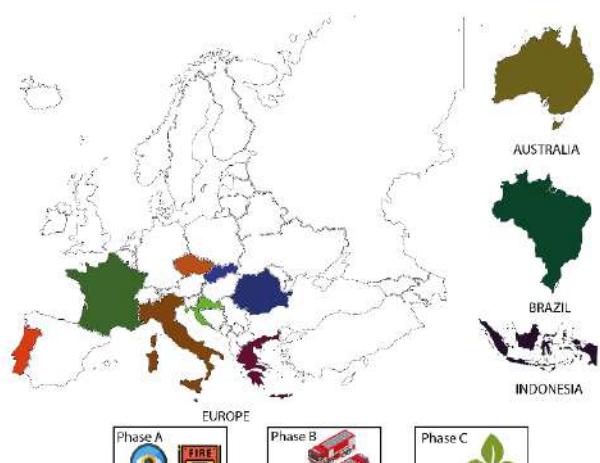


Figure 8 - SILVANUS pilot demonstration sites

stallation of the SILVANUS platform within the trial organiser premises or provide dedicated access to the cloud installation of the specific user. The timeline for Phase A, B and C demonstration activities have been outlined in Figure 7. In the rest of the section, an overview of the demonstration sites is presented.

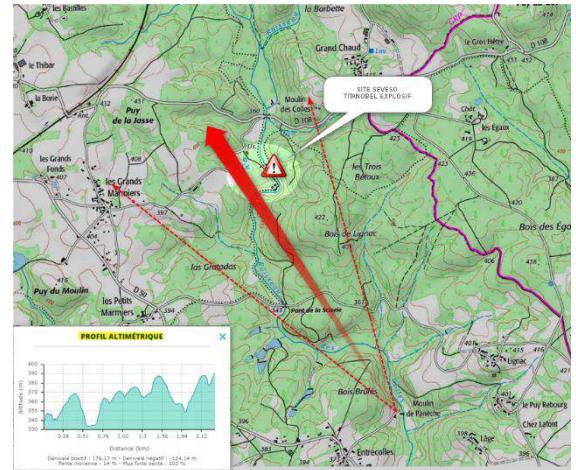
1.3.2.1 Phase A/B: Forest fire with Industrial accident in highly explosive plant – France (PUI)

Partners in charge: Fire service, Prefecture, Municipalities, Agriculture and forest administration,

Many industries with high risk of human dimensions (for example SEVESO industries) are situated near residential or rural areas. Managing a major accident in a delicate situation of forest fire is a challenge, and with the production of smoke cloud and explosive, it is always important to minimize further risks.

Scenario description:

The forest fire scenario has three active fronts, moving towards sensitive targets; With a large amount of smoke and a wind exceeding 70km / hour, the firefighters urgently need priority information: (a) mapping of the area; (b) identification of access paths, (c) urbanized areas, (d) roads and access routes; (e) temperature, dehydration of plants, (f) speed and direction of the wind, (g) -anticipation of fire development and development axes,



1.3.2.2 Phase A/B/C: Gargano park – Italy (FINC)

Gargano is a historical and geographical sub-region in the province of Foggia, Apulia, southeast Italy, consisting of a wide isolated mountain massif made of highland and several peaks and forming the backbone of the Gargano Promontory projecting into the Adriatic Sea, the "spur" on the Italian "boot". The high point is Monte Calvo at 1,065 m (3,494 ft). Most of the upland area, about 1,200 km² (460 sq mi), is part of the Gargano National Park. The Gargano National Park is a National Park established in 1991 (according to art. 19 of Law 394/91) and is located on the promontory of the same name, in the province of Foggia, in Apulia. It is managed by the Gargano National Park Authority, established in 1995 (Institutional Decree DPR 05/06/1995), which also manages the Tremiti Islands Marine Nature Reserve, established in 1989 (D.I. 14/07/1989).

The park falls entirely within the province of Foggia, covering nearly the entire promontory and extends over an area of about 120,000 hectares. It includes, totally or partially, 18 municipalities: Apricena, Cagnano Varano, Carpino, Ischitella, Tremiti Islands, Lesina, Manfredonia, Mattinata, Monte Sant'Angelo, Peschici, Rignano Garganico, Rodi Garganico, San Giovanni Rotondo, San Marco in Lamis, San Nicandro Garganico, Serracapriola, Vico del Gargano and Vieste. The boundaries of the park are jagged and are included within the Fortore river, the Candelaro stream and the coast.

Based on the degree of anthropization, the Park provides for internal zoning, which then divides it into two areas:

- Zone 1: of significant naturalistic, landscape and cultural interest with limited or non-existent degree of anthropization;
- Zone 2: of naturalistic, landscape and cultural value with a greater degree of anthropization.

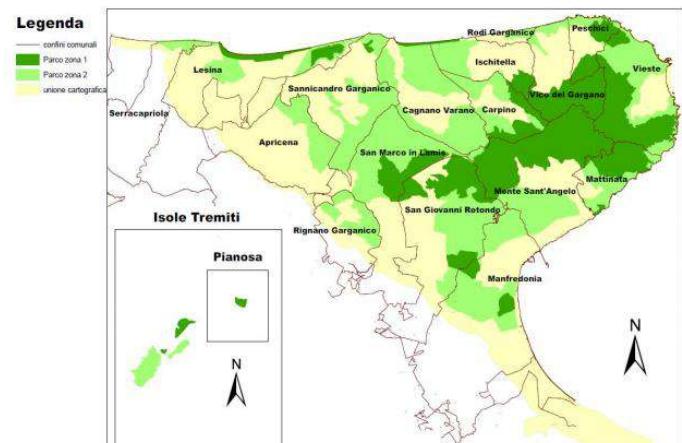


Figure 9 Gargano National Park map.

The Tepilora Regional Nature Park is a Regional Park established in 2014 (under Regional Law No. 21 of 24 October 2014). It is managed by the Tepilora Regional Natural Park Authority. The park is located in North-West Sardinia and covers an area of about 8,000 hectares. It entirely falls within the province of Nuoro, including a vast territory that covers four municipalities: Torpè, Posada, Lodè and Bitti.

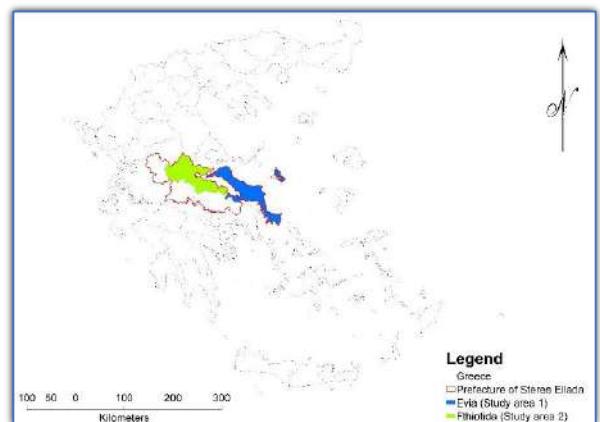
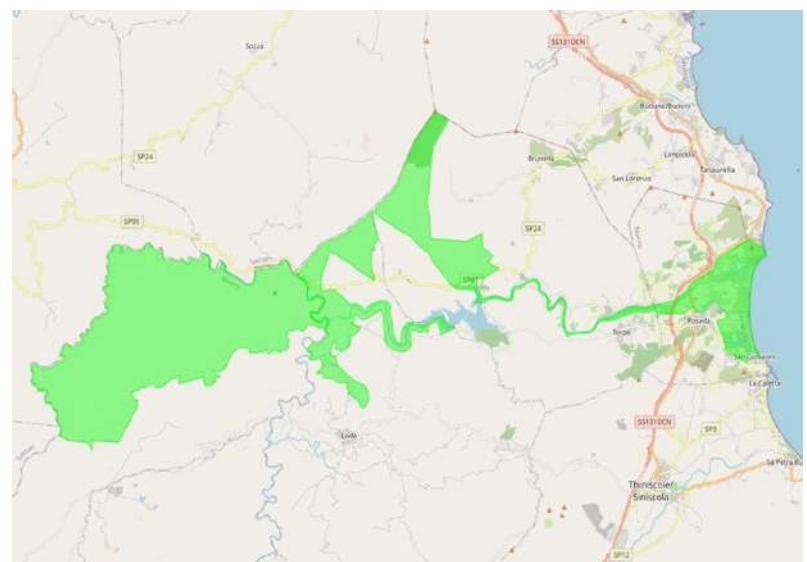
The territory covers an area of high naturalistic value, characterised by important natural systems: such as Mount Tepilora (528 m above sea level), the state forest of "Crastazza-Tepilora", part of the state forest of Sos Littos-Sas Tumbas in the territory of the municipality of Bitti, the forest complex of Sant'Anna in the municipality of Lodè, the state forest of Usinavà in the municipality of Torpè, and the course of the Posada river up to its mouth in the municipality of Posada. The park also includes the Biosphere Reserve "Tepilora, Rio Posada and Montalbo", recognised in 2017 in the "Man and the Biosphere Programme - MAB" by UNESCO.

1.3.2.3 Phase A/B: Romania (SIMAVI)

"Rodna" Mountains National Park is the second largest national park in the country, with an area of 47.177 ha, of which 3.300 hectares were declared to be a Biosphere Reserve in 1979. The importance of this protected area geology and geomorphology is due to both mountains and the presence of numerous species of flora and fauna, endemic and relict glacial. Rodna Mountains culminate the highest peaks of Eastern Carpathians (Petrosul Rodnei, 2303 m) and they are placed in north of Romania. They belong to the Northern Carpathian group, known as Maramures and Bucovina Carpathians, and dominate the boundary region, the highest altitude gap being recorded in the midst of Maramures hollow, which is placed in north of Romania, Eastern Carpathians, county of Maramures and Bistrita-Nasaud. The map to the right represents all the natural protected areas in Romania and highlights the pilot site among them. Rodna National Park is a protected area of national interest that corresponds to the second category IUCN. Rodna Mountains National Park is designated internationally as a Biosphere Reserve by the UNESCO Committee, within the "Man and Biosphere" Program. The national park overlaps both the site of Community importance (SCI) and the special avifauna protection area (SPA).

1.3.2.4 Phase A/C: Impact of wildfires on agricultural sector – Greece (PSTE/AUA)

In this pilot, a regional unit of the prefecture of Sterea Ellada (Central Greece, partner: PSTE) will serve as a study area. In particular, the regional units of Evia and Fthiotida have been selected as suitable candidates, and one of the two regional units will be chosen in the implementation phase of the research project, depending on the level of detail of available data. Evia is located in the eastern part of the geographical district of Sterea Ellada; it is the second largest island in Greece and its total area is 4,167 km². About 2,500 km² of Evia is covered by forests. Evia belongs to the Pelagonian zone of non-metamorphic formations (Central and North Evia) and to the Atticocycladic zone (South Evia). The most significant forest species that make up the forests of Evia are Aleppo pine (*Pinus halepensis*), Firs (*Abies* sp.), Black pine (*Pinus Nigra*) and from the broadleaf, Chestnut (*Castanea sativa*), Oak (*Quercus* sp) and, sporadically, in small areas, other species, such as *Platanus orientalis* and *Acacer* sp. The birds that live in the wider area are the rock partridge (*Alectoris Graeca*), the blackbird and passing bird species. The region is one of the most fire damaged in Greece. Frequent fires are the most serious



risk of degradation of the forests. According to statistics from a period of nine years, 322 fires occurred annually in Evia, destroying about 1% of the total area of the regional unit that is about the triple of country's average. On other hand, Fthiotida consists partly of a productive plain and the mountainous part covered, primarily, by fir forests and oak forests. In the mountainous Fthiotida, there is the Oiti's national park which is a protected natural area (Natura 2000). From the phytoecological point of view, the structures of vegetation that make up the forest vegetation of Fthiotida are less flammable than that of Evia's ecosystems, because the main vegetation species are oak and fir. According to statistics, over a period of nine years, 263 fires occur annually in Fthiotida, destroying about 0.6% of the total area of the regional unit, which corresponds to the double of the average of the whole county

1.3.2.5 Phase A/C: Powerline disruptions resulting in accidental fires – Portugal

Pilot site description: Cova da Beira is the region located in Interior-Este part of Portugal. It borders on the North with the subregions of Serra da Estrela and Beira Interior Norte, on the East with Beira Interior Sul, on the South with Beira Interior Sul along with Pinhal Interior Sul and on the West with Pinhal Interior Norte. It comprises 4 counties: Belmonte; Covilhã, Fundão and some parishes of Castelo Branco. It is much known for its top-quality agriculture products. Besides some industry, the region has strong agriculture and forestry activities.

Cova da Beira combines a strong implantation of the industry in an area with a strong rural influence, resulting in a rural region of high population density. The asymmetry in land distribution is revealed by the presence of large side-by-side properties with a generalized smallholding. The landscape is very diverse, due to the hydrographic network that influences land uses and their distribution. Today most of the area is occupied with intensive agriculture and fruit farming (apple, peach, cherry). The landscape is strongly compartmentalized, marked by the agricultural land uses and the granitic outcrops with oak woodland patches. This is a region of abundant water resources, characterized by a great inter-annual irregularity. The watering perimeter of Cova da Beira was implemented to respond to this variability, covering an area of about 14 440 ha. The main water sources are the Sabugal and Meimoa dams. The irrigation blocks of Covilhã, Fundão, Fatela and Capinha, have an equipped surface of 5 695 ha.

1.3.2.6 Phase A/B: Preparedness and response coordination in countering wildfires - Czech

The pilot area will be set in the north-east part of the Czech Republic and east part of Moravian-Silesian Region, at the territory of Moravian-Silesian Beskyds Mountains. Beskydy mountains are the northern territory of Protected Landscape Area Beskydy (PLAB). East border of the PLAB is located at national border with Slovak Republic. The territory of PNRB belongs to most visited tourist resorts in the Czech Republic. The overall area of the Protected Landscape Area Beskydy is 1.160 km². with the highest mountain, Lysá Hora, with an altitude of 1.323 meters. Lowest areas of PNRB have got the altitude approximately 400 metres. The pilot area will be placed nearby the municipality Ostravice (GPS 49.5513297N 18.3789831E), municipality Staré Hamry (49.4682900N 18.4321981E) and water dam Šance (GPS 49.5112764N, 18.4161478E). This territory is frequently affected by weather related emergencies (strong winds, floods, flash floods, landslides), thus there are installed systems for hydro-meteorological monitoring of the territory.

Territory of Moravian-Silesian Beskyds Mountains (MSBM) belongs to 26 municipalities, which dispose its own Volunteer Fire Brigade. This fire brigades are situated directly at the territory of MSBM or close to its borders. The Volunteer Fire Brigades provides the basic resources for forest firefighting. Area of MSBM is also covered by four professional fire stations of FRB-MSR. FRB-MSR provides well-trained personnel, appliances, facilities and is fully equipped to provide service in all scales of emergencies. FRB-MSR manages with 22 full time fire stations and operationally controls approximately 356 part-time and volunteer stations. Airborne firefighting vehicles (helicopters) to treat forest fires are at the disposal too.

1.3.2.7 Phase A/B Integrated next generation forest fires management systems - Croatia (RINI)

Pilot site description: Fire-fighting exercise ground and training center Šapjane and wider territory of Učka Nature Park. In order to provide conditions for training firefighters and other participants in the process of protection and



rescue of people, animals and material goods, the firefighter association of Primorje-Gorski Kotar County addressed the Government of the Republic of Croatia with a request to manage the former barracks "Boršt" in Šapjane, near the city of Rijeka, with the corresponding area. Since 2010, the former barracks has been entrusted to the management of the firefighter association of Primorje-Gorski Kotar County. All training grounds are primarily intended for the training of firefighters, but they fully meet the needs for the training of civil protection operational forces.

Učka Nature Park encompasses Mount Učka and a part of the Čićarija mountain range. It is located along the northern Adriatic coast at one of the most northerly points of the Mediterranean, right where Istria meets the continental part of Croatia. The distinctive features for which this area was proclaimed a nature park have been known about for long time. Due to its relief and proximity to the sea, the area is characterised by a particular climate and lush forest vegetation. Also important are its rich meadows and other anthropogenic habitats that are home to numerous endemic, threatened and protected plant and animal species. Encompasses: mount Učka and part of the Čićarija mountain range; area: 160 km²; highest peaks: Vojak 1,401 m, Veli Planik 1,272 m.



1.3.2.8 Phase A/C – Policy recommendations on restoration of forest landscape – Slovakia (TUZVO, PLAMEN, UISAV) Name of landscape: Podpolanie

Approximate location of the case study area is Podpolanie located in the central part of Slovakia (Figure 1), particularly within region of Banská Bystrica and its district Detva. Within case study area are situated two towns (Detva and Hriňová) and 13 municipalities. In 2011 the population of Detva district was almost 33 000 residents and population density 73 persons per km². The area belonged to the regions with the highest unemployment rate in Slovakia, when in 2011 its rate was 16,68 %.

The location of the Podpolanie case study area within NUTS classification is as follows:

- NUTS1 SK0 - The Slovak Republic;
- NUTS2 SK03 - Central Slovakia;
- NUTS3 SK032 - Banská Bystrica Region; LAU 1 604 - Detva District

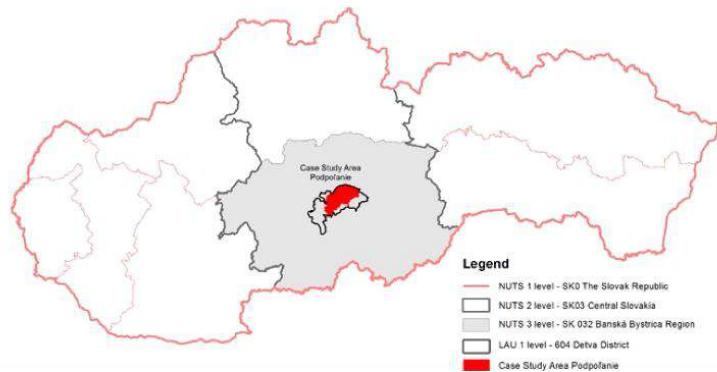


Figure 10 - Case study area Podpolanie within NUTS classification in Slovakia

The following table summarises the deployment of different technology clusters as identified in Section 1.3.1, as applied for different scenarios in the spread of fires. Each technology cluster will enable a specific set of features that is successfully demonstrate the effectiveness and efficiency of the SILVANUS technology deployed within the fire brigade organisations for combating wildfires.

	FR	IT	RO	GR	PT	CZ	HR	SK
Phase A: Innovation management in prevention strategies								
Cluster 1: Probability models and regression analysis for the quantification of fire danger index	X		X	X	X			X
Cluster 2: Interdisciplinary simulation models for global impact on climate		X	X			X	X	
Cluster 3: Communication toolkit for citizen engagement	X	X			X	X		X
Phase B: Innovation management of technology clusters								
Cluster 4: Environmental threat assessment	X	X	X	X		X	X	X
Cluster 5: Assessment of adherence to safety protocols		X	X				X	X
Cluster 6: Predictive analytics based on weather patterns	X	X		X		X		
Cluster 7: Response coordination and mitigation	X	X	X	X		X	X	X
Phase C: Innovation management in restoration of burnt area								

Cluster 8: Quality assessment of natural resources and habitat	X	X	X	X		X		X
Cluster 9: Testing protocols for evaluating burnt area impact			X		X	X		X
Cluster 10: Vegetation recovery and soil stabilisation	X	X		X	X			X

The three non-EU pilot demonstrations will be carried out in (i) Queensland Centre for Advanced Technologies, located in Brisbane, Australia coordinated by CSIRO (Phase B); (ii) Pantanal, Pocone, State of Mato Grosso, Brazil coordinated by UFRJ (Phase A, C) and (iii) Indramayu, West Java, Indonesia coordinated by AMIKOM (Phase C).

1.3.3 Synergies with National/international research & innovation activities

The SILVANUS consortium brings together 50 partners with strong expertise across interdisciplinary innovation to achieve the project objectives. A brief outline of the key assets brought into the project are presented below. A detailed expertise of each partner with a detailed list of successfully executed projects is presented in Section 4.

Table 2 - Synergies with past (background) projects

Project theme	Projects/Partners	Uptake in SILVANUS/Lead Partner
FP7 DRIVER+	DRIVER+ starts from the experience that neither successful R&D nor strong end-user demand always lead to innovation in the Crisis Management (CM) domain. This is a problem since as societies become more complex, increasing scope and unpredictability of potential crises and faster dynamics of major incidents put increasingly stringent demands on CM. European CM capabilities already constitute a mature System of Systems; hence wholesale redesign would often be too costly and might critically destabilise existing CM capabilities	Three of the core partners (TRT, ATOS, ITTI) of SILVANUS will bring forward background knowledge from Driver+ project on crisis management and incident detection system. The background knowledge will be used in coordinating crisis management response among stakeholders.
H2020 beAWARE	The overall context for beAWARE lies in the domain of situational awareness and command and control (C2). The first phase concerns the forecast of the extreme condition and the relevant preparations. Once a disaster occurs, an initial assessment needs to be conducted as soon as possible to determine the scope, geographical distribution, and scale of the incident.	CERTH in SILVANUS will lead the activity on social sensing and will deliver intelligence to the project command centre. The outcome of social sensing will facilitate the identification of fire ignition origin using multi-modal data analytics
H2020 SAFERS	The EU-funded SAFERS project will develop a complex emergency management system capable of acting along the whole emergency management cycle, thanks to the coupled use of heterogeneous Big Data, advanced models, and AI.	CERTH will contribute to WP4 and WP5 activities and leverage upon the existing large-scale repository for concept detection.
FP7 – PERICLES	PERICLES addresses the challenge of ensuring that digital content remains accessible in an environment that is subject to continual change in technology as well as in semantics, academic or professional practice, or society itself, which can affect the attitudes and interests of the stakeholders interacting with the content. PERICLES takes a ‘preservation by design’ approach that involves modelling, capturing and maintaining detailed and complex information about digital content, the environment in which it exists, and the processes and policies to which it is subject.	SILVANUS will capitalize from work in PERICLES related to contextualized semantics, both from an ontology vs. a high dimensional vector space perspective, developing ideas toward vector field semantics to address and formalize the inherent dynamics of knowledge organization. These dynamics was found to be typical for expanding information universes, and the concept is underlying ideas in SILVANUS WP5.

REDIRNET ³² EU FP7- 607768, 2014-2016,	REDIRNET (Emergency Responder Data Interoperability Network) provided a decentralized framework for interoperability for first responders' systems based on a public Metadata Gateway controlled by the agencies themselves via a REDIRNET socio-professional web. UISAV, as a core project partner, has developed a Poll Management and Aggregation Service (PMAS) which is able to request and reserve resources for a crisis mitigation in a very secure, reliable and fast manner.	The Metadata Gateway can be used for interconnecting operations centers and various stakeholders. UISAV will use its EmerPoll mobile app and the platform, based on the PMAS, to crowdsource information and to provide real-time situational awareness.
SECRICOM³³ Best Project Award in the SECURITY Call! FP7- 218123 IP, 2008- 2011,	The aim of the SECRICOM (Seamless Communication for Crisis Management) large integrated project was to create a seamless communication infrastructure with advanced intelligent functionality for crisis management with participation of multiple agencies and stakeholders. The project delivered: secure Push-To-Talk system integrated with IP comm. systems; improved interoperability and seamless connectivity; implementation of a Secure Docking Module ensuring secure code execution and comm. used by secure agents (SAI).	UISAV can bring its experiences from Secure Agent Infrastructure (SAI) implementation and deployment leveraging the expertise in secure and reliable communication for first responders, processing, and aggregation of large volume of heterogeneous data.
ECOPOTENTIAL ³⁴ H2020	ECOPOTENTIAL is a large European-funded H2020 project that focuses its activities on a targeted set of internationally recognised Protected Areas, blending Earth Observations from remote sensing and field measurements, data analysis and modelling of current and future ecosystem conditions and services.	CERTH and IST will bring forward innovation into SILVANUS to build a situational awareness and real-time monitoring of wild-fire spread within SILVANUS

In addition to the above projects listed, the SILVANUS consortium will extend demonstration invitation to the following projects and support interdisciplinary collaboration among the stakeholders.

H2020 STRATEGY; H2020 INGENIOUS; H2020 IN-PREP; H2020 CURSOR; FP7 INACHUS; H2020 Innovative Forest Fires Prevention Infrastructure for Residential Areas, Forestry and Critical Infrastructures; Instant Foam for Fighting Forest Fires; Integrated Fire Management System; Social Innovation in Marginalised Rural Areas; Aerosols, Clouds, and Trace gases Research InfraStructure; DANTE: Digital Alarm Network and Tracking Equipment for forest fire detection; Scooping Device for Aerial Forest Fire Suppressant; DroneHopper: an innovative solution for firefighting through remote-controlled aircrafts; EnhANCing emergencY management and response to extreme WeatHER and climate Events; HEIMDALL; WILD HOPPER; I-REACT; RESPONDRONE; Wildsmoke; GEO-SAFE; SPFireSD; COST Action FireLinks; H2020 FIRE-IN; H2020 MEDEA FirEURisk- DEVELOPING A HO-LISTIC, RISK-WISE STRATEGY FOR EUROPEAN WILDFIRE MANAGEMENT (Topic: LC-CLA-15-2020 Type of action: RIA); FDAAS; WARM; BRIGAID

1.3.4 Technology readiness levels (TRL)

In the context of positioning SILVANUS innovation technologies with respect to the market, the recommended guidelines of H2020 work programme have been adopted. This section outlines the technology readiness level (TRL) of the proposed innovation in SILVANUS project and foresee results delivered in the market creating a niche for the supply chain customers in forest management. The project outcomes addressing Phase A (4), B (5) and C (2) are systematically categorised into 11 assets, which are interdependent and complementary in nature. A more detailed outline of the consortium expertise in delivering the target TRL has been outlined in Section 4.1. However, following table provides a brief outline of the various collaborative activities to be carried out within the project with specific tools and services that will be further exploited jointly by the consortium partners or through internal sales process. The joint collaboration opportunities are further listed in Section 2.2.

Table 3 - SILVANUS technology readiness level metrics
SILVANUS Result Existing TRL, Target TRL and Remarks

³² <https://cordis.europa.eu/project/id/607768>

³³ <http://www.secricom.eu/>

³⁴ <http://ecopotential-project.eu>

Semantic framework for wildfire event models [current TRL: 6]: The knowledge formalisation of forest landscape management will incorporate an interdisciplinary approach with the involvement of various experts ranging from ecologists (TUZVO, UASVG, ASFOR, AUA), to citizen engagement experts (MDS, HB, UISAV) and technology providers (TRT, ITTI, FINC). The semantic representation framework will extend upon the existing services to model the threat of fire danger index and the events corresponding to the fire ignition resulting from accidental ignition, arson, environmental conditions, and weather patterns. The definition of the knowledge model will also support instantiation services customised across the different forest models commonly adopted globally (as identified in Section 1) The knowledge model definition will be led by CTL through the support of stakeholder consultation. [Target TRL: 8].

Fire danger index computational framework [current TRL: 5]: The computation of fire danger index based on the ecological and environmental impact assessment will be delivered through a computational framework that considers the impact of seasonal weather patterns. The computation and evaluation of the fire danger index is an ongoing research study with results validated in a regional forest environment. However, the lack of a global tool and solution that is customisable for the respective forest models being adopted will be addressed by SILVANUS. The interdisciplinary activity will be collaboratively addressed between the stakeholders (TUZVO, ASFOR, AUA, ADP, LETS, ASSET) with technology providers (CMCC, ITTI, FINC, INTRA). The activity will be led by ASSET. [Target TRL: 7]

Training platform for fire fighters [current TRL: 5]: The SILVANUS project will develop an intuitive training platform that will evaluate the preparedness of first responders in combating wildfires. The platform will provide first responders with the ability to design and apply decision policies in the context of emergency management scenarios. The platform can be assumed as a general disaster/crisis mitigation system in the big data era based on cooperation of large-scale, high-resolution, real-time simulations and assimilation of real-time observation data. Building on the existing AR/VR platform, the scenario definition based on the common occurrences of wildfires and the dynamic behaviour of wildfire spread will be curated within virtual platform. The creation of intuitive training platform will result from stakeholder engagement carried out with SGPS, PUI, FRB-MSR, PLAME and SMURD. SIMAVI, with support from EXUS will lead the activity on content curation. Additionally, the first responders will also be trained on the usage of SILVANUS technology platform in identifying threat levels, deploying resources to mitigate the ignition and achieve response coordination between mobile command centres that have been deployed during the pilot trials. [Target TRL: 8]

Citizen engagement toolkit [current TRL: 5]: The prevention strategies adopted within the SILVANUS will develop a citizen engagement toolkit (a mobile application) that is released in the respective application store. The application will support stakeholder consultation with EU citizens and global community visiting regional sites to follow safety regulations as prescribed by regional authorities. HB will lead the activity on methodology development for the stakeholder consultation, while the application will be developed by MDS and UISAV, which will integrate its EmerPoll platform to the citizens engagement toolkit. Additionally, the evaluation of the application will be carried out the first responders (HRT, FRB-MSR, SGSP, ASFOR, HVZ) during the pilot demonstration activities. The current methodology and the associated mobile application currently validated in a laboratory environment will be further extended to be evaluated as a complete and qualified system [Target TRL: 8].

Wireless sensor network for early-stage wildfire ignition detection [current TRL: 6]: The current deployment of the wireless sensors has been demonstrated successfully in relevant industrial environment by ASSETS, ASFOR, HVZ. However, the environmental monitoring toolkit developed and provided by CMCC will be further made available to pilot demonstration sites and thus will enable a higher degree of accuracy and reliability in the detection of environmental measurements for the presence of toxic substance leading to the early-stage detection of forest fires. Complementing the wireless sensor deployment, DELL, ATOS and FINC will provide data analytics solution for processing the input stream of measurements and generate respective alerts to notify the command and control centre. The result of the operational component will be demonstrated in an industrial environment. [Target TRL: 8]

Wireless communication using SDR [current TRL: 6]: RINI and WUT have long-standing expertise in the development of wireless communication infrastructure. The technology is based on the recent popularity of using software defined radio (SDR) systems, which enables dynamic configuration of the system operation with the ability to control the frequency spectrum upon which the radio infrastructure should operate. Thus, building on their current expertise, the activities within SILVANUS will further enhance the robustness of the system to be operational beyond line of sight upon being deployed on UAVs. The outcome of the activity will result in auto-configuration among swarm of drones to establish an on-demand wireless communication network, which will

facilitate coordination among ground personnel and extend the service to public in the absence of commercial communication infrastructure due to wildfire. The technology, currently demonstrated in a relevant industrial environment, will be further enhanced to become complete and qualified. [Target TRL: 8]

Surveillance deployment using UAVs and UGVs [current TRL: 4]: The use of drones has gained popularity over the years to gain intelligence from remote locations. The application of drones within the scope of combating wildfires, has been widely addressed in the market with several tools and solutions currently available. However, the need to establish visual line of sight makes the range of these drones limited to few hundred meters. Addressing this challenge, the development of SILVANUS will include (i) the autonomous configuration of drones for a fixed path independent navigation; (ii) coordination of geo-localisation with ground vehicles (UGVs) and (iii) communication interface with the wireless sensor network developed in the project. These additional features and novel functionalities are complemented with the integration of new sensor devices and equipment. The drones will be equipped with multi-sensor devices with the ability to capture thermal, IR and other visual spectrum frequencies. TRT will lead the activity on autonomous drone flights with ATOS, VMG offering support for on-board data analytics. [Target TRL: 7]

Edge data analytics toolkit [current TRL: 5]: Computational latency is a challenge to be addressed in order to deliver real-time response required to model the dynamic behaviour of wildfire. Thus, the edge data analytics toolkit developed in the project led by DELL will enable computational processing of information sources at the edge. Additionally, ATOS, VMG and CTL will provide support for the development of low-latency computational units capable of extracting knowledge from the continuous stream of information. The edge data analytics will support data streams generated from IoT and wearable devices and offer real-time situational assessment to the command and control centre. Using the toolkit several difficulties such as transmission latency, bandwidth constraints and high-energy consumption will be handled by driving the computing power near or at the source of data (edges). Sophisticated artificial intelligence algorithms will be performed in the resource-constrained edge devices for energy-efficient processing at the edge, as well as optimal distribution of resources and tasks along the edge-could continuum. The edge components will be integrated within the UAVs and UGVs to ensure the safety of fire fighters by increasing the distance to the front line. The technology validated in an industrial environment will be subsequently demonstrated as a system prototype during the pilot demonstration. [Target TRL: 7]

Command and Control centre for crisis management [current TRL: 4]: The development of command and control centre (C2C) will be led by INTRA, supported by FINC, RINI and EXUS. 3MON will support the development with integration of its GINA dispatch system. FRB MSR will deliver Integrated Security Centre of Moravian Silensian Region (ISCMSR). The C2C will offer the stakeholders the holistic functionalities extending from Phase A – threat level assessment to Phase B – detection and response coordination to Phase C – forest restoration and adaptation activities. The multi-stakeholder interface will deliver an interactive platform that will adopt cutting-edge industrial solutions for complex system integration. The C2C will be able to directly interface with the distributed deployment of wireless sensors and ingest diverse data sources as outlined in **Figure 5**. Additionally, the platform will also provide real-time support for response coordination between the frontline personnel and mobile command centres being deployed across vast distances. The wireless communication network configured via SDR will be used to exchange coordination messages. While several C2C solutions exist, the platform will be customised to address the use-case scenarios identified within the SILVANUS project. The outcome will be demonstrated as a fully qualified system prototype. [Target TRL: 7].

Forest landscape management platform [current TRL: 4]: The current availability of forest landscape management solutions in the market are limited in scope and lack the features for customisation. Thus, the product development carried out within SILVANUS will address stakeholder needs and requirements. The technical development of the platform will be led by FINC, with the end-user's functionalities being evaluated by LETS, ASSET, UASVG and TUZVO. The outcome will be demonstrated as a fully qualified system applicable across eight (8) EU member countries participating in the consortium. [Target TRL: 7]

Decision support system for rehabilitation strategy [current TRL: 4]: The development of the decision support system enables the implementation of a rehabilitation strategy to be adopted by regional authorities and governmental agencies. Observation data, as well as risk factors, risk thresholds and risk response strategies, obtained from the risk assessment and risk control processes that will be followed in the project, will be combined for applying human in the loop artificial intelligent approaches. These approaches will combine artificial intelligence methods (e.g., evolutionary fuzzy sets) with expert opinions to determine and provide optimal recommendations

and action plan. In addition to this, by defining several qualitative and quantitative criteria the potential recommendations/actions will be evaluated in a multi-criteria decision analysis and scoring context so as to rank them. Ranked actions will help first responders to apply a risk-based prioritization plan and solve resource allocation optimization problems subject to limited assets. The decision to support the nature-based rehabilitation should also consider the environmental impact and the ecological impact assessment along with biodiversity balance. Thus, the complex multi-stakeholder consideration will be led by AUA with focus on protecting the agricultural sector through targeted measures being put in place. Additionally, ASFOR, EDP will contribute to the finalisation of the decision support system strategy. [Target TRL: 7]

1.3.5 Gender Analysis

The consortium acknowledges the “gender issue” as stated in the EU regulation 1291/2013 as of 11. December 2013 establishing Horizon 2020 and supports the objectives of the framework programme on: a) Gender balance in research teams, b) Gender balance in decision-making and c) Integrating gender-sex analysis in R&I content. The Institutions involved in the project are committed to encouraging equal opportunities of career among women and men in their staff according to national and European laws and corporate ethical code. The project addresses women’s needs, as much as men’s needs. Women partners are well involved in the project. The partners will promote gender equality within the frame of the project, addressing the European Commission goal of reaching a 40% participation of women at all levels, in implementing and managing research programmes. In particular, the General Assembly, which is in charge of monitoring the progress of the overall project, will also have the task of:

- Adopting the appropriate measures encouraging women’s participation in the management of the project, in order to achieve a balanced representation
- Solving any gender-related issue.
- Supporting the implementation of the recommendations produced by the European Technology Assessment Network (ETAN) as well as by the “Helsinki Group” on the development and production of statistics and indicators, about the situation of women in scientific research.

SILVANUS is, in general, gender-neutral, because the same requirements for audience measurement will apply for both genders without any reason to discriminate them. Nevertheless, an attention in all the phases of the project will be paid to gender-related issues that will be considered while investigating scenarios and user needs. For example, preferences for certain means of transport may vary according to the end user characteristics and may be biased towards the sex or the gender of the subject

1.4 Ambition

In this section, a summary of SILVANUS ambition is presented that clearly highlights the scientific innovation to be carried out within the project. Each proposed innovation is categorised into different thematic groups and associated innovations to be achieved are highlighted.

Field of study: Wildfire spread models and risk index	
Current state of the art	A comprehensive definition of wildfire risk entails assessment of two key components ³⁴ —(i) probability of a wildfire event, and (ii) susceptibility of highly valued resources and assets to wildfire [10]. Under the framework devised in this study, community risk is reclassified into three stages of wildfire—(i) probability of wildland ignition ($P(Z(t))$), (ii) probability of wildfire that started in wildland to reach a specific WUI ($P(Y(t) Z(t))$), and (iii) susceptibility of community provided that a wildfire reached the WUI ($P(X(t) Y(t))$). Susceptibility of a community can be defined as the mean probability of fire reaching a house and causing ignition from the boundary of surrounding Wildland-Urban Interface (WUI). Therefore, the risk can be defined as the mean probability of fire reaching a house from the initial ignition point in the wildlands. The general definition of risk for any hazard is characterized by three components—(i) hazard, which is defined as the temporal probability of occurrence for a hazard of a particular intensity, (ii) vulnerability, which is defined as the degree of exposure, and (iii) amount of elements at risk, which is the quantification of exposed elements.
SILVANUS innovation	improve model predictions of wind-driven fires through highly porous fuels, wind-driven convection inside the fuel bed is included in the model. The second enhancement concerns the calculation of flame radiation during fire spread. Although it provides high accuracy, this calculation requires a large number of computational resources, which is incompatible with the operational needs of fire and land management services. In order to run real-time fire spread simulations, radiation calculation is thus performed using a precomputed database of view factors (VF) from the flame to the fuel surface for a wide variety of flame properties and environment conditions

Field of study: Statistical fire models	
Current state of the art	Fire models are used to adjust the measurements, to find fire boundaries and to describe the fire behaviour. Simple models use an elliptic shape fitted to fire, where each ellipse axis increases at some given rate. Other models can be very complex depending on the considered variables. Such models try to estimate the Rate Of Spread (ROS) of the fire based on wind speed and direction, terrain slopes, vegetation density, weather and other variables. <i>Weather</i> includes wind, temperature, cloudiness, moisture, and air pressure. High temperatures and low humidity cause vegetation to dry and wildfires to burn rapidly
SILVA-NUS innovation	Development of 3D visualisation layout of forest landscape model to emulate the spread of wildfire under varying degree of climatic conditions and develop scenarios for the preparedness and prevention activities within the project. Topographic modelling of forest landscape with physical features of an area, including slope and aspect (the direction it faces). Evaluation of wildfires burn rate across physical structures. Modelling of weather patterns across landscape plane to study the speed of spread. Consideration of different geometrical structures such as draws, which can act like chimneys and funnel flames upwards. Modelling of Fuels as vegetation and structures. The study of their impact on wildfire behaviour.
Field of study: Sensor technologies in fire detection	
Current state of the art	Remote sensing has been successfully applied in all stages of the fire disturbance continuum for several decades. Success stories include fuel type mapping (Marino et al., 2016; Mitri and Gitas, 2006; Peterson et al., 2013; Roberts et al., 2003), fire risk assessments, active fire detection (Giglio et al., 2003; Schroeder et al., 2014), burned area mapping (Barbosa et al., 1999; Giglio et al., 2009; Gitas et al., 2008; Katagis et al., 2014; Koutsias and Karteris, 2000; Pereira, 2003; Roy et al., 2005), fire/burn severity assessments (Eidenshink et al., 2007; Meng et al., 2017; Veraverbeke et al., 2010), and vegetation recovery mapping (Veraverbeke et al., 2012a).
SILVA-NUS innovation	Integration of advanced sensing systems upon the UAVs and UGVs. The new sensor system integration will include broadband multispectral remote sensing solutions capable of simultaneous acquisition of calibrated radiance units in a limited number (generally in the order between three and 15) of non-contiguous broad (generally wider than 20 nm) spectral bands. The effectiveness of narrowband hyperspectral remote sensing will also be studied by simultaneous acquisition of calibrated radiance in many (generally more than 100) narrow (generally 20 nm or smaller) spectrally contiguous bands. The UAVs and UGVs will be equipped with low-power onboard data analytics components capable of processing continuous input stream of data sources (including media data)
Field of study: Wireless communication, MESH in the sky	
Current state of the art	UAV data links for both civilian and military UAVs is the Coded Orthogonal Frequency Division Multiplexing (COFDM) waveform which can be described as multi-carrier modulation providing high bandwidth efficiency [Drury,2000]. COFDM provides superior performance in multi-path and fading channels and is incorporated in a number of international standards (DVB-T2, IEEE802.11,3GPP, to name a few). COFDM is also widely used for providing ad-hoc ground mesh network capabilities and downlink video streaming from UAVs
SILVA-NUS innovation	The SDR based systems are used on large UAV's, however there is nothing currently in the market applicable to medium sized UAV's that can be used in the identified military scenarios. Waveforms proposed for 5G systems are not directly applicable to UAV downlink systems. The proposed SILVA-NUS system will be burst based, meaning the amplifier will need to be switched on only when there is data. This requires the RF board interfacing with FPGA to switch at the right time – this ultimately gives a power saving over continuous transmission when PA is always on. These unique features will allow dramatic saving on power consumption and, increase in flight time of UAVs

In addition to the above list of innovations, two key scientific contributions are elaborated in detail as below.

1.4.1 Information fusion and semantic technologies

State of the Art. The process of blending data from diverse and possibly heterogeneous sources by employing a data-centric architecture built upon a semantic model is known as **semantic data fusion** or **semantic data integration**. Semantic models are typically based on **RDF (Resource Description Framework)**, a W3C standard for knowledge representation on the Web that represents resources as subject-predicate-object triples. Depending on the project at hand, there are three main approaches in semantic data integration: (a) **Single ontology approach**, where

a single ontology is used as a global reference model; (b) **Multiple ontologies**, each of which is modelling an individual data source, used in combination for integration; (c) **Hybrid approaches**, where multiple ontologies are applied, subscribing to a common, top-level semantic model.

Innovation. Besides the usual challenges in semantic integration, SILVANUS also entails the additional ambition of deploying a multilingual command center prepared for cross-border events as well. In such an environment, using the same terminology (correct labels for correct concepts) is paramount, since, as historical evidence shows, linguistic misunderstandings can result in catastrophes³⁵. Capitalizing on previous work of ours in the domains of crisis management³⁶, e-health³⁷ and border surveillance³⁸ amongst other, we will deploy a scalable and holistic semantic integration framework that will take full advantage of state-of-the-art semantic technologies (in Figure 5)

The SILVANUS semantic model will serve as a robust terminological layer, accepting inputs either in the form of raw data (e.g. sensor measurements) or as results from analyzing raw data (e.g. identified events and/or objects detected by a computer vision module). The result of the semantic integration process is a semantic model populated with the input data that delivers a unified view of the available information to the end-user, and various applications can run on-top of the semantic model, like e.g. analytics, predictions, and rule-based decision support.

1.4.2 AI-based Risk Management in Decision Making

State of the Art: Artificial intelligence (AI) plays a crucial role in the transition of the decision-making from its traditional form to its intelligent form in which the focus is placed on managing big data and explaining the algorithmic decisions of AI-based solutions with non-technical terms in order to make these computer-based decisions and recommendations trusted and easily understandable by human-decision-makers³⁹. Risk management is closely related to decision-making. There is a two-way relationship between decision-making and risk management⁴⁰ On the one hand, rational decision-making is an important task in a risk management process. On the other hand, a risk management process in decision-making is an important step for better decision-making.

Innovation: A novel computational intelligence approach for risk management in decision-making will be designed to support the development of a multi-risk AI-based decision support system (MR-AI-DSS). The MR-AI-DSS will be based on cutting-edge artificial intelligence algorithms, swarm intelligence and evolutionary optimization methods to support (1) a risk assessment process for identifying threats, analyzing and prioritizing them, as well as (2) a risk control process for recommending appropriate treatment plans, monitoring and facilitating the decision-making process.

2 Impact

The SILVANUS methodologies, products and services are designed by heavily involving, stakeholders dealing with forest management or providing services for forest and landscape management. The innovation capacity of the project relies on the development and demonstration of the technology intervention to combat the spread of wildfire but also to protect and naturally rehabilitate the forest regions. From a commercial standpoint, forest land management market is an industrial sector, that supports construction, housing, pulp, paper, bioenergy, furniture and feature timbers among other sectors. In contrast to the industries supported by the goods, the forest land management encompasses various types of services such as investment services, appraisal and valuation services, technical services for due diligence, reforestation, wildlife management and recreational services. Addressing both the commercial interest and

³⁵ <https://www.jstor.org/stable/42581315?seq=1>

³⁶ <http://publica.fraunhofer.de/documents/N-506473.html>

³⁷ <https://www.igi-global.com/article/multi-sensing-monitoring-and-knowledge-driven-analysis-for-dementia-assessment/134012>

³⁸ <http://www.semantic-web-journal.net/content/eucise-owl-ontology-based-representation-common-information-sharing-environment-maritime>

³⁹ <https://www.mdpi.com/2079-9292/8/8/832>

⁴⁰ <http://www.jcreview.com/?mno=302645115>

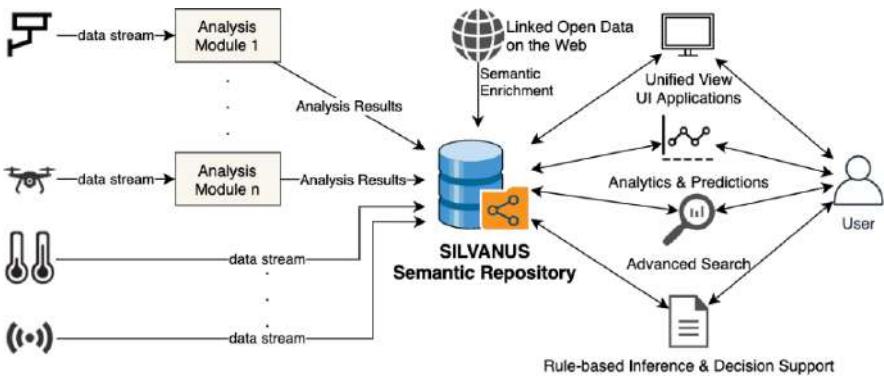


Figure 11 - Overview of the semantic integration process

the ecological balance to be maintained, the SILVANUS project has been conceived to deliver a balanced approach in the protection and restoration of forests.

2.1 Expected Impact

In addition to the general impacts on environmentally sustainable forest management services, SILVANUS project will also address the following expected impacts as outlined in the workprogramme. For each of the expected impact, the consortium has identified KPIs, target value and means of verification.

Table 4 - Expected impact, contributions and KPIs

Expected Impacts	
0 fatalities from wildfires	<p>As an IA project, SILVANUS will deliver an intervention solution for the end-users through effective engagement of stakeholders to promote fire prevention and fire safety both the first responders and the public. The effectiveness of adopted prevention strategies, the preparedness activities and the exercises carried out by the first responders using the latest AR/VR technologies for virtual training, but also real-life training will be monitored. Innovative use of social media communication and targeted dissemination of the communication messages will be developed by the project to achieve zero fatalities from wildfires. The use of advanced solutions such as UAVs, UGVs, communication mesh in the sky using swarm of drones, coordination among mobile command centres, use of advanced AI and machine learning algorithms, are conceived to ensure the project achieves 0 fatalities (for first responders and EU citizens) via the engagement platform and communication toolkit.</p>
Target value <ul style="list-style-type: none"> • No. of engaged citizens > 1000 • No. fire fighters trained > 50 • No. of scenarios > 10 	Means of verification: The SILVANUS project brings together a large collection of pilots carried out across eight (8) EU Countries and three (3) international organisations. Each pilot will be audited by external advisory board members, represented by experts listed in Section 3.2. The uniquely identified scenarios in the demonstration will be evaluated to achieve 0 fatalities from wildfires.
50% reduction in accidental fire ignitions	<p>The study of ecological impacts and environmental conditions will be used to identify the Fire Danger Index (FDI). The measurement of environmental attributes such as Air quality, amount of fuel available through seasonal changes and weather patterns will be promoted by the SILVANUS project. The methodologies and technologies adopted by the IA projects will be continuously assessed. The best practice recommendations will be published in the SILVANUS policy recommendation in collaboration with the CSA for adoption across Europe and globally.</p>
Target value <ul style="list-style-type: none"> • Accidental fire causes evaluated: 7 • Demonstration activities on accidental fire ignitions > 4 (Italy, Portugal, France, Indonesia, Romania) 	Means of verification: The demonstration reports will include data about the effectiveness of SILVANUS platform in preventing accidental fires. The methodology implemented for FDI computation and the quantification of natural fuel calculated from the field will be published for the community review.
55% reduction in emissions from wildfires	<p>The response coordination among firefighters for the accidental ignition of forest fire will be monitored and quantitative statistics will be produced within the technology impact assessment framework. The latency period of the fire ignition to the total amount of gas emissions resulting from the forest fire will be continually monitored. The deployment of technologies will be supported to ensure a reduction in the emission from wildfire. Fire suppression mechanisms adopted by the end-users will be evaluated for the performance efficiency and innovative solutions will be proposed such as condensed foam. The use of fire hydrants and the overall effectiveness of different materials leading to oxygen deprivation will be used. Evaluation of soil degradation from the lack of oxygen, which is consumed by the heat source and inadequate replenishment in the soil will also be analysed.</p>
Target value <ul style="list-style-type: none"> • Reduction in detection latency by 20% • Increase in response time coordination by 20% • Deployment of UAVs and UGVs to the front line for swift mitigation: 5 demonstrations (France, Italy, Greece, Romania, and Croatia) 	Means of verification: The demonstration activities carried out in response to the Phase B (detection and response) will be systematically coordinated. The improvements from the adoption of SILVANUS technology solutions will be further evaluated against legacy systems to compare and contrast between the amount of emissions due to the wildfire. The use of historical case-studies will also be exploited to evaluate the effectiveness of SILVANUS intervention. The emissions resulting from at least five (5) different categories will be evaluated across the pilots.
Control of any extreme and potentially harmful wildfire in less than 24 hours	<p>The SILVANUS platform envisages real-time distributed sensing solutions, citizen engagement toolkit, and social media content processing to ensure detection of fire ignitions and alerts at an early stage. The thoroughness in the training program and the swiftness in the deployment of remote sensing capabilities will deliver high engagement for the deployment of</p>

response coordination. Thus, the project will publish case-studies on the effectiveness of the platform for review by external experts supported by advisory board members and the CSA sister projects. The knowledge developed within SILVANUS will be shared as best practices for response coordination to control the spread of wildfires within a 24-hour time. Additionally, the deployment of innovative technologies and the associated training requirement for the first responders will also be considered in SILVANUS in the recommendations being submitted. The worst-case test scenarios will also be developed to emulate the dynamic behaviour of forest fire based on the changing weather and environmental conditions.

Target value	Means of verification: A detailed record of the different strategies adopted by the fire fighters and other stakeholders will be reported as a part of WP9 outcomes. The cross-cutting activities between Phase A, B and C will be used to evaluate the effectiveness of fire suppression systems. The use of helicopters, night-time inspection and the use of water bombs will be evaluated within the demonstration activities. The involvement of at least 2 external advisory board members will be encouraged along with experts represented in the CSA project.
50% of Natura 2000 protected areas to be fire-resilient	

The evaluation of forest models against the respective resilience will be published in the WP7 activities towards the recommendations on forest management. The project will investigate two main forms of forest resilience against fire will be evaluated namely (i) adaptive resilience and (ii) transformative resilience. Adaptive resilience to wildfire focuses on managing both the human-built and non-human environment in response to changing climate and fire regimes and decreasing wildfire risks and exposure of human communities. A transformative-resilience approach requires a profound shift in the human relationship with wildfire—one that embraces the dynamic and rapidly changing role of fire in social–ecological systems.

Target value: Phase C pilot demonstration for enhanced resilience across three (3) pilot locations	Means of verification: Key value indicators on soil degradation, moisture gradients, biomass reduction treatments and severity gradients will be published across the pilot demonstration sites.
50% reduction in building losses	

In addition to minimising the loss of life with zero fatalities, the dynamic modelling of forest fire spread will also be monitored to ensure damage to structural loss is also maintained at a minimum with at least 50% reduction. The technologies developed within SILVANUS will be shared with external experts to be objectively evaluated for the resource deployment that protects properties against fire damage. The decision support system algorithms will be evaluated to ensure the effective and efficient deployment of resources are carried out. The technology impact assessment and the data privacy regulatory compliance will be considered

Target value: Decision support system evaluated across eight (8) pilot demonstrations	Means of verification: Demonstration of phase B trials across regions as outlined in Section 1.3.3
90% of losses from wildfires insured	

The enhanced confidence in the use of technological intervention will yield confidence to the financial sector to ensure structure properties that are affected by forest fires. In consultation with the stakeholder, SILVANUS will promote methodologies on risk assessment for insurance.

Target value: Less than 5% deviation from the predicted fire behaviour against actual spread of wildfire	Means of verification: Pilot demonstration activities carried out across different geographic regions, as outlined in Section 1.3.3
25% increase in surface area of prescribed fire treatments at EU level	

Post fire rehabilitation strategies are vital to the natural growth of forests. SILVANUS global alliance will collectively evaluate the status of rehabilitation strategy and subsequently develop methodologies through the use of participatory processes that engages the local communities, public administrations and associated partners to promote rehabilitation

Target value: At least 3 Stakeholders consultation with advisory board members on fire-treatments	Means of verification: Phase C trials carried out for the rehabilitation of burnt area
“national climate change adaptation and disaster risk reduction strategies [...] related strategies;”	

The SILVANUS legal governance framework mode developed in consultation with the stakeholders and international cooperation will be used to promote EU policy on forestry management services.

Target value: Publication of 3 white papers on EU legal policy framework	Means of verification: Publication of white papers on the project website and promotion of policies through Centre for Adaptation Strategies and Development (CASD, WP10/T10.1) action.
“national guidelines and legislation on forest management planning [...] damaged forests and landscapes, etc;”	

The consortium is supported by WWF-Brazil, as a part of advisory board and thus will lead the discussion on nature conservation. The experiences from the rehabilitation of Amazonian forest, following the spread of wildfire will be analysed and used to promote strategies for protecting areas, natural habitats and restore damaged forests

Target value: Publication of at least 4 meetings minutes with advisory board members on forest restoration	Means of verification: Phase C trials will progressively implement the recommendations and demonstrate the effectiveness of conservation policies with evidence.
“European Forest Fire Information System (EFFIS) [...] System for Europe (FISE);”	
The project is committed to building a knowledge base that extends beyond the current classification of fire events. The evidence-based analysis of fire instances will be formalised with the help of ontologies. In addition, the historical analysis of case-studies from past fires will result in a large-collection of repositories of incidents and the lessons learnt. Supported by WWF-Brazil, the project will liaise with the global network of franchises to aggregate regional reports on fire instances.	
Target value: At least 10 years of historical records summarised from 4 continents	Means of verification: Publication of the analysis results
Union Civil Protection Mechanism (UCPM) and Emergency Response Coordination Centre (ERCC) ^[18] ;	
The strength of SILVANUS consortium relies on the expertise of building technology platforms for emergency services in the context of delivering disaster resilient services. The consortium will build on the existing and past collaboration to develop policies and recommendations that focus on the needs and requirements of fire fighters.	
Target value: Platform assessment report from 50 end-users	Means of verification: Publication of policy recommendation based on end-user evaluation
“Copernicus Emergency Management System (EMS) [...] Galileo Emergency Warning Service;”	
The project will interface with the EO repositories to build climate-sensitive forest models. The big-data processing framework developed in the project will facilitate granular prediction of weather patterns based on existing climate models.	
Target value: At least five (5) pilot demonstrations that utilise EO data repositories	Means of verification: Evaluation assessment of the demonstrations
“the planned Horizon Europe Mission on [...] Transformation - with a strong focus on citizens’ engagement;”	
The core building block of SILVANUS is the development of citizen engagement methodology supported by the mobile application. The consortium partners will liaise with CSA and advisory board members to promote the utilisation of citizen engagement application.	
Target value: At least 2500 downloads of the citizen engagement toolkit	Means of verification: Phase A trial reports from regional pilot demonstration (as outlined in Section 1.3.3)
“EU co-funded regional and interregional initiatives [...] infrastructures and units to prevent and fight wildfires;”	
The consortium includes international partners from Australia, Indonesia, and Brazil, that will contribute to the setup and sustainability of CASD (WP10/T10.1). The initiative will launch programs to promote the European commitment to climate change and combating against wildfires.	
Target value: At least 30 international experts from four (4) continents represented in the board of directors.	Means of verification: Meetings minutes published from the launch of initiative.
“at international policy level, the Sendai Framework [...] sustainable development efforts;”	
In collaboration with WWF-Brazil, the consortium will engage with the global network of WWF and promote policies for environmentally sustainable, disaster resilient framework.	
Target value: At least five (5) invited keynote talks at WWF conferences and co-located events	Means of verification: Video recording and participant list.
“international standardisation bodies [...] (IFAFRI) among others.”	
The SILVANUS project will publish the demonstration activity reports in events organised and co-located by IFAFRI. Several partners in the consortium are already members of Community of Users (CoU) for disaster resilient society network.	
Target value: At least four (4) case-studies reported in IFARI related events.	Means of verification: Publications available in open – access journals.

2.1.1 Market rationale for SILVANUS and expected impact at the economic level

The interdisciplinary conceptualisation of the project platform will directly impact the industrial sectors listed below. A detailed overview of the market analysis and in-depth review of market niche created by SILVANUS will be published within the lifecycle of the project activities. (a) Forest management product vendors; (b) IoT and environment sensing vendors; (c) Drone operators; (d) 3D visualisation market for forest landscape management; (e) Cloud operators; (f) Edge service providers; (g) Big-data analytics and others..

2.1.2 Expected impact beyond the workprogramme

The project is committed to sustain the international collaboration among the partners through the launch of a CASD initiative, which will be self-sustainable. The organisation setup of CASD will be formalised within the project, and will include representatives from advisory board members, project partners and external stakeholders. The vision of CASD is to bring together fragmented efforts from national and international organisations to build synergies, share

knowledge, experiences, and expertise among the community to address the challenges of wildfires. The diverse representation of international and European partners within the project provides an ideal platform to launch such an initiative. The SILVANUS project will also extend invitation to the European community of users and liaise with CSA project to build synergies with other projects.

2.1.3 The key SILVANUS strategic impacts and innovation capacity

The platform development will contribute to stimulate the enhanced employment opportunities, ranging from system design, installation, equipment manufacturing to the operation and maintenance. In other words, the project will create opportunities for employment of people with different skills from highly skilled jobs (such as data analytics, edge-enabled detectors, big-data system architects, cloud computing architects, and system designers), via medium-qualified ones (operation and maintenance) to the low-qualified jobs (detector installation, configuration, actuator system configuration). Moreover, many of these employment opportunities will be created locally using systematic knowledge transfer aggregated from the eight (8) national pilots organised in France, Portugal, Czechia, Slovakia, Romania, Croatia, Italy, and Greece. The strategically identified pilot scenario setup will ensure the resourcing of equipment are carried out locally to strengthen the value chain (distribution, planning, installation and maintenance) thus increasing the SME creation opportunities and accelerating the emergence of digital defence services for the efficient coordination of environmentally sustainable forest management services.

2.1.4 Contribution to relevant roadmaps

The SILVANUS partners will actively contribute to the climate emergency policies both at European and international recommendation with the support of advisory board members (WWF-Brazil, refer to Appendix A).

Partner	Network	Description
INTRA, ATOS, SIMAVI	BDVA, AI-OTI, etc	Participation in strategic meetings among partner organisations to promote climate change action
Stakeholders	Horizon Europe programme	Contribution to the following thematic categories <ul style="list-style-type: none"> • Adaptation to climate change including societal transformation • Climate – neutral and smart cities • Soil health and food
CTL, TRT, VMG	Community of Users	<ul style="list-style-type: none"> • Disaster resilient societies • Secure societies
All partners	The European Green Deal Roadmap	<ul style="list-style-type: none"> • Contribution to climate change policies • Resilient societies, roadmap on transferable skills and technologies. • Knowledge transfer partner setup through (CASP resulting from T10.1)
All partners	Horizon Europe	<ul style="list-style-type: none"> • Contribution to implementation strategy, through maximising impact, great transparency (refer to public deliverables), synergies with International organisations, digital transformation services for wider benefits.

2.1.5 Barriers, obstacles, and framework conditions

For the maximization of the impacts to be obtained, on the one hand it is essential to achieve the prognosis of wide adoption in the sector. With this purpose, partners will disseminate project results by different means, and they will encourage concerned stakeholders to review SILVANUS recommendations. This communication must be bi-directional. Information coming from external technology providers and stakeholders will serve to feed, align and review SILVANUS methodological and technological objectives throughout the whole project duration. The PEST analyses list the different factors that can affect the above-mentioned impacts.

P- POLITICAL: Major awareness of Governments is required to bring them up to implications at social level for the impact on implementing green policies that minimise carbon footprint. Since the global financial crisis, there is a **lack of investment from both public and private sectors** in the deployment of new system and solutions for enriching the combat against forest fires. An efficient communication of SILVANUS results, implemented in WP8, will increase the awareness on the Governments and Industry, to implement low cost and – **in line with the EC Green Deal - environment friendly solutions**.

E- ECONOMIC FACTORS: SILVANUS will promote the effectiveness of innovations developed in IA projects which depends on many systemic economic factors. Phase A outcomes will help in reducing costs preventing forest fires rather than acting a-posteriori. Barriers to the internal market and the **high fragmentation of the end-user needs and requirements** does not enable working on common solutions to new needs on a European scale. The variations of the stakeholder needs hinder the adoption of a common market solution released for detecting and mitigating forest fires. SILVANUS will adopt data privacy methodology both during developing and testing of the implemented solutions to overcome this barrier. Another important financial barrier such as the upfront costs of

implementing IA technologies must be considered. The solutions must be cost effective. Besides, currently there is a **lack of understanding of the amount of investment needed** to offset the risk and SILVANUS will address this in WP1.

S-SOCIAL FACTORS: EU citizens do not feel sufficiently informed on or prepared for, **the threats presented by forest fires**: human negligence still remains a critical factor, especially at the levels of increasing spread of wildfires. There are missing business cases, meaning that there are a limited number of examples where threats have been realised, and this has led some stakeholders to wonder if the investment is justified. SILVANUS will provide and analyse a **set of new scenarios** (to be further developed in WP2-WP8) to overcome this problem.

T-TECHNOLOGICAL FACTORS: Demand for highly **skilled staff** (data analysts, software architects, transport analyst) today far exceeds availability on the labour market. The European private sector is already facing serious shortages in this regard. 41% of EU enterprises that recruited or tried to recruit ICT specialists in 2017 reported **difficulties in filling vacancies**.

2.2 Measures to maximise impact

The SILVANUS dissemination concept lies in creating interactive communication channels between the target groups (refer to Section 2.2.1) and the project. SILVANUS has clearly identified the position of the project with respect to the current reality and has identified the target groups affected by each of the project developments. In this context, SILVANUS will adopt specific dissemination strategies to each target group in order to maximise impact. The SILVANUS consortium has developed a strategy to maximise the impact that relies on three fundamental pillars.

2.2.1 Dissemination strategies

Addressing the critical need of structured dissemination plan, SILVANUS will tailor the messages to the environmentally sustainable forest management stakeholders. The main steps of SILVANUS towards a successful dissemination strategy are the following (i) selecting the dissemination channels, messaging and timings per target group; (ii) involving and informing stakeholders, public-private partnership members; (iii) providing open access to scientific papers. To achieve the project objectives from a dissemination point of view, the dissemination and communication strategy will follow three phases: (a) raise awareness [M1-M18]; (b) diffuse knowledge [M19 – M30]; (c) intensify communication [M31-M42]. **Key dissemination events and activities:** In accordance with the dissemination strategy, outlined above, the activities to be undertaken during the project will include participation in events and activities of great impact in the academic communities, as well as industrial showcases.

Table 5. Dissemination activities

Partner	Main dissemination activities	Target audience
Stakeholders	(i) promotion of project activities among vendors (ii) product branding; (iii) presentation of the SILVANUS demonstration outcomes in industrial showcases	General public, forest management service providers, crisis management solution vendors
SMEs	(i) contribution to dissemination material content; (ii) facilitate engagement with a range of industrial stakeholders involving them in current work and potential future project work; (iii) participation in industry-related events; (iv) international conferences; (v) EU and national cluster representation	General public, industry, local communication organisations
Industry	(i) internal dissemination across several branches of the business; (ii) customers engagement with product enhancement; (iii) cloud service operators and data analytics; (iv) edge service providers	Business organisations, stakeholder groups from forest management services, forestry, biodiversity and ecological resilience programme, fire fighters
Academic	(i) publication in high-impact scientific journals and conferences on data analytics, signal processing, ecological studies, forest resilience management, situational awareness, crisis and disaster management services, (ii) contribution to dissemination material content; (iii) participation in competitions; (iv) demonstration to industrial partners and potential clients	Research community, industrial consumers of SILVANUS, hardware vendors, system integrators, venture capitalists, angel investors.

2.2.2 Communication strategy

The SILVANUS communication strategy will identify the methodologies to be adopted for delivering messages to target groups (pillar: **Stakeholder-centric**) to achieve the strategic goals. Apart from the categorisation according to the promoting green initiatives and safety awareness among citizens outlined in the previous section, different stakeholder groups will be identified, and the main target groups will be defined. To bring the right messages to the target groups a strategic approach is chosen and specific, measurable, attainable, relevant and time bound targets (pillar:

Stakeholder-centric) are determined. Specific core messages for the target groups will be developed and linked with suitable channels of communication. As each target audience has formal and informal channels of communication, it is also necessary to be aware of style and totality in communication (pillar: **engagement**).

SILVANUS consortium will ensure public confidence by focussing on communication activities on measures, which will foster communication in a tangible way, tailored to different audience groups specifics and background. The communication activities will be as interactive as possible to stimulate interest, focussing on results and targeting also local markets/communities in order to exploit existing business relationships or brand recognition. EU support on the research and innovation activities in accordance with the climate change commitment will be emphasised. The following table summarises the basic means of communication planned by SILVANUS.

ACTION	KPI	Measure
Whitepapers (business and/or scientific)	Case studies (including pros and cons), market research findings in relation to the project results in specific application domains	At least 4 whitepapers during the project's lifetime (with the main number towards the end of the project). MD will engage in external communication events.
Scientific publications	Number and venue of top (class 1) journals and conferences Peer reviewed publications in renowned journals presentations at major conferences and workshops in the targeted fields	To imprint ground-breaking research contributions to the field. At least <ul style="list-style-type: none"> • 6 per project year on average • 24 in total within the project lifecycle
Open access publications	Number and venue of top (class 1) journals and conferences	To make freely available recent key research on the SILVANUS project field. At least 75% of the scientific publications by the project are accessible free of charge and available either through an open access repository, the project website, or individual partner's websites
Organisation of knowledge transfer workshops	Number and prestige of organized workshops	8 workshops (co-organised) through the project lifecycle
Marketing collateral materials	Videos introducing the concept of the project and highlighting interim and results in a manner to grasp easily for the general public – provided through platforms like YouTube or Vimeo.	At least three videos: one at the beginning of the project (M5), a second one at PM18 following the release of SILVANUS platform, and one at the end of the project. The marketing materials will be distributed across Phase A, B and C trial demonstration
	Material (information sheets, post-cards etc.) for specific events	At least 8 additional pieces of material distributed to more than 250 persons
Collaboration action	Collaboration with EU, national or international projects, e.g. on use-cases, user-requirements and when possible by sharing or interchanging datasets.	At least 5 collaborative outcomes from each of the pilot deployment and validation.
Project website	Detailing the projects concept Providing in depth information on project results	150 unique visitors per day on average (increasing as the project is progressing)
	Referencing (or holding) project publications, providing links to additional resources	100 downloads or referrals per month on average (increasing as the project is progressing)
Social media channels	Twitter targeting the public	One post on average per week. 800 followers at the end of the project. All partners in the consortium will promote the project outcomes through open innovation days and company's own social network channels
	LinkedIn targeting the professional environment	One post on average per week, read by at least 300 people on average

Pilot demonstration activities	Public engagement programme to promote the outcome of SILVANUS project.	<ul style="list-style-type: none"> • 5 awareness workshops with 250 attendees (50 for each event) • 10 school events mainly in secondary schools with 300 students (minimum of 30 for each school) • 5 press conference with 50 attendees (10 for each) to spread all the best practices and result
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2.2.3 Exploitation strategy

The interdisciplinary design, development and delivery of SILVANUS platform will create a niche market encompassing the features and characteristics of a currently fragmented market. The competitor products available in the market are aimed at (i) fire suppression, which is expected to reach USD 31.55Billion by 2025 according to Zion Market Research⁴¹; (ii) fire protection system, which is expected to reach USD 98.85 Billion by 2025 according to Zion Market Research⁴²; (iii) firefighter drone market whose market estimated market is yet to be deterministically obtained. In contrast to these three markets focussed on delivering solutions for the fire detection, the scope of products and services available to public administration authorities is limited. In addition, the SILVANUS innovation outcomes also consider impact on remote sensing market; big-data analytics market and several others. Thus, through the envisaged demonstration activities, the project aims to create a niche market in which selected products/services, or both could be licensed and/or leased for a flexible duration of time. To this end, the consortium has already identified a broad scope of stakeholders extending beyond the scope of combating fire to include landscape management, biodiversity restoration methodology, citizen engagement and others. Each consortium partner is fully committed to exploiting the outcomes of the project within their national and regional market. Within the scope of the project, the consortium will undertake a market research survey to position the SILVANUS product that delivers value to multi-stakeholder end-users. The various stages of the market research to be undertaken within the project is outlined in Figure 12. The involvement of advisory board members will be further extended engage in public consultation. However, the consortium through iterative discussions during the proposal preparation, has already identified a set of products, services, software licencing opportunities to be leveraged in launching the product in the market. The rest of the section outlines a strategic overview for the joint exploitation roadmap agreed within the consortium.



Figure 12 - Market Research overview

⁴¹ <https://www.globenewswire.com/news-release/2019/04/24/1808732/0/en/Global-Fire-Suppression-Market-Will-Reach-USD-31-55-Billion-By-2025-Zion-Market-Research.html>

⁴² <https://www.globenewswire.com/news-release/2019/03/13/1752273/0/en/Global-Fire-Protection-System-Market-Will-Reach-USD-98-85-Billion-By-2025-Zion-Market-Research.html>

2.2.3.1 Joint exploitation strategy

The joint exploitation of the project results will be carried as formulated in the business canvas model (*Figure 13*). The overall scientific expertise for the development of data analytics components will be essentially provided by the academic partners. The platform architecture (outlined in Figure 4) is split into seven (7) main components, namely: (i) base product; (ii) vendor integration; (iii) SILVANUS products; (iv) Knowledge base; (v) software licensing and subscription services; (vi) IT management command centre; (vii) SILVANUS services. The module design of the SILVANUS platform will

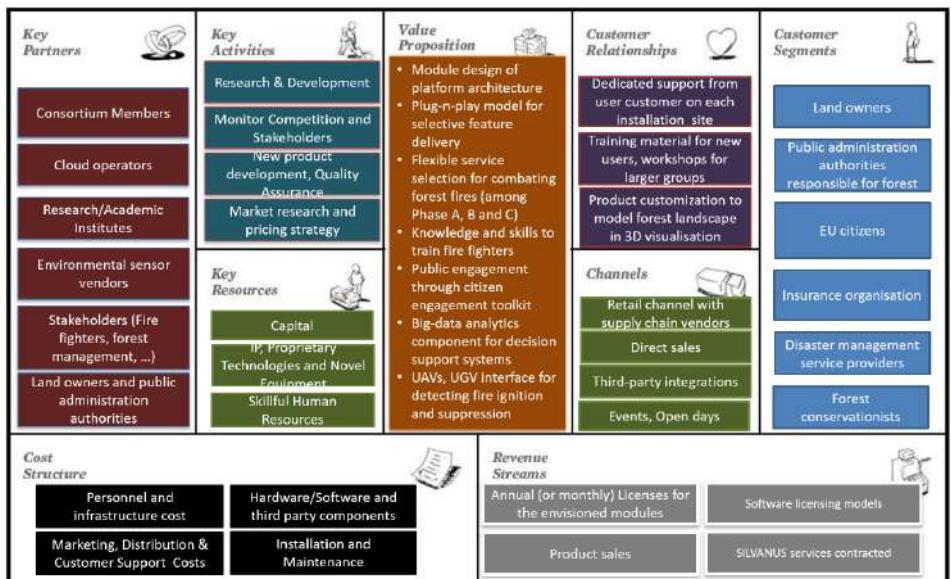


Figure 13 - Business model canvas

deliver support for individual vendor integration within the platform. The software components and services will be delivered on a subscription model to support the continuous maintenance and update of data analytics components. The main impact for the public administration authorities will include cost savings from the ecological damage delivered by the spread of wildfires. Since the current market for SILVANUS platform is fragmented, the consortium partners will develop a pricing strategy within the lifecycle of the project. In the following table, commercial market for SILVANUS exploitation products is identified along with path to exploitation.

Table 6 - Exploitation modalities, key partners, target groups and path to exploitation

Exploitation area	Partner	Target group	Path to exploitation
Vendor integration			
Environmental sensors	Technology providers	Device manufacturers, resellers, retailers, public administration authorities	System integration and support for ingesting environmental sensor data streams
Actuators (UAVs, UGVs)	Technology providers	Hardware manufacturers, command and control system operators, on-demand remote sensing service providers	System integration with vendors, high-tech SMEs, remote sensing organisations and high-tech companies
SILVANUS Products/Services – Phase A			
Training toolkit	Technology providers / scientific organisations / stakeholders	Stakeholders – fire fighters, protective gear manufacturers, disaster resilient service providers	Consultancy for skills training, curation of AR/VR content based on scenarios, historical case-studies.
Citizen engagement component	Technology providers / scientific organisations	EU citizens, international organisations on promoting fire safety, public administrations	Customisation of mobile application for international use.
Landscape models	Technology providers	Landowners, insurance organisations, public authorities	Consultancy services for visualising forest models and landscape management services
SILVANUS Products/Services – Phase B			
Licensing/subscription models for AI algorithms	Technology providers	High-tech organisations, cloud providers, edge analytics operators	End-user engagement for detection and response for wildfire ignition.
Integrated command centre	Technology providers	Stakeholder engagement	Demonstration of pilot outcomes. Patent protection on the algorithm associated procedure. Royalty exploitation.
SILVANUS Products/Services – Phase C			

Centre for adaptation strategies and development	All partners	Stakeholders	Participation in events organised within the project and promote awareness on the European commitment to climate change policy.
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In addition to the joint exploitation, every partner in the consortium has outlined an individual exploitation plan in Section 4. The individual exploitation categories include: (i) internal exploitation by industrial partners; (ii) IPR creation and product enhancements for SMEs; (iii) capacity building on innovative technologies for scientific and research organisations; (v) integration of SILVANUS solutions within their infrastructure by stakeholders. The consortium has carried out a SWOT analysis that encompasses the key features of SILVANUS platform development (Figure 14). The industrially led consortium, will engage with the internal business units to develop a sustainability model for the integrated platform along with commercial sale of individual products being developed in the project.

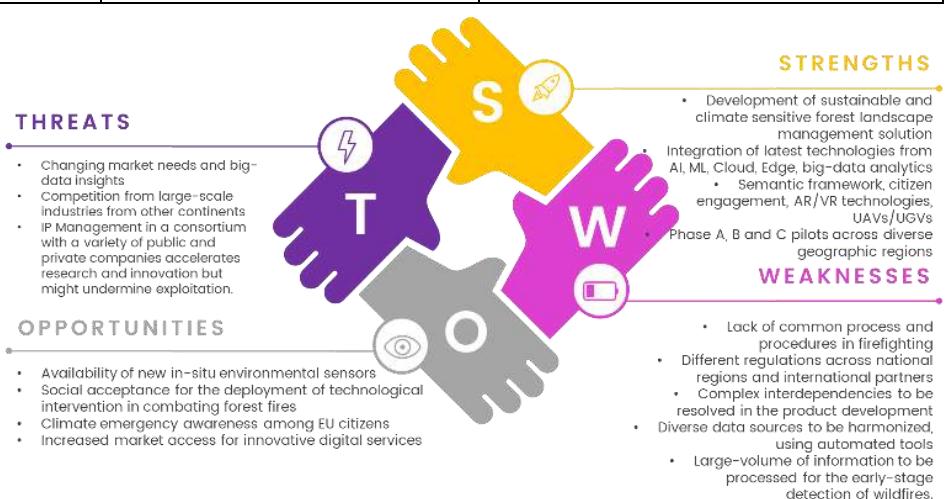


Figure 14 - SILVANUS SWOT analysis

2.2.4 Management of Knowledge and Intellectual Property Rights

The SILVANUS partners have even at this stage come to some preliminary agreements with regards to the management of knowledge and the management of IPRs, that are analysed below.

Management of Knowledge and contribution to Open Science: Given the potential sensitivity of some of the collected data, the access to the SILVANUS inventory will be regulated and not made of public use. The dissemination of the results of the research and the studies will be done via peer-reviewed research articles, published in academic journals (as detailed in 2.2.2). They will be published with open access (green access). Regarding publications, a self-archiving process will be followed. All partners will deposit publications stemming from the project into an organisation-based repository and will provide open access to these repositories within a period of no more than six (6) months. Open access publications will be also used when feasible (pillar: **openness**).

Management of IPR: For the success of the project, it is essential that all project partners agree on explicit rules concerning IP ownership, access rights to any Background and Results for the execution of the project, the protection of intellectual property rights (IPRs) and confidential information before the project starts. Therefore, such issues will be addressed in detail within the Consortium Agreement between all project partners.

Special emphasis within the project will be given to the management of knowledge and more importantly to the protection of IPRs, as well as to the management of ownership of the project results, following the main principles.

Ownership of Background Knowledge: To ensure a smooth execution of the project, in the Consortium Agreement the project partners will grant each other and their affiliated companies, royalty-free Access Rights to their Background and Results for the execution of the project. This will allow the researchers the possibility to execute the project to the best of their ability, without being hindered by administrative issues. The Consortium Agreement will define further details concerning the Access Rights for Exploitation to Background and Results. The general scope is to grant to the consortium partners responsible to produce foreground knowledge, all access rights to the background knowledge required both for the implementation of the project, and for the use of the background royalty-free. More specifically it is agreed that: 1) Access rights to the background knowledge (pre-existing know-how) necessary for the implementation of the project will be made available to the Consortium members royalty-free, 2) Access rights to the background knowledge for dissemination, research and academic purposes, shall be granted to the Consortium members royalty-free, 3) All IPRs of the background knowledge will always be retained by the corresponding consortium partners. Other consortium partners may request from the owning consortium partner a reasonable and non-discriminatory licence to utilise background knowledge for exploitation and commercial purposes.

Ownership of Foreground Knowledge: All partners will be able to utilise it for future dissemination, research & academic purposes on a royalty-free basis, while the commercial exploitation of the platform will be regulated by the exploitation plan that will be developed during the project.

Protection of Foreground Knowledge: Although the availability of legal protection for software has increased rapidly around the world over the past fifteen years, the scope and the feasibility of enforcement of that protection continues to vary significantly by country. In order to promote adequate and effective protection of intellectual property rights while ensuring that national laws enforcing such rights do not themselves become barriers to trade, protection of the foreground knowledge of the project will be based upon: 1) The Council Directive 91/250/EEC of 14 May 1991 on the legal protection of computer programs, 2) Directive 2009/24/EC of the European Parliament and of the Council of 23 April 2009 on the legal protection of computer programs, 3) Directive 96/9/EC of the European Parliament and of the Council of 11 March 1996 on the legal protection of databases, and 4) The WTO's Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS), taking into consideration all corresponding International Legal Protection for Software Policies.

Consortium Agreement: The purpose of the Consortium Agreement is to establish a legal framework for the project in order to provide clear regulations for issues within the consortium related to the work, IP-Ownership, Access Rights to Background and Results and any other matters of the consortium's interest.

2.2.5 Contribution to Standards and International activities

The SILVANUS partners are active members in several international standardisation bodies. The project outcomes will be promoted within in collaboration with the CSA project and other IA projects to achieve interoperability among the technologies developed. The scope of standardisation initiatives will be outlined and defied within the project lifecycle, following the completion of requirements analysis and assessment.

3 Implementation

3.1 Work Plan – Work Packages, Deliverables and Milestones

The SILVANUS workplan extends 42 months and the activities of the project are clustered into 10 work-packages for addressing the all the phases (A, B and C) of the project. The interdependency of the project activities is outlined in Figure 15. The technical activities of the project are grouped into four (4) main thematic structures, with WP2 focussed on the aggregation and consolidation of functional requirements of SILVANUS platform. The output of WP2 will be fed into the development of Phase A and B activities carried out in WP3, WP4 and WP5. The planning, preparedness and citizen engagement activities are grouped into WP3 (Phase A). Subsequently, the advanced detection and response coordination activities are grouped into WP4 and WP5. The post rehabilitation activities on forest restoration is carried out in WP6, followed by the development of policy recommendations in WP7.

The overall platform integration is carried out in WP8, while the large-scale demonstration activities are carried out in WP9. The overall project lifecycle is structured into two main sprint cycles. The demonstration activities are carried out from M12 to M42 as outlined in Section 1.3.2. The project activities will be continuously disseminated and communicated within the community of interdisciplinary stakeholders. The project gantt chart is also presented.

3.1.1 Table 3.1b: List of work packages

WP No	Work package Title	Lead Part. No	Lead Part. Short Name	Person Months	Start Month	End Month
1	Project coordination	1	PEGASO	205	1	42
2	Environmentally sustainable, resilient forest models and assessment framework	46	TUZVO	345	1	30
3	Culture of deterrence and prevention against wildfires based on sustainable forest management services	8	SIMAVI	395	3	36
4	Advanced detection capabilities for early-stage detection of wildfires	20	CMCC	399	3	36
5	Response coordination to contain the spread of wildfire	7	DELL	451	3	42
6	Enhanced resilience programme for forest management through restoration and adaptation	48	AMIKOM	224	1	42
7	Policy recommendations on environmental sustainability and forest restoration	26	AUA	233	1	42
8	Platform design specification, interfaces and integration	3	INTRA	314	3	42
9	Large-scale demonstration activities of project outcomes	38	ASFOR	515.5	12	42
10	Dissemination and exploitation	23	MD	360	1	42

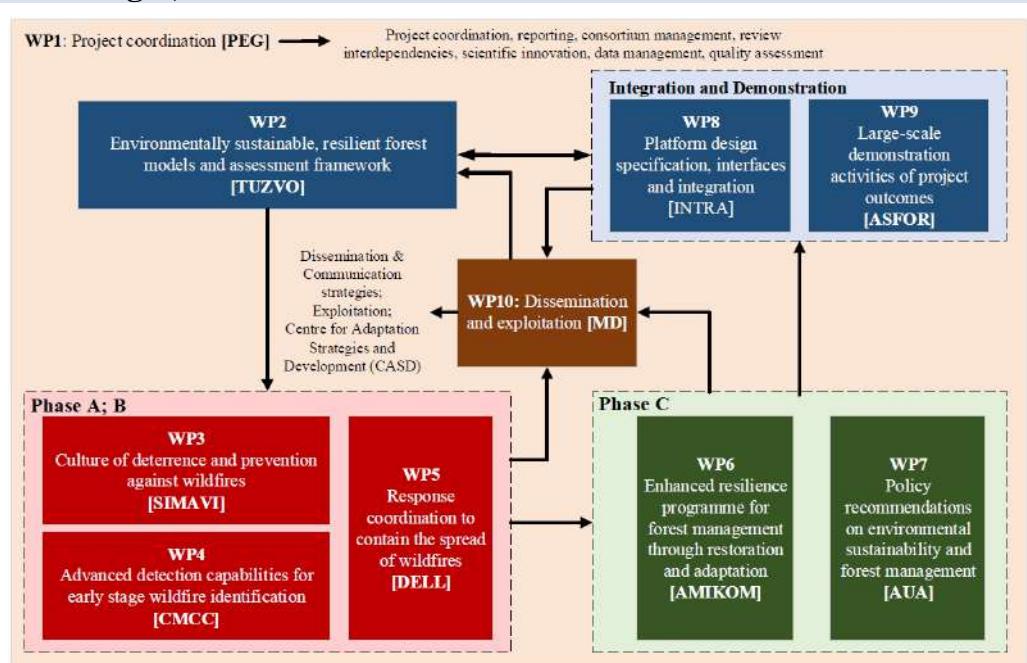


Figure 15 - SILVANUS WP interdependency

3441.5

WP No	Titles	Leader	Year 1						Year 2						Year 3						Year 4			
			M1-M3	M4-M6	M7-M9	M10-M12	M13-M15	M16-M18	M19-M21	M22-M24	M25-M27	M28-M30	M31-M33	M34-M36	M37-M39	M40-M42								
WP1	Project coordination	PEG																						
T1.1	Project management	PEG																						
T1.2	Innovation management and scientific coordination	Z&P																						
T1.3	Quality assurance and risk management	PEG																						
T1.4	Data management and ethics advisory board management	PEG																						
T1.5	IPR management	Z&P																						
T1.6	Management of external legal and ethical advisory board	KEMEA																						
WP Deliverables			♦	♦	♦													♦					♦	
WP2	Environmentally sustainable, resilient forest models	TUZVO																						
T2.1	Review of sustainable forest management services	TUZVO																						
T2.2	Functional requirements	TUZVO																						
T2.3	Forest landscape models for wildfire threat	AUA																						
T2.4	Climate sensitive forest models for forest management	CMCC																						
T2.5	Forest resilience from historical case studies	ASSET																						
T2.6	Assessment framework	LETS																						
WP Deliverables			♦	♦	♦													♦			♦			
WP3	Culture of deterrence and prevention against wildfires	SIMAVI																						
T3.1	Formalisation of sustainable and resilient forest mgmt	EAI																						
T3.2	Forest fire ignition models	SIMAVI																						
T3.3	Preparation and pre-planning activities for wildfire	SBPS																						
T3.4	AR/VR content curation for training fire fighters	SIMAVI																						
T3.5	Citizen engagement programme for preventing wildfires	HB																						
T3.6	Mobile application for citizen engagement	MDS																						
WP Deliverables				♦																			♦	
WP4	Advanced detection capabilities for wildfires	CMCC																						
T4.1	Data collection, aggregation and pre-processing of EO	DELL																						
T4.2	Tailored weather/climate models outputs for forest fire	CMCC																						
T4.3	Data collection, aggregation and pre-processing of in-situ	CTL																						
T4.4	Social media sensing and concept extraction	CERTH																						
T4.5	UGV monitoring for wildfire behaviour	CSIRO																						
T4.6	UAV deployment for remote sensing	TRT																						
WP Deliverables																		♦					♦	
WP5	Response coordination to contain the spread of wildfire	DELL																						
T5.1	Big-data analytics framework for situational awareness	DELL																						
T5.2	Semantic framework for information fusion	CTL																						
T5.3	Real-time monitoring of wildfire behaviour	CTL																						
T5.4	Data toolkit for decision support system	INTRA																						
T5.5	Wireless communication infrastructure using SDR	RINI																						
WP Deliverables																		♦			♦		♦	

Figure 16 - SILVANUS Gantt Chart (WP1-WP5)

Figure 17 - SILVANUS Gantt Chart (WP6-WP10)

3.2 Management Structure and Procedures

The SILVANUS project represents a group of organisations and individual experts who are experienced in coordinating and participating in large EU innovation projects. The project consortium therefore has formulated an unambiguous management structure, which provides clear form of communication between all the partners. To oversee the project development activities, the consortium has formulated key managerial responsibilities to be discharged by experts from reputed organisations. The rest of the section describes the overall SILVANUS project management, the decision-making structures to be applied, the communication flows within consort and the quality assurance measures that will be implemented. The methodology to be adopted to be compliance with legal and ethical obligations are also outlined.

3.2.1 Governance

The management structure of SILVANUS will ensure that (i) all members of the consortium will contribute to management; (ii) decision-making takes place efficiently; (iii) the project delivers the expected results on time and within budget; (iv) communication with the European Commission is streamlined; (v) disputes are effectively resolved; (vi) experts are actively involved in monitoring the project progress. The overall organisational structure is presented in Figure 18. SILVANUS will be overseen by the Steering Committee (SC), which will be responsible for formal decision, project monitoring, communication between partners and with the European Commission (EC), conflict resolution and overall fulfilment of contractual obligations.

The SC comprises of the Project administrative coordinator (PAC), Scientific, innovation coordinator (SIC) and Demonstration coordinator (DC), the exploitation and IP manager (E&IPM) and data protection manager (DPM) and a representative from each partner. To ensure effective and fair supervision of the project, the SC will take decisions based on consensus and majority vote, where the PAC and SIC will have the casting vote and each SC member with one vote. SC meetings will be called in association with technical meeting twice a year (Section 3.2.4 project meetings). Participation by full partners or their delegates is mandatory. In addition, one audio-conference will be organised per month for administrative and technical discussions. The partners internal project activities will be supervised and coordinated by their representative in the SC, while a local manager will oversee administrative and financial issues.

Prof. Luigi Moccia (Project administrative coordinator, PAC) from PEG has extensive experience in coordinating national and international research projects. PEG as the project coordinator, will have authority for the overall project administration, reporting both to the Steering Committee and the EC. The project administrative coordinator will also setup-up and head the Project Office which will be staffed also with administrative/financial personnel.

Dr. Davide Ferraro (Scientific, innovation coordinator SIC) from Z&P will be responsible for the scientific coordination of the project, planning and control of activities and preparation of deliverables, as well as collecting contributions from other partners participating in these tasks.

Mircea Segarceanu (Demonstration coordinator, DC) from ASFOR will lead the demonstration coordinator for the deployment of SILVANUS platform.

Dr. Francisco Gala (E&IPM) from ATOS will (i) investigate exploitation and innovation potential of project outcomes; (ii) examine IPR protection issues and develop a corresponding IPR protection plan; (iii) update the exploitation plan for the project technologies individually and as whole; (iv) monitor partners publications to avoid disclosure of confidential information or other sensitive data (v) communicate creation of exploitation options and IPR protection issues to the PAC and SC.

Dr. Galateia Kapellakou (DPM) from KEMEA will be responsible for the development of data protection plan and chair the external ethics advisory board.

WP Leaders (WPL): will be responsible for the monitoring of respective activities being carried out by partners contributing to the overall objective.

WP1	Michele Corleto (PEGASO)	WP6	Kusrini Kusrini (AMIKOM)
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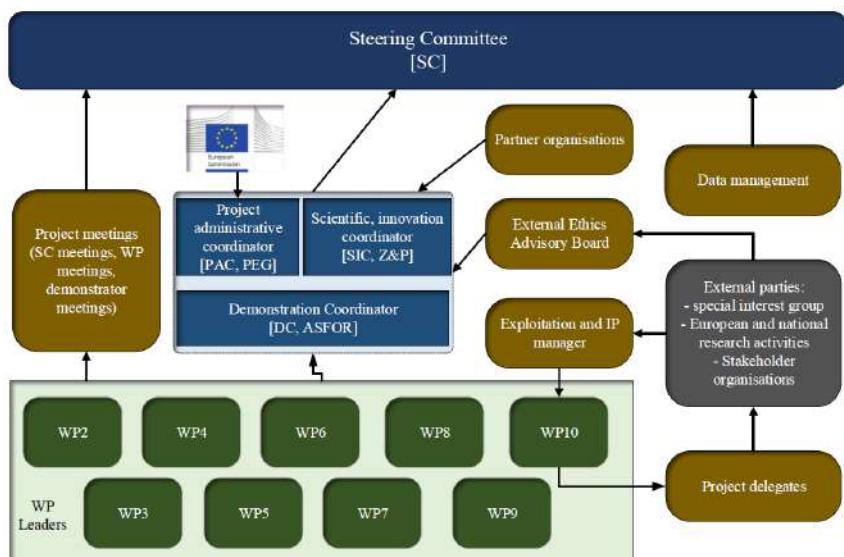


Figure 18 - SILVANUS management structure

WP2	Andrea Magjilingova (TUZVO)	WP7	Kostas Demestichas (AUA)
WP3	Monica Florea (SIMAVI)	WP8	Sofia Tsekeridou (INTRa)
WP4	Marco Mancini (CMCC F)	WP9	Mircea Segarceanu (ASFOR)
WP5	David Bowden (DELL)	WP10	Lovorko Maric (MD)

Advisory board: The project is supported by external advisory board members (refer to Appendix A for LoS). The following members' expertise across pan-European fire safety measures will be used to monitor and steer the project outcomes.

1. Drazen Jaksic, Director, Energetski Institut, Zagreb, Croatia
2. Egon Vasilic, Director, Ucka Nature Park Public Institution, Lovan, Croatia
3. Damir Trut, Civil Protection Directorate of the Ministry of the Interior of the Republic of Croatia, Velika Gorica, Croatia
4. Felipe Spina Avino, WWF Brazil, Brazil.
5. Stjepan Sucic, KONCAR, Power plant and Electric Traction Engineering, Zagreb, Croatia
6. Antonio Pinto Dias Rocha, Association of Municipalities of Cova da Beira, Belmonte, Portugal

The following additional members will be added to the advisory board, to represent the geo-graphical requirements of fire suppression from the Northern European countries representing the Baltic region.

7. Swedish Civil Contingencies Agency
8. Estonian Rescue Board
9. Estonian Academy of Security Sciences
10. Fire School in Wilno
11. Dutch representative to the EU Expert Group of Forest Fires
12. Finnish Meteorological Institute (FMI) <https://en.ilmatieteenlaitos.fi>
13. Firefighters in Denmark (FBBK)

A project management office (PMO) will provide support for daily administrative and coordination issues. It will be situated in the premises of PEG, leveraging its long-standing experience in project management and coordination. The PMO will (i) undertake administrative communication between the project partners and the EC; (ii) carry out budget monitoring and transfer of funds to partners; (iii) oversee the timely preparation and submission of project reports, deliverables, cost statements and (v) manage contract-related matters (GA amendments, CA, etc). The SC will contain, apart from the regular members of the Consortium, several affiliated users. It will be run by a committee chaired by Z&P, with representatives of all partners and affiliated members. It will be responsible for building relations with external, non-partner user groups, such as potential customers or representatives of related projects who can be likely users of the SILVANUS results. Reporting and Communication. The organisation of the project in 10 WPs is designed to carry out the work and produce early results in the most effective manner possible. Work packages will have regular planned teleconferences and meetings; WP teams will meet periodically to check progress and cross-WP meeting and working groups will be planned as needed according to SILVANUS needs and workplan. SILVANUS will put in place necessary communication mechanisms supporting the project structure including but not limited to document repository, effort reporting, address book of partners, assignment of document reviewers etc. and collaboration tools such as wiki, blog and forges. As part of communications management activities, SILVANUS strategy will set out KPIs to measure progress, monitoring and reporting and re-planning to adjust workplan.

3.2.2 Decision Making and Conflict Management

In general, it is expected that the procedures derived from overall ongoing and coordinating tasks will be followed by each WPL and the conflicts will be solved bilaterally. In the exception circumstances when conflicts cannot be solved on WP level, the TMC may be called by the respective WP Leader and asked to resolve the conflict. Any conflicts that cannot be resolved through the principles above will be handled according to the dispute resolution provision set forth in the Consortium Agreement. This procedure will be described in more details in the Consortium Agreement (CA), which along with the Contract, will constitute the basis upon which the project will be managed. To cover legal issues related to roles and responsibilities of the project participants, project management, ownership, commercial rights, exploitation, dissemination of the project results, confidentiality and intellectual property rights (IPR), a Consortium Agreement (CA) will be signed before the beginning of the project by each partner. The specific provisions will comply with general rules set out in the contract proposed by the European Commission.

3.2.3 Project Meetings

The project partners will meet on a regular basis as envisaged in the table below. To guarantee a smoother and more efficient start-up of the project, the first meetings will be organised in person, to foster expedited development of the SILVANUS scientific framework. The following meetings are planned within the duration of the project lifespan:

Meeting purpose	Estimated date	Host (Partner)
General assembly	Every 6 months	Z&P, TUZVO, SIMAVI, CMCC F, DELL, AUA, ASFOR
Remote teleconference	Monthly	Z&P

The above meetings will be co-located with each other to reduce the overheads and in addition to the above meetings, regular meetings using teleconferencing systems will be further used. Also, additional meetings will be called as and when necessary based on the unanimous consensus of the steering board members.

3.2.4 Quality monitoring

The project management system will be defined in D1.1, which will be the top document for project management purposes to ensure the best quality of results. The plan will set out the organisation for project management and define the key criteria for planning and control of the technical work, the budget and the programme. This management handbook will be practical guideline to facilitate the management of the project for all participants. It will detail and explain all contractual rules and management procedures. It will provide useful advice and management tools, which will help project participants to do what is required in due form and in due time. The following table summarised the major milestones which will be used to evaluate the success of SILVANUS.

3.3 Consortium as a Whole

The SILVANUS consortium consists of 50 partners from 18 countries as presented in Figure 19. All partners have exemplary track record of high-impact innovation in technical and scientific research required to achieve the project objectives. The composition of the consortium has been considered to offer complementary skill sets among the partners to collaboratively develop the environmentally sustainable forest management platform. The various scenarios developed for modelling the cause of wildfire ignition and subsequent factors influencing the spread of the wildfire will be analysed in detail across different pilot demonstration activities planned within the project. **Complementary and role of partners.** The SILVANUS consortium has been carefully selected to incorporate the necessary interdisciplinary expertise to complement the industrial strength to achieve the project objectives. The consortium contains a broad scope of expertise and technical knowledge in the analysis of climate pattern, IoT devices and edge sensing, cloud computing, ecological and biodiversity resilience, fire suppression systems and big-data analytics. A detailed overview of each partner specific contribution to the workplan is outlined in Section 4.1



Figure 19 - SILVANUS consortium map

3.4 Resources to be committed

3.4.1 Other direct costs

A total of 2.8% of project resources are allocated to the pilot demonstration owners for equipment and consumables. In complementary, a total of 5.2% is allocated for travel to facilitate collaboration among national, European, and International partners. Additionally, funding is also allocated to support the collaboration with advisory board members representing eminent organisations such as WWF-Brazil, leading experts on post-fire rehabilitation and forest conservation.

P1. PEGASO	Cost	Justification
Travel	€60,000	<p>Support for advisory board, GA, conferences, and workshops</p> <p>Participation in 7 general assembly meeting by the coordinator and the PMO and 2 review meeting in M18 and M42.</p> <p>Support for 20 external advisory board members to be invited to join the project GA.</p>

Audit cost	€6,000	Allocated for the preparation of financial statements
Total	€66,000	
P11.TP	Cost	Justification
Consumables/ equipment	€20,000	<p>The following equipment will be used in the Phase A trial of the project activity</p> <ul style="list-style-type: none"> • Procurement of autonomous drones with pre-configured flight path = €10,000 (2 units @ €5,000.00) • Computing infrastructure for platform installation = €5,500 (1 unit of high-end GPU PC @ €5,500.00) • Storage system = €4,500.00 (3 units of 4TB @ €1,500.00 each)
Travel	€30,000	Support for participation in GA and pilot demonstrations. 2 personnel to attend 7 project GA and 2 Review meetings. The Phase A trial will be hosted by TP for national and international visitors represented in the external advisory board of the SILVANUS project.
Total	€50,000	
P13.3MON	Cost	Justification
Consumables/ equipment	€65,000	<p>Use of UAVs and UGVs for the pilot demonstration in Slovakia</p> <ul style="list-style-type: none"> • SW - GINA CENTRAL = €15, 600 (to be licenced for 24 months 1 unit @ €650.00) • SW - GINA TABLET = €8,400 (to be licensed for 24 months 2 units @ €175.00) • SW - GINA GO = €2, 700 (to be licensed for 3 months 15 units @ €60) • UGV COLOSSUS Robot Rent = 12, 500 (to be leased for 5 months @ €2,500 per month) • Server or Hosting = €7, 500 (to be used for 40 months for data storage, processing) • UAV Drone DJI Mavic2 Ent. with thermo camera (or compatible) = €12,780 (to be rented for the Phase B trials which is compatible with GNA). • UAV Monoplane with camera = €5,520 (to be leaded for 2 months)
Travel	€17,000	Support for GA, pilot demonstrations. 19 personnel to attend seven project GA and Review meeting, national pilots and visit to France for the procurement of Robots.
Total	€82,000	
P28.IST	Cost	Justification
Travel	€35,000	Support for GA and pilot demonstrations. 2 personnel to attend 7 project GA and 2 Review meeting, 10 visits to national pilots and visit to other pilot sites (Italy, Slovakia, Czechia) for the Phase A trial evaluation.
Total	€35,000	
P33.SGSP	Cost	Justification
Consumables/ equipment	€15,000	<p>Fire fighter gear to be made available for Phase A and Phase B trials. The following equipment expenses have been envisaged for the usage within the project.</p> <ul style="list-style-type: none"> • Firefighting uniforms = € 3.000 (2 sets of special uniform including jackets, pants and gloves). • Firefighting vests = € 2.500 (2 sets of special vests to support firefighter in handling firefighting equipment during trial-related activities). • Firefighting helmets = € 500 (2 helmets to be completed with the uniforms and vests and be referenced to face masks).

		<ul style="list-style-type: none"> Drone = € 2.000 (1 UAV to support firefighters during trial-related activities and to monitor them from operational and safety perspectives). Face masks = € 2.000 (at least 3 types of face masks to be used during trial-related activities). Radio communicators = € 2.000 (2 radios for personal communication between firefighters during trial-related activities). Wildfire backpacks = € 3.000 (2 wildfire backpacks to support firefighter in handling firefighting equipment during trial-related activities).
Travel	€20,000	Support for GA, pilot demonstrations, workshops, conferences. A total of 7 project meetings will be participated by at least 2 personnel. Additionally, 5 members will attend the project review meeting and pilot demonstrations carried out in Italy.
Total	€35,000	
P34.ASSET	Cost	Justification
Consumables/ equipment	€114,000	<p>Phase B trials with the use of helicopter and water bombs for fire suppression.</p> <p>PIX4D mapper = €7,980.00 (software license of €3,990.00 for 2 units to be used for 1 month)</p> <p>Pix4D SURVEY = €3,360.00 (software license of €140.00 for 1 unit to be used for 24 months)</p> <p>Pix4D CAPTURE = €0.00</p> <p>Pix4D CLOUD Advanced = €5,208.00 (software license for 1 unit @ 217.00 to be used for 24 months).</p> <p>Pix4D MATIC = €7,368.00 (software licence for 1 unit @ €307.00 to be used for 23 months).</p> <p>Pix4D BIM N.B.: Pix4Dbim cloud is now Pix4Dcloud Advanced = €0.0</p> <p>AutoCAD = €8,500.00 (yearly licence for 2 unit @ €2,125.00 to be used for 2 months).</p> <p>3 External hard disk (2TB capacity ..) = €180.00 (3 units @ €60.00)</p> <p>Artificial targets for aerial photogrammetric survey (eg in PVC 80 × 80 cm) + installation elements = €500.00 (25 units @ €25.00)</p> <p>Anemometer, barometer, thermohygrometer for the evaluation and recording of environmental and meteorological conditions = €100.00 (25 units @ €20.00)</p> <p>Light meter and Colorimeter = €300.00 (1 unit @ €300.00)</p> <p>walkie talkie radio = €100.00 (1 unit @ €100.00)</p> <p>Safety helmet + DPI = €200.00 (1 unit @ €200.00)</p> <p>harness and climbing material = €300.00 (1 unit @ €300.00)</p> <p>laser meter = €250.00 (1 unit @ €250.00)</p> <p>Drone_SAPR + stabilized double-sensor and four-sensor cameras = €15,500 (1 unit @ €15,500)</p> <p>GIS platform, triple frequency GNSS antenna (e.g., Leica GS18 T) = €20,000.00 (1 unit @ €20,000.00)</p> <p>laptop (CPU Intel i7, 12 GB; e.g., HP DV6-7316EL) = €1,900 (2 units @ €950.00)</p> <p>desktop (Intel i7, 16 GB; e.g., Dell 3240 compact) + 24" monitor (e.g., Samsung Monitor SF35) = €2,200 (2 units @ €1,100.00)</p> <p>Mouse, headset = €94.00 (2 units @ €47.00)</p> <p>Multifunction laser printer (e.g., Kyocera Taskalfa 5053ci bundle) = €10,000.00 (2 units @ €5,000.00)</p>
Travel	€35,000	Support for GA, pilot demonstrations, workshops, conferences.

		A total of 12 events will be participated by ASSET which includes project GA to be organised by different WP leaders (as outlined in Section 3.2)
Audit cost	€6,000	Cost of financial statements.
Total	€155,000	
P36.PNRT	Cost	Justification
Consumables/ equipment	€10,000	<p>€ 1,000 Firefighting gear (there is no depreciation for this equipment)</p> <p>€ 3,000 Purchase of 6 laptops. (there is no depreciation for this equipment)</p> <p>€ 2,000 purchase of necessary software for laptops (there is no depreciation for this equipment)</p> <p>€ 3,000 Purchase of 2 GPS systems for topographic surveys. (depreciation is expected to take three years)</p> <p>€ 1,000 purchase of computer equipment (external hard disk, webcam, etc.) and office supplies (there is no depreciation for this equipment)</p>
Travel	€25,000	Each partner is supported with required support to enable participation in project meeting and stakeholder workshops
Total	€35,000	
P37.SMURD	Cost	Justification
Consumables/ equipment	€35,000	<p>Phase A and Phase B trial equipment. Use of AR/VR devices.</p> <p>Laptop VR €2500*1=€2500</p> <p>AR Hololens2 €4000*1 = €4000</p> <p>VR QUEST 2 ELITE STRAP WITH BATTERY AND CARRYING CASE €600*1= €600</p> <p>VR HMD Helmet €800*1=€800</p> <p>VR gloves €400*1=€400</p> <p>VR KAT WALK €1500*1=€1500</p> <p>wristband to monitor physiological signals in real-time €1800*1=€1800</p> <p>wildland firefighter lightweight costume €3000*2=€6000</p> <p>Forest Fire Protection Shelter €400*4=€1600</p> <p>Firefighting backpack, buy 20L Water Mist Fire Extinguisher Backpack €200*4=€800</p> <p>Drona DJI Phantom 4 pro V2.0 €2000*2=€4000</p> <p>shock resistant laptop €2000*2=€4000</p> <p>Flexible open tank €4000*1=€4000</p> <p>Fireline Plow €3000*1=€3000</p>
Travel	€25,000	Support for GA, pilot demonstrations, workshops, conferences. 5 project meetings (KoM, final conference, 3 yearly project meetings) + 3 dissemination events) * 2 people * €1562.5 per meeting
Total	€60,000	
P38.ASFOR	Cost	Justification
Consumables/ equipment	€35,000	<p>Phase A and Phase B trial component.</p> <ul style="list-style-type: none"> - Professional drone – €5.000 x 2 = €10.000 - Radio comm. equipment – €300 x 5 = €1.500 - Portable field equipment – €2.100 x 5 = €10.500 <ul style="list-style-type: none"> o Mountain backpack – €300 o Mountain boots – €400 o GPS – €250 o Axe/knife and multifunctional tool – €400 o Binoculars – €300 o Medical kit – €150 o Heat Scanner – €300 - Portable tablets for smart apps – €800 x 5 = €4.000 - ATV – €4.500 x 2 = €9.000
Travel	€25,000	Support for GA, pilot demonstrations, workshops, conferences.

Total	€60,000	
P40.HRT	Cost	Justification
Consumables/ equipment	€10,000	<p>Fire safety gear for Phase A trials. The following equipment expenses have been envisaged for the usage within the project.</p> <ul style="list-style-type: none"> • firefighting uniforms - €1.500 • firefighting vests - €1.000 • firefighting helmets - €1.500 • chainsaws - €500 • face masks - €500 • drone - €2.000 • Radio communicators - €1.000 • Wildfire backpacks - €2.000
Travel	€25,000	<p>Support for GA, pilot demonstrations, workshops, conferences. A total of 7 project meetings will be participated by at least 2 personnel. Additionally, 5 members will attend the project review meeting and pilot demonstrations carried out in Greece.</p>
Total	€35,000	
P43.PSTE	Cost	Justification
Consumables/ equipment	€10,000	<p>Soil sample analysis equipment for Phase C trials, Greece. VIS-MIR Spectroradiometer €4000.00 Drone €3500.00 Conductivity meter €500.00 Workstation €2000.00</p>
Travel	€25,000	<p>Support for GA, pilot demonstrations, workshops, conferences. Participation of 2 personnel for each of the seven GA and hosting of the Phase C trial in Greece.</p>
Total	€35,000	
P41.AHEPA	Cost	Justification
Consumables/ equipment	€5,000	<p>Wearable devices and diagnostics resources for monitoring the health condition of fire fighters. Example devices: ~5-10 Oximeters (e.g., Powertech PT-922) - they will be used in combination with oximeters present at smart watches ~15-20 Smart watches carrying multiple sensors like oximeter, blood pressure, heart rhythm monitoring, etc (e.g., Samsung watch3) ~1-2 Spirometers (e.g., MIR Spirobank II Smart)</p>
Travel	€30,000	<p>Support for GA, pilot demonstrations, workshops, conferences. A total of 7 project meetings will be participated by at least 2 personnel. Additionally, 5 members will attend the project review meeting and pilot demonstrations carried out in Greece.</p>
Total	€35,000	
P42.OIR	Cost	Justification
Travel	€20,000	<p>Support for GA, pilot demonstrations, workshops, conferences. A total of 7 project meetings will be participated by at least 2 personnel. Additionally, 5 members will attend the project review meeting and pilot demonstrations carried out in Italy.</p>
Total	€20,000	
P45.HVZ	Cost	Justification
Consumables/ equipment	€10,000	<p>Fire fighter protection gear for Phase A and B trials, Croatia. The following equipment expenses have been envisaged for the usage within the project.</p> <ul style="list-style-type: none"> • Laptop VR €2500*1 = €2,500 • AR Hololens2 €4000*1 = €4,000 • firefighting uniforms - €1,500

		<ul style="list-style-type: none"> • firefighting vests - €1,000 • Radio communicators - €1,000
Travel	€25,000	Support for GA, pilot demonstrations, workshops, conferences. A total of 7 project meetings will be participated by at least 2 personnel. Additionally, 5 members will attend the project review meeting and pilot demonstrations carried out in Croatia.
Total	€35,000	
P47.PLAM	Cost	Justification
Consumables/ equipment	€10,000	<p>Fire fighter protection gear for Phase A and B trials, Slovakia</p> <p>The following equipment expenses have been envisaged for the usage within the project.</p> <ul style="list-style-type: none"> • firefighting uniforms – €2.000 • firefighting vests – €1.500 • Drone - €2.500 • Face masks – €2.000 • Radio communicators - €1.000 • Wildfire backpacks - €2.000
Travel	€25,000	Support for GA, pilot demonstrations, workshops, conferences. Participation in 7 GA and 2 review meeting. Additional support for national pilot participation.
Total	€35,000	
P50.UFRJ	Cost	Justification
Consumables/ equipment	€20,000	<p>The following computational simulation software solution will be used to conduct the Phase A and B trial in Brazil.</p> <p>MATLAB and Simulink software licence of 2 units @ €5,000.00 unit cost.</p> <p>High performance computing systems, 3 units @ €3,000.00 unit cost</p> <p>Operational expenses encountered during the pilot trials, €1,000.00</p>
Travel	€25,000	Support for GA, pilot demonstrations, workshops, conferences. Participation of 2 personnel for each of the 7 GA and 2 review meetings. Hosting of Phase A and B trials in Brazil with local representatives from WWF-Brazil.
Total	€45,000	

4 Members of the Consortium

4.1 Participants (Applicants)

The consortium consists of a carefully selected mix of partners who complement each other with their competencies, experience, and ambition at high level.

4.1.1 UNIVERSITA TELEMATICA PEGASO

Partner Name: UNIVERSITA' TELEMATICA PEGASO	 PEGASO <small>Università Telematica</small>
Company Website: www.unipegaso.it	
Type: UNIVERSITY	

Partner profile

The core business and expertise of Pegaso University is Online teaching. UNIPEGASO has introduced in the university system new didactic methodologies, as a result of the binomial between the interactive logics of the Web 3.0 and the evolutional forms of the learning, achieving as a result a high level of technological innovation. Our staff is made up of qualified teachers, tutors and experts in learning and training activities by using online methodologies. The UNIPEGASO educational offer, with its 15-degree courses and over 200 post degree and post diploma courses, is developed on multidisciplinary themes of Economics, Law, Engineering and Social Sciences. The wide range of the didactic pathways offered, is arranged in order to meet the market needs, the professions and employment,- responding, in the same excellent way, to the requirements coming from our country as well as to those from the European Union. Lifelong learning is the essential tool for the integration of formal, non-formal and informal learning. The courses provide several monitoring activities of the students' level such as assessment and self-evaluation tools. UNIPEGASO promotes the international development of teaching and research through several cultural exchange programs with some EU universities. UNIPEGASO teaching methodology consists in educational courses combined with a wide variety of learning objects in which multiple tools, materials, and services converge.

In particular students have a lot of learning tools as: written texts of the lecture, slides, video recordings of lessons. Students participate in a wide range of activities in their virtual classrooms (forums, web conferencing, live sessions) which are coordinated and overseen by expert tutors. UNIPEGASO promotes, encourages and finances scientific research by encouraging agreements with other entities and funding research. UNIPEGASO also disseminates the research's outputs by conferences and meetings. UNIPEGASO is moving towards the internationalization of research and teaching, by activating a network of partnerships with foreign universities and promoting the mobility of students and teachers

CVs of involved key researchers / staff members:

Prof. Luigi MOCCIA (Male), holder of the Jean Monnet Chair of "European Union Law and Institutions" (since 1999), Doctor h.c. University of Oradea (Romania), President of the European Centre of excellence Altiero Spinelli (CeAS). He is professor of Comparative Environmental Law and Director of the Law and Economics Department at Pegaso University. Prof. Moccia has been Project Coordinator of the Horizon 2020 project "Trivalent" (Terrorism Prevention Via Radicalisation Counter-Narrative, 2017-2020), and former dean of the Faculty of Political Science at University "Roma Tre" (1998-2008), president of the Italian Association of the Deans of the Faculties of Political Science (2005-2007). He is member of several societies and associations, including: "Société de législation comparée" (SLC); - "Associazione Italiana di Diritto Comparato" (AIDC); - "European Community Studies Association" (ECSA); - "Associazione Universitaria di Studi Europei" (AUSE); - "International Academy of Comparative Law" (IACL). He is chief editor and scientific director of the journal "La Cittadinanza europea".

He has lectured in universities abroad, including: Shenzhen and Shanghai, China (1990, and 2007, 2010); Poona, India (1993); Liège, Belgium (2006, 2007); UADE, Buenos Aires (2008) and La Plata (2008), Vrije Universiteit Brussel, (2008); Cluj-Napoca, Romania (2009). He has directed post-graduate courses in "European Citizenship" (2000-2007), and is currently director of the Master course in "European Citizenship and Euro-Mediterranean Integration" (Roma Tre University).

Expected contribution to the project: Principle Coordinator, Management and Coordination of the Project;

Prof. Michele CORLETO (Male): Professor of international law at the Faculty of Law at UNIPEGASO. Doctor of International Law with honors at the Scuola Normale Superiore of Pisa. Visiting researcher at the Hague Academy of International Law and the Max Planck Institute of Public International Law in Heidelberg. Member of the Steering Committee of the Jean Monnet Centre of Excellence on the rights of migrants in the Mediterranean, established at the University of Naples L'Orientale, he is an expert of European project programmes: Academic Coordinator of the Jean Monnet Fu.C.C.E. module on "The future of criminal cooperation in the European Union: issues and perspectives" (2015/2018). Deputy Coordinator of the Jean Monnet Centre funded by the European Union, Erasmus Plus+ 2014, on "The protection of migrants in the Mediterranean region". He participated in the Research Group of the European Project "CiSoTRa - Civil Society for social inclusion of unaccompanied minors in transition to adulthood", IUS13 disciplinary scientific area, as head of the Legal Area: "Harmonising the Approaches to Protection of Unaccompanied Minors and Young Migrants in Europe". Project Partner Countries: Slovenia, Turkey, Greece, Germany and Italy. He is involved in the Staff member of CiSoTRA Civil Society for social inclusion of unaccompanied minors in transition to adulthood - learning communities for shaping transition interfaces. He is part of the Steering Committee of the Jean Monnet Network M.A.P.S Migration Asylum Protection System with 10 other universities in Europe. Scientific Coordinator of the ECLJ Project "Present and Future of Eu Competition Law for the national Judges: a workable approach", financed by the European Commission DG Competition. Legal expert of the International Centre for the Development of Migration Policies (ICMPD) in the project "Strategic and institutional management of migration in Libya" founded by the European Commission. He is an expert in European criminal law, human rights law, and international law and EU law. He is the author of numerous publications on international public law and European Union law. He is also a member of the Italian Society of International Law and European Union Law (SIDI). He is on the special list of university professors and researchers and of research institutes and research bodies of the Council of the Bar Association of Naples, of which he is also a member of the Commission for Human Rights. He has received the "Nicola Calipari" Award, attributed to a monographic work of importance in the field of international criminal law.

Expected contribution to the project: Deputy Coordinator, Management and Coordination of the Project;

Prof. Francesco FABBROCINO (Male), Professor of Solid and Structural Mechanics and Structural Design at the Pegaso University. He was and is involved in several national and international research projects. He is editorial board member and reviewer of numerous international journals. He is author of more than 75 scientific papers, published on national and international journals and conference proceedings. He received several awards and public acknowledgements for his scientific research activity. Fields of Expertise Computational Mechanics, Multiscale Mechanics of Materials and Structures, Composite Materials and Structures, Innovative Materials and Structures for Civil Engineering, Seismic Engineering, Simulation and Characterization of the Dynamic Response of Materials and Structures, Structural Optimization, Big Data Scientist and Analysis & Strategy. He is the coordinator of the Scientific Program in "Big Data Strategy in Civil Engineering and 3D Advanced Materials", program also involved in CESMA University of Naples Federico II and OSDxE, Spin Off of Oxford University, GB. He is Scientific Director of the Engineering Group for Mayor of the Metropolitan City of Bari and President of ANCI, On. Antonio Decaro and Scientific Director of Benecon University Consortium UNESCO.

Expected contribution to the project: Assistant Coordinator, Management and Coordination of the Project;

Role in the project

- **WP1:** PEG will lead the project administrative coordination and will chair the Steering Committee (SC). A project management office (PMO) will be setup for handling the day-to-day organisations and implement contingency plans based on technical development of the project. PEG will closely collaborate with Z&P and KEMEA on the scientific innovation management and data governance policies to be implemented.
- **WP7:** PEG will also contribute to the development of the EU legal framework for forest governance models in collaboration with stakeholders on ecological resilience (AUA, AMIKOM, UGAV and TUZVO)
- **WP10:** PEG will actively contribute to the project dissemination and exploitation activities. The outcome from the project will be integrated within the undergraduate and postgraduate university courses.

Relevant publications, and/or products, services or other achievements

Du droit pénitentiaire islamique à la prévention de la radicalisation violente et du prosélytisme à l'intérieur des prisons aujourd'hui. Le casItalie, in Re-defining a Space of Encounter. Islam and Mediterranean: Identity, Alterity

and Interactions (a cura di A. Pellitteri, N. Elsakaan., M. G. Sciortino, D. Sicari), Proceedings of the 28th Congress of the Union Européenne des Arabisants et Islamisants(UEAI) (Palermo – September 12-16, 2016), Orientalia Lovaniensia Analecta, Peeters, Leuven, 2019, ISBN 978-90-429-3640-9;

Global Citizenship: How to Approach Identity Issues from an Intercultural Point of View, in L. Moccia (ed.), "Identity Issues and Intercultural Challenges: A European and Global Perspective on Peace in the World", Abdulaziz Saud Al-Babtain Cultural Foundation, Kuwait, Dans Civitas Europa 2018/1 (N° 40), pages 107 à 125

The practice of informal EU-Third State agreements on the management of migration flows. In: (a cura di): CORLETO M, FRONZONI V, Nuove opportunità di sviluppo dai contesti migratori. Inclusione, Sicurezza e Confessionalità. vol. n.1, p. 9-35, COSENZA: Luigi Pellegrini Editore, ISBN: 978-88-6822-868-2. (2020);

The responsibility of Italy in the effective prosecution against migrant smugglers and traffickers. In: GIUSEPPE CATALDI, MICHELE CORLETO, MARIANNA PACE, . (a cura di): GIUSEPPE CATALDI, MICHELE CORLETO, MARIANNA PACE, ,Mediterranean area in Migrations and fundamental rights: the way forward . p. 23-40, NAPOLI: Editoriale Scientifica (2019);

Search and Rescue at Sea in light of International Regulations and National Policy. The Case of Sea Watch 3. EUROPA ETHNICA, vol. n. 79, p. 155-160, ISSN: 0014-2492

List of relevant previous projects or activities, connected to the subject of this proposal

- Fu.C.C.E. (The Future of Criminal Cooperation in the European Union (EU): issues and perspectives) - Beneficiary Organisation, years 2015/2018 reference number: 565645-EPP-1-2015-1-IT-EPPJMO-MODULE (Erasmus plus – Jean Monnet Chair)
- CiSoTRA (Civil Society for Social inclusion of unaccompanied minors in Transition To Aduthood) – Partner beneficiary, years 2017/2020, reference number: 592154-EPP-1-2017-1-SI-EPPKA3-IPI-SOC-IN (Erasmus plus – Capacity Building)
- ECLJ (Present and future of European Competition Law for the national Judges: a workable approach) – Partner beneficiary, Years 2018/2020, reference number: COMP/A4 KD 2018/084247 (EU Competition Law - Call for proposals on training of national judges)
- ASTRE (Automatic System for TRacking E-Learners) – Partner beneficiary, years 2015/2021 reference number: 2019-1-ES01-KA204-065644 (Erasmus plus -. Capacity Building)
- ENTER.M (Internship Model for Developing of Entrepreneurial skills Higher Education Students), Partner beneficiary, Years 2019/2020 reference number (601125-EPP-1-2018-1-SK-EPPKA2-KA) (Erasmus plus – Capacity building)
- T-BRIDGE Transnational BRIDGE, Partener Beneficiary, Years: 2014/2020, reference number: (559005-EPP-12014-2-EL-EPPKA2-CBY-ACPALA) (Erasmus plus – Capacity building)
- CuLTY (CuLtural Tourism for Youth) , partner beneficiary, years: 2019/2017 reference number: (570123-EPP-1-2015-2-IT-EPPKA2-CBY-ACPALA) (Erasmus plus – Capacity building)
- KA107 – ZAMBIA E BENIN - International Credit Mobility, Years: 2020/2022, reference number: (2020-1-IT02-KA107-078644) (Erasmus plus – Capacity building)
- MED2IaH (MEDITERRANEAN countries: Towards Internationalisation at Home), Years 2020/2023, reference number: (610107-EPP-1-2019-1-SI-EPPKA2-CBHE-JP) (Erasmus + KA2 Capacity Building)

Individual exploitation plan

PEG is an independent, profit research and higher-education institution. The cutting-edge innovation targeted as the outcome of SILVANUS, focussed on EU legal frameowkr combined with the competence gained through technology transfer during the project will further improve PEG abilities to serve EU society and increase the competitiveness of EU and national industries

Communication strategy for promoting project outcomes

- Workshops, conferences, high-impact journals

Description of significant infrastructure and major items of technical equipment relevant to the project

N/A

4.1.2 ZANASI & PARTNERS

Partner Name: Zanasi & Partners (Z&P)	 Zanasi & Partners Security Research and Advisory
Company website: https://www.zanasi-alessandro.eu/	
Type: SME	

Partner profile

Founded in 2006, limited liability company under the Italian law since 2007, Zanasi & Partners (registered brand of “Zanasi Alessandro Srl”) is a security research and advisory company active in EU and MENA areas. Z&P serves its customers by focusing on technology solutions. Its main clients include national and international public institutions - including LEAs and intelligence agencies - and leading technology companies. Its professionals and partners (former LEA officers, academic and industrial researchers) can rely on a two-fold background: security/intelligence and advanced technology skills. The company was appointed full member of ESRIF (European Security Research and Innovation Forum) in 2007, following the appointment of its founder to ESRAB (European Security Research Advisory Board) in 2005.

CVs of involved key researchers / staff members

Ing. Alessandro ZANASI (Male): Alessandro is the founder and CEO of Zanasi & Partners and co-founder of TEMIS SA (Paris-based company specialised in the development of Text Mining software). Graduated in Nuclear Engineering (University of Bologna) and in Business Economics (University of Modena and Reggio Emilia), he formerly was a Carabinieri officer in charge of forensics investigation at the Scientific Centre in Rome. Alessandro moved to the private sector working as Big Data analytics researcher and consultant for IBM (in Italy, France and U.S.) and as business intelligence analyst for META Group (now Gartner). He was the coordinator of the KDD Centre, a laboratory born thanks to a partnership between IBM and the Italian supercomputing centre CINECA. Professor of “Knowledge Management and Data Mining” at the University of Bologna and chairman of the conference series “Data Mining, Protection, Detection and Security” and “Safe City”, Alessandro authored more than 100 publications in security and intelligence.

Dr. Giovanni VASSALLO (Male): Giovanni holds a Bachelor and a Master’s Degree in Political Science and International Relations from the University of Bologna (Italy), during which he had the opportunity to carry out research on security threats and crisis management at Sciences Po (Aix-en-Provence, France). Prior to joining Zanasi & Partners, he worked as a researcher at “Rights and Humanity” (Ipswich, United Kingdom), in which he deepened his knowledge of EU strategies and funding instruments. He currently works as Research Manager and coordinates the development of EC-funded projects on behalf of Z&P.

Dr. Davide Mauro FERRARIO (Male): Davide achieved a Bachelor and Master’s Degree in Mathematics at University of Bologna (Italy), with six months abroad at Cardiff University (UK) as part of the Erasmus project. Expert in mathematical physics, applied mathematics for biology and number theory, he started working for Zanasi & Partners in 2018 as Project Manager for several EC-funded research projects (ECHO, FINSEC, SOCIAL TRUTH) in the field of cybersecurity, artificial intelligence and data protection.

Ds. Giulia VENTURI (Female): Giulia has achieved a Master’ Degree in Physics from the Alma Mater Studiorum - University of Bologna (IT) with Master thesis internship at the University of Cambridge (UK). Prior to joining Zanasi & Partners, she worked as researcher in the fields of applied physics and complex systems dynamics. With Z&P she has been project manager of several EC-funded defence and ICT research projects. Her expertise includes methodological approaches to operative research, risk assessment and data management and protection.

Role in the project

- WP1: Z&P will lead the scientific coordination of SILVANUS and will bridge the end-user requirements to the technical partners. Z&P will be responsible for monitoring the technical progress achieved within the project and will closely collaborate with the technical partners in the consortium.
- WP2: Z&P will contribute to the participatory process setup by TUZVO and will further facilitate the formalization of functional requirements.
- WP7: The project outcomes will be formally published by the consortium with contributions from Z&P. The success of technology intervention validated by stakeholders (resulting from WP9) outcomes will be promoted across the community.
- WP9: Z&P will monitor and oversee the preparation readiness of each pilot organization. Z&P will also participate in the formal evaluation of the demonstration outcome.
- WP10: Z&P will contribute to the dissemination and exploitation of the SILVANUS results.

Relevant publications, and/or products, services or other achievements

- Zanasi, A., and Ruini, F., Cybersecurity and cyberdefence: EC-funded research trends. International Journal of Security.
- Laudy, C., Ruini, F., Zanasi, A., Przybyszewski, M., and Stachowicz, A. (2017), Using Social Media in Crisis Management. SOTERIA Fusion Center for Managing Information Gaps. In Proceedings of FUSION 2017, 20th International Conference on Information Fusion;
- Zanasi, A. (2009). Virtual Weapons for Real Wars: Text Mining for National Security. In Corchado, E., Zunino, R., Gastaldo, P. & Herrero, A. (Eds.), Proceedings of CISIS'08, the International Workshop on Computational Intelligence in Security for Information Systems (pp. 53–60);
- Zanasi, A., & Artioli, M. (2009). Text and video mining solutions to national security intelligence problems. WIT Transactions on Information and Communication Technologies, 42, 3–12;
- Zanasi, A. (Ed.). (2007). Text Mining and its Applications to Intelligence, CRM and Knowledge Management. Southampton, UK: WIT Press.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
CRISYS (Critical Response in Security and Safety Emergencies)	Member of the consortium, situational awareness, disaster management	FP7 project dedicated to demonstrating the feasibility of an integrated and scalable crisis management system capable of providing comprehensive situational awareness to decision makers in both defined and novel disaster situations.
SOTERIA (Online and Mobile Communications for Emergencies)	Data mining, social media and Big Data analysis, emergency communications	FP7 project dedicated to the development of a toolbox for improving the communication between citizens and public safety organisation during emergencies situation, by relying on Big Data analytics technologies.
iSAR+ (Online and Mobile Communications for Crisis Response and Search & Rescue)	Big Data analytics, emergency communications, Disaster management	FP7 project dedicated to the design of a platform for automatically retrieving and analysing the large volume of information posted on social media, by citizens, during a crisis situation.

Individual exploitation plan

Z&P plans to exploit the findings of the SILVANUS project for improving its offer, enlarging in turn its market share and its customer base. Participation in the project will help Z&P obtaining additional advisory contracts for providing victim detection-related services to end-users, in particular first responders' organisations and law-enforcement agencies. The knowledge acquired during SILVANUS will also be exploited by transferring state-of-the-art know-how to Zanasi & Partners' customer base and enhancing co-operation between the company and the European security industry as a whole. Furthermore, Z&P's role in the project will allow the company to position itself as a reliable partner for future research initiatives (e.g. Horizon Europe projects) in the area of big data analytics, artificial intelligence and other relevant domains.

Communication strategy for promoting project outcomes

Z&P will contribute to disseminate the results achieved in SILVANUS by producing articles describing the results of the activities carried out throughout the project, either to be published in scientific journals or presented during European conferences and events. In addition, Z&P will create a dedicated section of the company's website dedicated to the project and promote the project activities through the company's website, as well as via social media and newsletters.

Description of significant infrastructure and major items of technical equipment relevant to the project

N/A

4.1.3 INTRASOFT INTERNATIONAL S. A

Partner Name: INTRASOFT International S.A. (INTRA)

Company website: <https://www.intrasoft-intl.com/>

Type: Large Industry



Partner profile

INTRASOFT International is a leading European IT Solutions and Services Group with strong international presence, offering innovative and added-value solutions of the highest quality to a wide range of international and national public and private organisations. The company employs more than 2200 highly skilled professionals, representing over 20 different nationalities and mastering more than 18 languages. With headquarters in Luxembourg, INTRASOFT International operates through its **operational branches, subsidiaries and offices in 13 countries**: Belgium, Bulgaria, Cyprus, Denmark, Greece, Jordan, Kenya, Luxembourg, Romania, RSA, UAE and USA. More than 500 organizations in over 70 countries worldwide (Institutions and Agencies of the European Union, National Government Organizations, Public Agencies, Financial Institutions, Telecommunication Organizations, and Private Enterprises) have chosen the company's services and solutions to fulfil their business needs.

INTRASOFT International is a subsidiary of the ASE-listed INTRACOM Holdings, one of the largest multinational technology groups in SE Europe, with more than 35 years of experience and possesses a successful track record of delivering very large and complex IT systems, especially for the public sector. Through its continuous investment over the years it has earned a place among the primary IT services suppliers for EU institutions and bodies (Commission, EU Parliament, European Investment Bank etc.), but also among the public sectors of its global markets. Other market sectors of INTRASOFT International include the banking sector, transportation, telecommunications, and the healthcare sectors.

INTRASOFT International (Luxembourg) has **proven expertise in conceptual system architecture and system design, advanced application development and integration services**, information portal management and communication services, and project management. INTRASOFT International's Software Engineers, Analysts and Programmers keep abreast of all major technology innovations and developments that can add value to our business activities. INTRASOFT has been awarded the following certifications: Quality Management of Products and Services (ISO 9001:2008); ISO/IEC 20000-1:2005 certification that underlines the quality of INTRASOFT's IT service management systems; ISO/IEC27001:2005 certification that recognises the strength of INTRASOFT's information security management procedures; CMMI Level 2 (Capability Maturity Model Integration) v1.2 for its Software Development activities; and since October 2012 has been successfully appraised at CMMI Level 3 for its software development projects in three locations (Luxembourg, Athens, Bucharest).

INTRASOFT International (Luxembourg) has top level know-how and significant experience in providing all the range of professional information security services and solutions, starting from specialized consultancy, including legal and IT consultancy for compliance with GDPR, up to the design, implementation and operation of cutting-edge security infrastructure. The offered Security Solutions and Services cover areas such as:

- User's management (Identity & access management, Privileged Account Management, Remote Access Management)
- Data security (Data Loss Prevention-DLP, Document Classification, Data Base Protection & Monitoring)
- Security Hardening (Systems hardening services, Host Based Intrusion Detection)
- Security Assurance (VA & Penetration tests, Security Audits)
- Security Governance (Security Policy, Security Risk assessment)
- Network Security (Network Security Architecture, Next Generation Firewalls, Security web gateways)
- Security intelligence (Security Events Management, Security monitoring & intelligence)
- Legal & IT Consultancy for compliance with the General Data Protection Regulation

For more than 20 years, INTRASOFT International (Luxembourg) actively contributes to the development of **innovative pre-industrial products and services** through its participation in EU Research Programmes. We possess a successful track record in managing large and complex collaborative research projects, implementing innovative research prototypes, and effectively communicating research results in Europe and beyond. Serving this mission, the **Research and Innovation Development (RID) Department** contributes to the strategic policy objective of enabling Europe to master and shape future developments in ICT, while sustaining the company's leadership in ICT. Research is conducted by in-house and associate consultants, in conjunction with prestigious universities and research institu-

tions, and acclaimed industrial partners that ensure the articulation of emerging ICT trends into innovative and exploitable research outcomes. As a result, INTRASOFT International offers an interdisciplinary centre of competence on the effects, use and applications of ICT in our targeted markets with a medium to long-term agenda.

The RID Department works in close collaboration with other INTRASOFT International (Luxembourg) teams, to bring technological and business innovation within the Group. The company continuously monitors new technological trends where RID is dealing with the development and assessment of innovative pre-industrial products and services. Starting in 2015, INTRASOFT International has taken a step further by investing even more in innovation and R&D both internally, but also through participation in venture capital funds and start-ups.

INTRASOFT International (Luxembourg) has extensive R&I activities related to **Big Data, Data Analytics and AI**. Indicatively, INTRASOFT participates with key roles in Big Data H2020 lighthouse projects in the areas of bioeconomy, manufacturing and transport. INTRASOFT International is heavily investing in Big Data. Currently, a Big Data virtual team has been created with representatives from business units across the company. The virtual team is responsible for exploring and developing opportunities related to Big Data pertinent to all company activities. This approach aims to transform corporate culture in such a way that all decisions, both business and technical will ultimately become data driven. Recently INTRASOFT has founded the Data Analytics Competence Center providing data science and data engineering professional services to all market segments that the company covers in cooperation with its BU sales teams and delivery groups, which is enforced by the recent strategic collaboration with the startup Incelligent. INTRASOFT International is further a member of BDVA.

In addition, INTRASOFT International is already active on **blockchain/distributed ledger technology and smart contracts**, exploring the technical applicability of the technology and the potential efficiencies that it could release in various use-cases, such as Customs and Taxation trade facilitation, Insurance and Banking, among other. The company has developed blockchain technology solutions, for the customs and insurance sectors as a starter, having been awarded two projects from DG TAXUD, on the one hand, and business agreements with private Greek insurance companies on the other hand.

CVs of involved key researchers / staff members

Dr. Sofia Tsekeridou (F) is currently a Senior Research and Innovation Manager and Expert at the Research and Innovation Development Dept. of INTRASOFT International, heading the Security and Safety Lab. She previously held the position of Associate Professor at Athens Information Technology (AIT) heading the Multimedia, Knowledge and Web Technologies research group. She has acquired an Electrical and Computer Engineering Diploma and a PhD in Computer Science, both from Aristotle University of Thessaloniki. Dr. Tsekeridou has more than 20 years' experience in research, development and innovation activities, as Senior Researcher, Senior Project and/or Technical Coordinator as well as Senior Technical Architect and Leader of software development teams and software integration and testing activities, in more than 40 national, industrial and EU-funded research and development projects in the areas of multimedia processing/AI, e-learning, data analytics/data mining, information security/cybersecurity, information retrieval/search engines/recommender systems and knowledge engineering/data science in diverse application domains (public safety and security, e-health, learning, tourism, digital libraries, media, entertainment/gaming, etc.). Exemplary such recent projects in the security domain have been: H2020 PHOENIX, devising a holistic cybersecurity solution for EPES infrastructures, capitalizing on distributed ledger and federated learning technologies, H2020 iTRACK that developed an intelligent and secure tracking, incident reporting and threat detection system for the protection of humanitarian aid missions, H2020 INSPEC2T that developed a holistic community policing solution for LEAs, powered by multimedia analytics, FP7 IMPRESS that developed a multi-agency coordination and decision support system for effective health emergency management and response in mass casualties, fusing and harmonizing heterogeneous data inputs in near real-time. These projects resulted, among other, to the in-house development of the Continuous Integration/Continuous Deployment (CI/CD) asset of RID. She has published many papers at international scientific journals and conferences and has contributed to the TV Anytime and W3C standardization bodies. She is currently involved in the IEEE P2145 Working Group on Blockchain Governance, and its sub-group on interoperability. She has served as a reviewer to many international scientific conferences and journals, as an evaluator to EU-funded and national projects and proposals, as organizing chair, tutorial speaker, and TPC member in many conferences. Dr. Tsekeridou is a senior member of IEEE and a member of the Technical Chamber of Greece. She is an active validated member of Europol's Data Protection Experts Network and has received personnel security clearance in 2019 from the National Ministry of Defence at EU SECRET and NATO SECRET level.

Dr. Eleni Trouva (F) received her diploma in Computer Engineering from the University of Patras, Greece in 2006 and a Master of Science in Computer Science from the Department of Informatics of Athens University of Economics and Business in 2009. In September 2009, she joined the i2CAT Foundation, where she initially contributed in research projects related to network management and telecommunications and future network architectures. In 2013,

she affiliated with the Institute of Informatics and Telecommunications of NCSR Demokritos, working as a Research Fellow, where she contributed to network management related research projects. Lately, she has joined the Research, Innovation Development Department of INTRASOFT International as a senior engineer contributing in various projects related to systems and software integration. She has also been implementing and leading complicated tasks related to big data analytics and blockchain. Her research interests include network orchestration and management, monitoring and big data analytics for security purposes.

Mr. Ioannis Sarris (M) is a Senior Research and Innovation Software Engineer at INTRASOFT International S.A. With extensive experience in both leadership and engineering roles, Ioannis has a track record of delivering successfully complex projects across diverse local and international teams on tight deadlines. He has significant experience in building and technically owning software for some of the largest telecommunication and technology companies in France (Dassault Systèmes, IDEMIA and Orange Labs) and in Greece (Intrasoft International, Fujitsu-Siemens). Previously, he worked as Senior Research & Development Software Engineer – Team Leader at Dassault Systemes S.A at DELMIA Digital Manufacturing Foundation team where he mainly focused on the design and development of 3D digital manufacturing applications and algorithms used for planning, simulating and modeling modern global production processes. Formerly, he worked as Research and Development Software Engineer at IDEMIA on the design and development of the next generation OS of smart cards – eSIM (embedded SIM) and its applications. He also worked as Research and Development Engineer intern at Orange Labs (formerly France Telecom R&D) at the Big Data for Content Delivery Lab on the development of a distributed monitoring and reporting system of QoS/QoE metrics for CDNs. He received his Master of Science in Networked Computer Systems from Telecom ParisTech (ENST) in Paris, France, and his Diploma in Electronic and Computer Engineering from Technical University of Crete (TUC) in Chania, Greece. His research interests lie in the field of industry 4.0, big data analytics, cloud computing, IoT and digital manufacturing.

Role in the project

- **WP1:** INTRA will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** INTRA will contribute to the participatory process and will be involved in the formalization of the functional requirements for SILVANUS platform development. Additional contribution in this WP, will also include review of historical case – studies, development of platform assessment framework and analysis of forest models
- **WP3:** INTRA will contribute to the development of semantic framework for knowledge representation. Additonal contributions include development of training activites and AR/VR content curation.
- **WP5:** INTRA will lead the task on implementing decision support system driven by data analytics. The use of advanced data science toolkit based on statistical models and regression analysis will be considered in the component development.
- **WP8:** INTRA will lead the workpackage and will define the architecture specification of the platform. An integration roadmap will be outlined to the consortium and will oversee the progress achieved in the workpackage. INTRA will closely coordinate the development oversight with Z&P to ensure systematic execution of project objectives.
- **WP9:** INTRA will coordinate with ASFOR, SIMAVI for gathering feedback and implement continuous integration plan to enhance and improve the quality of the pilot demonstration. The CI/CD pipeline will be adopted by technical partners.
- **WP10:** INTRA will contribute to the promotion of project outcomes. As a member of EU initiatives such as BDVA and other organisations, the project outcomes will be disseminated through such networks.

INTRAsoft will be the Technical Architect and SILVANUS platform integrator, leading WP8 and technically supporting the trials phase in WP9. INTRA will further lead task T5.5 capitalizing on its data aggregation, management, analytics and visualization platform. INTRA will further contribute in WP3 in the formulation of forest management knowledge models and relevant training tools, as well as in dissemination, communication and exploitation activities of the project.

Relevant publications, and/or products, services or other achievements

1. N. Dobrinkova, T. Finnie, J. Thompson, I. Hall, C. Dimopoulos, G. Boustras, Y. Danidou, N. Efstathiou, C. Psaroudakis, N. Kourtras, G. Eftichidis, I. Gkotsis, M. Heckel, A. Olunczek, R. Hedel, A. Kostaridis, M. Moutzouris, S. Panunzi, G. Seynaeve, **S. Tsekeridou**, D. Vergeti, “Optimisation of Preparedness and Response of Health Services in Major Crises Using the IMPRESS Platform”, In: Fidanova S. (eds) Recent Advances in Computational Optimization. Studies in Computational Intelligence, vol 795. Springer, Cham,

2019. https://doi.org/10.1007/978-3-319-99648-6_2

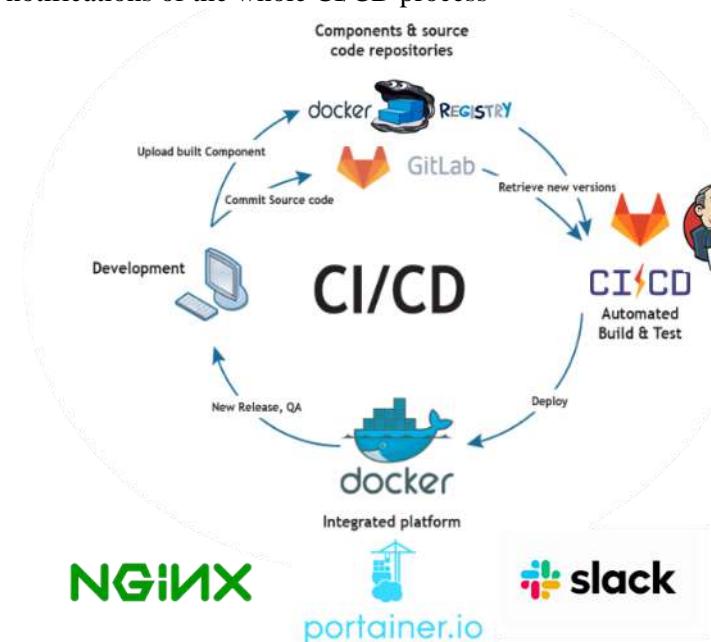
2. S. Virkar, C. J. Udoekwu, A.-S. Novak, **S. Tsekeridou**, "Facilitating Public Access to Legal Information: A Conceptual Model for Developing an Agile Data-driven Decision Support System", International Data Science Conference 2019 (iDSC2019), accepted to be published, Salzburg, Austria, 22-24 May 2019.
3. S. **Tsekeridou**, et. al, "A Crowd-Sourced Intelligent Information Management and Decision Support System enabling Diverse E-Government G2C2G services", Int. Conference on Information and Communication Technology (ICICT2018), London, UK, Feb. 2018.
4. N. Dobrinkova, A. Kostaridis, A. Olunczek, M. Heckel, D. Vergeti, **S. Tsekeridou**, G. Seynaeve, A. De Gaetano, T. Finnie, E. Nectarios, and C. Psaroudakis, "Disaster Reduction Potential of IMPRESS Platform Tools", International Conference on Information Technology in Disaster Risk Reduction, November 2017.
5. S. **Tsekeridou**, H. Benhadda, "Data Mining Techniques Empowering Automated Early Warning System for Critical Infrastructure Protection – the ARGOS case", Proceedings of the Proactive Workshop on: "Models and architectures for emergency management", Rome, Italy, 19-20 Feb. 2015.

Relevant products/services:

1. Continuous Integration / Continuous Deployment Environment and Tools

As INTRA will undertake integration tasks, to support integration and system testing activities, INTRA will capitalize on its CI/CD stack and relevant tools to support agile development and implement a DevOps approach. The CI/CD stack and its relevant tools is to be hosted on the cloud, for easy access by all other technical partners. The CI/CD tools consist of:

- GitLab for source control, code repository, code versioning
- Jenkins or Gitlab CI/CD for automated build and testing
- Docker for containerization of services and components
- Docker Registry for storing and distributing Docker images
- Portainer for easily managing Docker containers through a GUI
- NGINX for efficiently managing requests towards the deployed services
- Slack for getting notifications of the whole CI/CD process



2. INTRASOFT's Big data StreamHandler platform

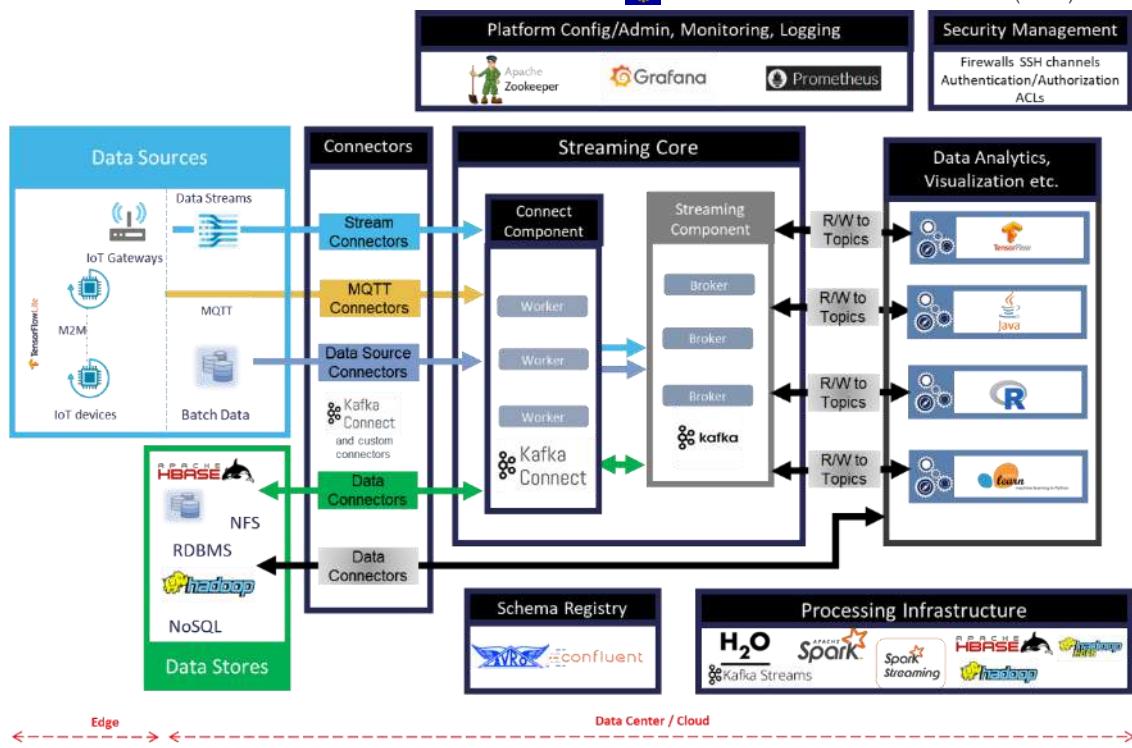
The Big Data StreamHandler platform is a fully featured industrial grade solution: *i)* which is capable to scale out and accommodate various and from different domains big data, interoperating with all modern data storage technologies as well as other persistence approaches and *ii)* can support all important Big Data languages including Python, Java, R and Scala as well as other traditional programming approaches.

The Streamhandler Platform consists of: *i) Data sources and Data store, ii) Connectors and Streaming Core component, iii) Schema Registry, iv) Processing Infrastructure and v) Platform Config/Admin Dashboard.*

a. Data sources and Data store, which represent data streams and data sources, both in a structured or unstructured format that can be made available and potentially be connected to the Streamhandler platform, generated by any IoT device and/or gateway on the edge. Similarly, and according to the requirements, appropriate persistent storage can be used, as depicted in the input/output data components (Figure). The described data sources will be seamlessly integrated with processing components by the means of integration connectors (Connectors). The Streamhandler platform can efficiently interoperate with all the modern data storage technologies of a Big data ecosystem such as RDBMS, NoSQL, HDFS Hadoop, Apache HBASE, etc. as well as other persistence approaches such as Mongo, MySQL, JDBC, etc.

INTRAs Streamhandler Platform can interoperate with IoT architectures building an end-to-end IoT integration with the platform with the use of MQTT protocol. MQTT is a widely used ISO standard (ISO/IEC PRF 20922) publish-subscribe-based messaging protocol. MQTT has many implementations such as Mosquitto or HiveMQ. MQTT and Apache Kafka are a perfect combination for end-to-end IoT integration from edge to data center (and back, of course, i.e. bi-directional).

b. Connectors and Streaming Core, that connect external data sources and make them available to the AI platform. External data sources are connected and made available by employing the “Stream Connectors” and “Data Source Connectors”. The underlying technologies and capabilities of the Streaming Component and the multiple workers of the Connect Component allow the realisation of scalable and secure stream data pipelines. The Communication Platform represents a distributed streaming platform which is an Apache Kafka cluster. Apache Kafka allows to publish and subscribe to streams of records (Topics) similar to the functionality provided by a message queue. The streams of records are stored in a fault-tolerant durable way and consumers (Big Data Apps or AI Apps) can process them as they occur. In general, Kafka is suitable for building real-time streaming data pipelines to reliably get data between systems or applications and for building real-time streaming applications that transform or react to the streams of data. The flexibility of running the Communication Platform in a clustered manner allows for the horizontal scalability of the system achieving thus a scalable, fault-tolerant communication-efficient framework for cross-streaming data management and integration.



StreamHandler - High level Architecture

c. **INTRA's Streamhandler Platform** supports data model and their metadata by using the **Schema Registry** service (Kafka addon). **Schema Registry** provides a serving layer for your metadata. It provides a RESTful interface for storing and retrieving Avro schemas. It stores a versioned history of all schemas, provides multiple compatibility settings and allows evolution of schemas according to the configured compatibility settings and expanded Avro support. It provides serializers that plug into Kafka clients that handle schema storage and retrieval for Kafka messages that are sent in the Avro format.

d. **Processing Infrastructure.** The underlying infrastructure spans multiple VMs and provides all the necessary technologies and components that enable the storage and analysis of the data involved and further allowing the usage of any technology agnostic algorithms, by providing a distributed computing environment that enables the above. Some of them include among others Apache Spark, Hadoop, Kafka Streams, Spark Streaming, H2O, etc.

e. **Platform Config/Admin Dashboard.** Platform administration and monitoring is assisted by accompanying dashboards which visualise selected metrics of interest. The platform components are capable of exporting JMX metrics which in turn are made available in customised Grafana dashboards. The available information includes the status of the Zookeeper chorum, the status of the Kafka Brokers together with insightful graphs about incoming and outgoing data throughputs, message rates per broker and per topic and other information regarding CPU and memory usage per broker. Similarly, healthy Schema Registry and Rest Proxy instances and their corresponding connections are monitored. The cluster overview is completed by Kafka Connect specific panels which present the user with running Connectors and tasks information in addition to data rates per worker node. The available dashboards allow not only a very good overview of the cluster performance and health status but also provide significant information when performance tuning is necessary.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
IMPRESS (IMproving Preparedness and Response of HEalth Services in major crises (GA:614100)	It aimed at improving the efficiency of decision making in emergency health operations, which had a direct impact on the quality of services provided to citizens. It provided a consolidated concept of operations, to effectively manage medical resources, prepare and coordinate response activities, supported by a Decision Support System, using data from multiple heterogeneous sources. The	INTRASOFT has been the Project Coordinator, System integrator, Technology provider of Data Aggregation and Harmonization Component.

https://cordis.europa.eu/project/id/608078	<p>proposed solution facilitated communication between Health Services (and Emergency Responders) at all levels of response and the crisis cycle with the necessary health care systems support, supervision and management of participating organizations.</p>	
INSPEC²T – Inspiring Citizen Participation for Enhanced Community Policing Actions (H2020-FCT-2014, 653749). https://cordis.europa.eu/project/id/653749/en .	<p>INSPEC²T projects' scope is to develop a sustainable framework for Community Policing that effectively addresses and promotes seamless collaboration between the police and the community by devising an end-to-end fully-featured next generation community policing system, with intelligent information processing and visualization and special-purpose online communities' platform for effective communication and collaboration among all stakeholders involved. INSPEC²T is focusing on a user-centric design and development approach and has already mobilized and engaged a critical user group mass, in EU and abroad.</p>	INTRASOFT has been the Technical Coordinator and Leader of System Development and Integration. Developer of the Online Community Platform for Community Policing
iTRACK - Integrated TRACKing and collecting intelligence in civilian humanitarian missions (H2020-BES-2015, 700510) https://cordis.europa.eu/project/id/700510 .	<p>It developed human-centred technologies that take into account actual real-world practices of humanitarian aid workers, and provides policies for better protection and a more effective and efficient response. The project is based on the principles of Privacy by Design and will build the iTRACK system, an integrated intelligent real-time tracking and threat identification system to improve protection of responders and assets, and provide information management and logistics services such as real-time information updates and analyses as well as navigation, routing and scheduling.</p>	INTRASOFT led the system design, integration and testing Workpackage, as well as the Exploitation Workpackage
Track&Know (H2020-ICT-2016-2017) (Big Data Mobility Tracking Knowledge Extraction in Urban Areas). https://trackandknow-project.eu/	<p>It researched, developed and exploited a new software framework that aims at increasing the efficiency of Big Data applications in the transport, mobility, motor insurance and health sectors. Stemming from industrial cases, Track&Know will develop user friendly toolboxes that will be readily applicable in the addressed markets, and will be also investigated in additional domains through liaison activities with running ICT-15 Lighthouse projects. Track&Know integrates multidisciplinary research teams from Mobility Data management, Complex Event Recognition, Geospatial Modelling, Complex Network Analysis, Transportation Engineering and Visual Analytics to develop new models and applications. The Track&Know Toolboxes will be demonstrated in three real-world Pilots using datasets from niche market scenarios to validate efficiency improvements.</p>	INTRASOFT develops the Big Data Stream-Handler and Aggregation Platform for diverse data sources and IoT sensors.
PHOENIX - Electrical Power System's Shield against complex incidents and extensive cyber and privacy attacks (H2020-SU-DS-2018-2019-2020) https://phoenix-h2020.eu/	<p>PHOENIX aims to offer a cyber-shield armour to European EPES infrastructure enabling cooperative detection of large scale, cyber-human security and privacy incidents and attacks, guarantee the continuity of operations and minimize cascading effects in the infrastructure itself, the environment, the citizens and the end-users at reasonable cost. PHOENIX will realise 3 strategic goals: (1) Strengthen EPES cybersecurity preparedness by employing security a) "by design" via novel protective concepts for resilience, survivability, self-healing and accountability, and b) "by innovation" via adapting, upgrading and integrating a number of TRL5 developments to TRL7-8 and validating them in real-live large scale pilot lots; (2) Coordinate European EPES cyber incident discovery, response and recovery, contributing to the implementation of the NIS Directive by developing and validating at national Member States and pan-European level, a novel fully decentralized inter-DLTs/blockchain based near real-time synchronized cybersecurity</p>	INTRASOFT is the Leader and Developer of Pan-European Incidents Information Sharing Platform among EPES stakeholders and CERTs/CSIRTS. Significant contribution to platform integration and distributed inter-ledger technology for securely sharing sensitive information.

	information awareness platform, among authorized EPES stakeholders, utilities, CSIRTs, ISACs, CERTs, NRAs and the strategic NIS cooperation group; (3) Accelerate research and innovation in EPES cybersecurity by a novel deploy, monitor, detect and mitigate DevSecOps mechanism, a secure gateway, privacy preserving federated Machine Learning algorithms and establishment of certification methodologies and procedures through a Netherlands-based Cybersecurity Certification Centre.	
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Individual exploitation plan

To support growth and innovation in its products and services portfolio, INTRA participates actively as a project and/or technical coordinator, as well as technology provider, in EU-funded research and development projects, that among others facilitate know-how exchange and business alliances. Furthermore, through its participation in SILVANUS, INTRA is expecting to:

- Exploit the resulting technologies in its current products
- Join in joint exploitation paths of the SILVANUS technological platform with the consortium partners
- Investigate the possibility of offering SILVANUS as a service ecosystem in collaboration with the rest of the Consortium partners (i.e. customization, maintenance, installation, service provision, training)
- Deliver consultancy services to customers interested in deploying similar infrastructures.

INTRA is further interested in:

- licensing for commercial exploitation its own developed technology
- joint ownership agreement among partners for commercial exploitation of the SILVANUS platform and services

Communication strategy for promoting project outcomes

INTRA will use its own internal communication channels (INTRABlog, INTRAbuzz magazine, Website and Twitter/LinkedIn accounts) to promote the project results. INTRA will further target scientific dissemination to reputed relevant conferences and journals, as well as exhibition events.

Description of significant infrastructure and major items of technical equipment relevant to the project

INTRASOFT International maintains interconnected data centres across Europe that provide a computational cloud for the development and business needs of the organisation. ICT facilities and applications include the following:

- Over 900 virtual servers including Windows, OVM, Linux & Solaris, distributed over a VMware ESXi infrastructure on blade and rack mount server hardware
- Over 300 TBs of Fiber Channel storage using several IBM V7000 storage systems on redundant CISCO MDS SAN
- Veritas Netbackup 5240 appliance infrastructure
- Veeam backup infrastructure
- CISCO highly available Nexus 10Gbps datacenter access infrastructure with 40/160 Gbps backbone
- Highly available F5 Web Application Security systems
- Highly available AIX infrastructure on the Power 822 hardware platform
- Various Linux and UNIX-like systems including HPUX and Oracle SPARC
- Over 400 WINTEL based servers (including physical and virtual machines) spread across four data-centres
- Over 200 network, security and remote access appliances, providing the means of access, interoperability, security and high availability for a wide variety of hosting services.
- High-speed inter-site communications links, allowing for the establishment of enterprise cloud architecture.
- Over 1600 high-end MAC, Windows 10 and Linux workstations in four main locations.
- JIRA used as tracking tool
- Jira Service Desk used as a service desk tool
- Document repositories (Alfresco, Redmine)
- SharePoint Online (Office 365) used a document sharing environment
- Collaboration spaces on all locations, including Skype for Business and CISCO SX-20 videoconference infrastructure

For the development phase of the project, INTRASOFT International will capitalise upon its internal infrastructure for development purposes and cater for external hosting and SLA for the project duration.

4.1.4 THALES

Partner Name: Thales	
Company website: https://www.thalesgroup.com/en	
Type: Industry	

Partner profile

THALES is one of the world's leading providers of mission-critical systems for security, defense and aerospace. With over 80,000 employees in 68 countries, Thales annual revenue is over 19 billion EUROS with 20% devoted to R&D and 25,000 researchers working on cutting-edge technologies. It provides its customers with all the key functions in the critical information loop, from detection and processing to transmission and distribution. Leveraging a global presence and spanning the entire value chain, from prime contracting to equipment, Thales plays a pivotal role in making the world a safer place. Moreover, as a key player in security markets, Thales role is to protect people, countries, critical infrastructure and data. To do that, Thales works closely with its customers — governments, cities, essential operators, companies and major national and international organizations — to address their specific concerns and develop solutions that meet the needs of their stakeholders. Thales develops its strategic capabilities in component, software and system engineering and architectures through its R&T organization. Designing and developing the mission/safety-critical information systems that underpin the company's leadership in aerospace, defense and security markets calls for comprehensive expertise in increasingly sophisticated technologies and the ability to integrate these technologies with large-scale software driven systems.

Thales SA is involved in SILVANUS project also through its French corporate research center, the Thales Research & Technology center from Palaiseau (France) which has strong skills algorithms for complex problem solving using approaches like genetic algorithms, planning, non-linear optimization, multi criteria and group decision making. Thales Research & Technology (TRT), a network of corporate research laboratories of the Thales group, coordinates the research activities at the global level. TRT's primary mission is to forge links between the company and leading scientific bodies in each area of expertise in order to monitor the latest advances, develop disruptive technologies and expertise in new areas, attract talented science graduates and provide a platform for innovation and knowledge sharing to support company-wide projects. Most of these corporate laboratories are located on university campuses in immediate proximity to the company's research partners. The corporate research laboratory in France, for example, is located on the campus of the École Polytechnique – one of the country's most prestigious engineering schools – and forms part of a complex of world-class research establishments located just south of Paris. Thales research centers in the Netherlands and Singapore are located at Delft University and Nanyang Technological University (NTU). In the UK, the Reading laboratories have close ties with major British universities including Cambridge, Surrey and London Imperial College. The joint Thales Nokia research laboratory dedicated to III-V semiconductor technologies is also part of this worldwide network.

CVs of Key personnel involved in the project

Dr. Cédric L.R. Buron is a Research Engineer in Thales Research & Technology in the Decision and Optimization Laboratory. He got MSc in Computer Science and Engineering from the National Chiao Tung University (Taiwan) in 2013. His Master thesis dealt with the issue of applying various Monte-Carlo based algorithm to an imperfect information variant of the Go Game. He then got an Engineer degree from Telecom SudParis in 2014. He finally got his PhD in Computer Science from Sorbonne Université. His main research focuses on Game Theory, more precisely mechanism design applied to negotiation and bargaining and heuristics applied to games. In this domain, he has worked on Monte Carlo algorithms applied to imperfect information games and negotiation. His research also focused on application of machine learning to economy, to predict the financial value of a fund on the one hand, and to predict future proposals of an opponent in a negotiation in the other hand. He took part of the development of Kinvo, an autonomous invoice marketplace in a FUI project. He is now working on projects involving MCDA, statistics and Distributed Decision Making.

Mr Lionel Gayraud is a research engineer in optimization and applied mathematics. He holds a M.Sc. in Engineering from ENIB (2003) and SUPELEC (2005), a M.Sc. in Telecommunications from “Université de Bretagne Occidentale” (2003) and a M. Sc. In Nanosystems from “Université Paris Sud” (2005). From 2005 to 2007, he worked in industry as software engineer. From 2007 to 2018, he worked as military engineer for the French MoD. Since 2018, he works at the Optimization and Decision Laboratory at Thales Research & Technology on motion planning. Its interests cover optimization theory, computational complexity, computer science, and computer graphics.

Mr. Pierre-Yves Lagrave joined Thales R&T as a research engineer in January 2020 and focuses on Trustable Artificial Intelligence related topics. He graduated from the French engineering school Ecole Nationale des Ponts et Chaussées in 2011, where he majored in Applied Mathematics and Computer Science. He started his careers as a quantitative analyst in the financial industry (Société Générale , JP Morgan), where he was involved in designing and implementing several stochastic models, probabilistic simulation tools and risk metrics computation engines for the purpose of Model Risk management. He then took a research engineer position at the French Ministry of Armed Forces in 2016, where he designed and developed some mathematical tools for software and cyber security matters. His areas of expertise and research interests include Safe and Secure Machine Learning, Probabilistic Simulations, Statistical Modeling and Risk Management tools.

Dr. Florence Aline is a research engineer in applied maths and statistical modelling. She hold a Master of Sciences in Statistical and Stochastic modelling at Orsay University (France). She then obtained her PhD in Signal Analysis (1999) with a focus on data analysis, statistics and optimisation algorithms. She worked on road traffic control optimisation and maritime routeing in INRETS (IFSTTAR), then on modelling and analysis of air-traffic controllers' workload in Eurocontrol. Since 2006, she works in Thales Research and Technology (TRT-France), and applies decision, classification and optimization techniques to several Thales applications and European projects, such as languages identification, crisis management, biological threat detection, road traffic optimization, maritime piracy detection... Since 2013, she is head of TRT-France Optimisation and Decision Laboratory (LDO).

Role in the project

- **WP1:** TRT will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** TRT will actively contribute to the participatory process and will engage with PUI to analyse the pilot demonstration site in France. Additonal contributions include review of assessment farmwork methodology.
- **WP4:** TRT will lead the activey on UAV route planning for autonomous aerial platform.
- **WP5:** TRT contribute to the big-data framework being setup within the project for data aggregation from end-point sensors, storage and processing. The use of open-source technologies based on Apache BD framework will be investigated for component development.
- **WP8:** TRT will contribute to the integration of SILVANUS platform.
- **WP9:** TRT will contribute to the organization and execution of pilot demonstration for Phase B. TRT will closely collaborate with the pilot owners for the evaluation of the demonstration activities.
- **WP10:** TRT will adopt a two-stage strategy for the dissemination and exploitation of the project toucomes. (i) The internal dissemination of the project outcomes on the technical objectives will be published within the organization to strength the exchange of knowledge among departments. (ii) The external dissemination strategy will lead to contributions to project publications such as newsletter, websites, social media posts, etc. The explolitation of project outcomes will include new knowledge integration within the existing products.

Relevant publications

- N Nour, R Belhaj-Soullami, C Buron, A Peres, F Barbaresco "Multi-Radar Tracking Optimization for Collaborative Combat", *Conference On Artificial Intelligence in Defense (CAID'2020)*
- Labreuche, C., Buron, C., Moo, P., & Barbaresco, F. (2019, June). Multi-criteria Performance Assessment of Adaptive Radar Resources Management: Application to Naval Scenario. In *2019 20th International Radar Symposium (IRS)* (pp. 1-6). IEEE.
- Brunet, Jean-Philippe, Thomas Sousselier, Johann Dreо, and Luc Jaulin. "Method for controlling a set of robots, and set of robots." U.S. Patent Application 14/649,867 filed November 19, 2015.
- Lagrave Pierre-Yves. (2020) A Principal Component Analysis Approach for Embedding Local Symmetries into Deep Learning Algorithms. In: Casimiro A., Ortmeier F., Schoitsch E., Bitsch F., Ferreira P. (eds) Computer Safety, Reliability, and Security. SAFECOMP 2020 Workshops. SAFECOMP 2020. Lecture Notes in Computer Science, vol 12235. Springer, Cham
- Mirebeau, Jean-Marie, and Johann Dreо. "Automatic differentiation of non-holonomic fast marching for computing most threatening trajectories under sensors surveillance." *International Conference on Geometric Science of Information*. Springer, Cham, 2017.

Past relevant projects

- **CAMELOT (H2020-SEC-2016-2017-1): Border Security: autonomous systems and control systems**

The creation of the Schengen area has been one of the major achievements of the EU. However, this agreement requires countries to cooperate tightly in order to keep a high level of security at their internal borders, as well as to share the responsibility of managing external borders. Such a variety of borders (land, sea and air) and current challenges requires a consistent approach to border surveillance, based on a plethora of heterogeneous assets. These can be manned or unmanned, ranging from sensors (optical, radar, IR) to unmanned platforms (UAV, UGV, USV or UUV), and need to be combined to offer an integrated situational picture of the area under surveillance and of their location.

- **ASSISTANCE (H2020-SU-DRS02-2018-2019-2020): Adapted situation awareness tools and tailored training scenarios for increasing capabilities and enhancing the protection of first responders**

The main purpose of ASSISTANCE project is twofold: On the one hand to help and protect different kind of first responders' (FR) organizations that work together taking into account the type of disaster/crisis they are mitigating in each moment and on the other hand, to enhance their capabilities for facing complex situations providing them advanced training based on Virtual Reality (VR), Mixed Reality (MR) and Augmented Reality (AR), tailored to their real needs depending on the type of incident. ASSISTANCE project will use novel technologies such as; UAV, Robots, drones' swarms and advanced training based on VR, MR and AR for increasing the FR's situation awareness (SA) taking into account their need in terms of data (e.g. real time video, persons and objects location, evacuation routes status, ad-hoc network coverage and so on).

- **SWARMS (H2020- ECSEL-2014-1): Smart and Networking UnderWAtter Robots in Cooperation Meshes**

Nowadays, the major part of offshore operations is done by divers in dangerous missions. Since their number is limited, the dependency on their work represents a real threat to the offshore industry. The extended use of unmanned underwater vehicles (AUVs/ROVs) could solve this problem but since they are usually tailor-made for a specific task and difficult to operate their deployment is very expensive. The overall goal of the SWARMS project is to expand the use of AUVs/ROVs and facilitate the reaction, planning and execution of maritime and offshore operations. This will reduce the operational cost and increase the safety of tasks assigned to divers.

- **RAPID (H2020-MG-2018-2019-2020): Risk-aware Automated Port Inspection Drone(s)**

RAPID will save lives by delivering an early warning system that will detect critical deterioration in transport system infrastructure, while also minimising system disruption and delays to critical supply chains. It will achieve this goal by combining and extending state-of-the-art drone technology to deliver a fully automated and safety assured maintenance-inspection (MI) service for bridge inspection, ship hull surveys and more. By combining self-sailing unmanned surface vehicles (USV) with swarms of autonomous unmanned aerial systems (UAS), RAPID will dramatically cut the time and cost of structural condition monitoring. RAPID-enabled MI services will increase efficiency and competitiveness for maritime transport stakeholders – such as ports, shipping companies, and landside transport authorities – and will deliver the safe and seamless operation of supply chain and mobility infrastructures – such as material handling equipment, cargo and passenger ships, and bridges. It encourages prioritisation of safer transport infrastructure where the technology seeks to improve environmental impact. RAPID will validate the high level of digitalisation, automation, and regulation required to support safe, beneficial, and scalable access to U-Space.

Dissemination plan

THALES Research & Technology, as French research center of the group will disseminate results towards different audiences. A first target is the Business Units of THALES to show them the interest of the innovation that SILVANUS will raise to encourage them to introduce such innovation in their new products. TRT already has many internal events called "Journées de Palaiseau" where research center exchange with Business Units each month. A second target is the scientific community to get feedbacks on our research activities and to ensure to be at least at the State-of-the-art in our domains. The dissemination-planned activities will be defined in the Dissemination plan with the help of the consortium in order that THA takes part of it.

Exploitation plan

THALES, as the main research centre of Thales aims at transferring the SILVANUS results inside the Business Units that could industrialize and exploit the results. The SILVANUS results will be relevant for different Business Units of the group when this is relevant to distribute computing. One of the applications is the Critical Infrastructure Protection. Thales divisions have a local and international portfolio with Critical Infrastructure (CI) operators (airports, energy and critical sites), transport operators (subways, tramways, buses), security forces and medium or large towns. Thales is also a major European leader in cybersecurity with 1,500 cybersecurity specialists. Three cybersecurity operation centres (1 in France 24/7, 1 in the United Kingdom and 1 in the Netherlands). Thales expects an increase of 7% of the market share on C4I (Computerized Command Control Communications & Information) systems in a global market of \$38 billion forecast infrastructure security spending by governments between 2010 and 2020 with 6.2% predicted annual growth in government infrastructure security spending to 2020 (CAGR 2008-2015). The increase is expected few years after the end of the project thanks to innovations from the SILVANUS results integrated into Thales products serving as key differentiators in front of our competitors.

4.1.5 FINCONS SpA

Partner Name: FINCONS SpA Company website: https://www.finconsgroup.com/ Type: Large-Enterprise	
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FINCONS GROUP is an IT Business Consulting company working on IT market for over 35 years. Alongside clients as a strategic partner, the Group supports business development through innovative approaches, models and IT solutions, providing tailored and end-to-end software solutions to tier-1 players in several markets: Media, Energy & Utilities, Financial Services, Transportation, Manufacturing and Public Administration. The Group can count on more than 1400 professionals with offices in Switzerland (Küssnacht am Rigi, Bern, Zurich, Lugano), Italy (Milan, Verona, Rome, Bari, Catania), in the UK (London), Germany (Munich), France (Paris), and in the USA (New York and Los Angeles), and a 2019 Group's turnover of over 144 million euro.

FINCONS has been able to adapt to, and to anticipate, major market trends, complementing technological excellence and innovation with growing business comprehension. Innovation is a key driver for the Group which develops several collaborations with industrial and public partners and with research centers and universities through the FINCONS Innovation Lab. Driven by market emerging needs, the Lab is in charge of technology observatory, relationship with international Academic and R&D institutions and partners, new concepts and prototypes design, selection of third party products, innovative business applications development. The Lab is actively involved in R&D activities in the areas of IoT, Artificial Intelligence, Machine Learning, Blockchain, Big Data, Cloud Computing, HbbTV, ICT Privacy and Security.

FINCONS is active in several R&D projects such as: FP7 FI-SPACE (on Logistics) and FI-CONTENT2 (on Social Connected TV), CIP “RADICAL” (IoT solutions for Smart Cities), Horizon 2020 “PSYMBIOSIS” and “BEinCPPS” (on Manufacturing), “MPAT”, “PRODUCER” (media convergency), “CONTENT4ALL” (accessibility, coordinated by Fincons) and “ABC-DJ” (creative industry), “CITADEL” (Public Administrations), and several H2020 IoT projects (Symbiote, Fiesta-IoT, TagITSmart!), and of the Italian Regional and National Research “Health@Home” (on Smart Communities for citizens’ wellness), “Energy Router” (Smart Energy) and “Fincons Smart Manufacturing Platform” (Industry4.0).

CVs of involved key researchers / staff members

Matteo Villa (Male) born in 1973 and graduated in 1998 at the Politecnico di Milano in IT Engineering. After working for 3M Spa as software engineer, he joined TXT e-Solutions in 2000, where he worked as project leader and project coordinator on several European research projects, in the areas of SW Architectures (IST SOA4All, Be-in-Grid IP, SORMA, Chememoentum), supply-chain management (Main-e, SFIDA-PMI), Environmental Risk Management (IST GIMMI), and Cultural Heritage (IST Agamemnon, WearIT@Work). From 2010 until 2012 while working with Polymedia Spa he was in charge of the delivery of professional services to the Joint Research Centre (Ispra) and EFSA (Parma), managing a team of 90+ consultants active in several scientific domains (environment, security, energy, etc.). Since 2013 he is working with FINCONS SpA, as Business Development and Innovation Manager for funded R&D projects, participating into FP7 and H2020 projects FISPACE [<https://www.fispace.eu/>],

FICONTEXT2 [<http://mediafi.org/>], RADICAL [<http://www.radical-project.eu/>], PSYMBIOSYS [<http://www.psymbiosys.eu/>], MPAT [<http://mpat.eu/>], ABC-DJ [<http://abcdj.eu/>].

Domenico Rotondi [<http://orcid.org/0000-0002-5298-4449>]: graduated cum laude in Physics and has postgraduate scholarship in computer networks, distributed systems and telematics services. He is working on R&D projects since 1985 in Tecnopolis CSATA N.O., TXT e-solutions SpA). Since January 2014 works in the FINCONS Group as responsible for the activities on EU R&D (H2020 PSYMBIOSYS, BeinCPPS, CITADEL, FIESTA SpyIoT, TagITSmart COSMEU-Tag & TagITSecure, XR4ALL eCAR) and national projects. The expertise acquired range from: innovative technologies for the protection of confidential or personal data (also in light of the new European regulation on privacy), problems relating to the IoT, event stream analysis based on CEP technologies, EDA architectures, blockchain technologies and CP-ABE cryptographic techniques for GDPR compliance and technologies for systems event driven, data analysis and classification technologies. He was member of many Technical Programme Committees of international conferences and he is the author of more than 50 scientific and technical papers published on international journals or conference proceedings.

Marco Saltarella (Male) born in 1994, is an industrial PhD student in Usable Security at the University of Bari. Since 2018, he is a Junior Developer in FINCONS where is currently contributing to several European and Regional funded Research & Development projects with a focus on IoT and Blockchain technologies, confidential data protection via new cryptographic techniques and GDPR compliance.

Role in the project

- **WP1:** FINC will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** FINC in collaboration with ASSET, LETS, PSNR will participate in the development of participatory process methodology and will implement the necessary tools to aggregate stakeholder requirements.
- **WP4:** FINC in collaboration with CMCC will contribute to the implementation of data collection APIs and software interfaces to aggregate information stream from environmental sensors and EO repositories.
- **WP5:** FINC will contribute to the setup, operation and maintenance of big-data framework.
- **WP6:** FINC in collaboration with the stakeholders, will investigate the effectiveness of Phase C methodologies proposed by AMIKOM for forest rehabilitation within EU and beyond.
- **WP8:** FINC will lead the activity on information sharing between SILVANUS mobile command centres. Additional contribution will include the development of data services to monitor and evaluate the impact assessment of environmental sensors upon forests.
- **WP9:** FINC will participate in the pilot demonstration to be carried out within Italy (across 2-pilot sites).
- **WP10:** FINC will internally and externally disseminate the project results. The knowledge gained from the project will enhance the internal product development roadmap.

Relevant publications, and/or products, services or other achievements

- D. Rotondi, S. Gusmeroli, S. Piccione, “A capability-based security approach to manage access control in the Internet of Things”, Mathematical and Computer Modelling Journal, ISSN 0895-7177, 10.1016/j.mcm.2013.02.006.
- S. Pérez, J. L. Hernández-Ramos, D. Pedone, D. Rotondi, L. Straniero and A. F. Skarmeta, “A digital envelope approach using attribute-based encryption for secure data exchange in IoT scenarios”, 2017 Global Internet of Things Summit (GIoTS), Geneva, 2017, pp. 1-6. doi: 10.1109/GIOTS.2017.8016281
- S. Pérez, D. Rotondi, D. Pedone, L. Straniero, M.J. Núñez, F. Gigante, “Towards the CP-ABE Application for Privacy-Preserving Secure Data Sharing in IoT Contexts”, in: L. Barolli, T. Enokido (eds) “Innovative Mobile and Internet Services in Ubiquitous Computing”. IMIS 2017. Advances in Intelligent Systems and Computing, vol 612. Springer, Cham (<https://doi.org/10.1007>)
- S. Pérez, J. L. Hernández-Ramos, S. N. Matheu-García, D. Rotondi, A. F. Skarmeta, L. Straniero, D. Pedone, “A Lightweight and Flexible Encryption Scheme to Protect Sensitive Data in Smart Building Scenarios”, in IEEE Access, vol. 6, pp. 11738-11750, 2018. doi: 10.1109/ACCESS.2018.2801383
- D. Rotondi, M. Saltarella, G. Giordano, F. Pellecchia, “Distributed ledger technology and European Union General Data Protection Regulation compliance in a flexible working context”, Internet Technology Letters Volume 2, Issue 5, pag. Ee127, August 2019 (<https://doi.org/10.1002/itl2.127>)

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
H2020 FoF PSYMBIOSYS (http://www.psymbiosys.eu/): PSYMBIOSYS aims at improving the competitiveness of European Manufacturing industries by developing an innovative product-service engineering environment.	FINCONS focused its activities on privacy and security solutions, thanks to the use of CPE-ABE and elliptic encryption techniques, for Product-Service Manufacturing tools and services.	The security features will be reused to assure confidentiality or integrity in SILVANUS
H2020 FoF BEinCPPS (http://www.beincpps.eu/): BEinCPPS aimed to integrate and experiment a service platform ‘Cyber Physical Systems oriented’, ‘Future-Internet based’ and ‘machine-factory-cloud based’. The final aim of this project was to dramatically improve the adoption of CPPSs all over Europe by means of the creation, nurturing and flourishing of CPS-driven regional innovation ecosystems, made of competence centres, manufacturing enterprises and IT SMEs.	FINCONS focused on secure event collection and dispatching, assuring the confidentiality of exchanged data.	BEin CPPS extended the FIWARE platform with additional components (e.g., for data collection for sensors deployed in the field) supporting a wider set of protocols (e.g., MQTT, AMQP)
EcoLoop : R&D project, co-funded by Puglia Region, focused on developing an integrated infrastructure, envisaging in field sensors and edge and cloud data processing, to support the reuse of refined wastewater in agriculture. The functionalities provided by the system are addressed to farmers, as well as water distribution and refining plants operators offering them the possibility to optimize the use of the water resources thanks to advanced, predictive models and resource allocation algorithms.	FINCONS is responsible for the data collection from the remote, on field, sensors, and of the cloud services, including cloud data analysis	Analysis mechanisms developed in EcoLoop will be reused in SILVANUS
H2020 CITADEL (https://www.citadel-h2020.eu/) CITADEL focuses on transforming the public sector to make more efficient, inclusive and citizen-centric public services that identify/capture new or unsatisfied needs more quickly and satisfy them more effectively and in an inclusive way, providing also guidelines and features to support new processes.	FINCONS contributed to privacy related issues and, specifically, on GDPR ones. To this end one of the pilot activities involving FINCONS was related to the development of a GDPR compliant solution, based on DLT (Distributed Ledger Technologies), to support smart working for the Municipality of Bari (Italy).	CITADEL provided a set of components (e.g., the CITADEL Security Toolkit) that could be useful in SILVANUS (e.g., for privacy assurance, or data trusting via using the blockchain)
Within this project FINCONS has been appointed two open call projects	TagITSmart! (https://tagitsmart.eu/) /Tagitsecure/D3.1.pdf): that has extended the TagItSmart! (TIS) ecosystem with the SeDEM (Secure Data Exchange Management) module; IS-COSMEU-Tag (https://www.tagitsmart.eu/CosmeuTag/D1.2.pdf): in which FINCONS developed an innovative solution for cosmetic brands protection for EU SMEs, based on TagItSmart!, blockchain, AR and CB-ABE encryption technique.	The security mechanisms are able to assure the confidentiality and integrity of data collected from remote sensors

<p>H2020 XR4ALL (http://xr4all.eu/) Within this project FINCONS has been appointed the eCAR open call project</p>	<p>eCAR (encryption for Confidential AR) aiming at enhancing the XR4ALL platform with components that enable developers to create AR applications able to customise the provided information according to attributes that characterise the AR application's user</p>	<p>The eCAR approach can help in customising information provided to end-users based on their roles</p>
<p>JRC new MARS Viewer: design and development of the new version of the MARS (Monitoring Agricultural ResourceS) Viewer, a Spatial Data Infrastructure for geospatial processing and visualization to be used by the Agri4CAST team for generating maps, graphs, and time series based on agriculture-related data over Europe and neighboring countries, in order to support the periodic publication of the JRC MARS Bulletin and the entire research and reporting activity of the JRC D.5 Food Security Unit</p>	<p>FINCONS is the developer of the MARS Viewer</p>	<p>The Viewer can provide useful elements for the SILVANUS data analysis and visualization features</p>

Individual exploitation plan

As an industrial partner, FINCONS has a concrete interest in the commercial exploitation of the project results. To this end, the strategy that will be adopted will be to promote the project and the results, first of all, towards current customers in the PA and utilities sectors, and subsequently towards other potential customers. The promotion and exploitation of results will also see participation in events and conferences relevant to the theme or type of participants

Communication strategy for promoting project outcomes

As stated, the communication strategy will be mainly focused on fostering and supporting the commercial exploitation of the project. In collaboration with the Apulia regional agency ASSET and CMCC, particular attention will be devoted to the communication in the Apulia region and in neighbour geographical areas so to increase the awareness about the SILVANUS project and the exploitability of its results thanks to the availability of the Parco del Gargano pilot site.

Description of significant infrastructure and major items of technical equipment relevant to the project

FINCONS Delivery Center instituted in Bari (Italy), counts on more than 600 experienced software engineers and project managers can guarantee excellent and highly competitive IT remote development and management services and solutions, in maximum collaboration and transparency with the clients.

Since 2019, FINCONS has established two Cloud Competence Centers as part of the Delivery Center:

- **FINCONS Cloud Competence Center:** leveraging on Group's long-standing experience as Amazon Web Services (AWS) partner, working with the most popular and complete cloud platform to support the many business that have entrusted FINCONS to implement their IT services on AWS cloud. FINCONS Group was nominated Select Consulting Partner in 2018, but decided to further reinforce its offering with the establishment of an AWS Competence Center that supports the Group's clients in the development of tailored end-to-end solutions for the migration of their IT services on the most popular cloud platform in the world.
- **FINCONS Cloud SMEs** (Subject Matter Expert) are able to support project for different business domains like Media and Entertainment, Public Sector and International Organizations, Energy & Utility, Banking, Insurance and so on. When needed, FINCONS can leverage its AWS Specialists in order to validate the proposed solution and ensure the alignment to AWS best practices in term of Solution BluePrint, Architecture implementation, security, availability, cost optimization.

FINCONS is also working to extend the skills of the Cloud Competence Center resources to other Cloud providers like Microsoft Azure.

4.1.6 ATOS IT Solutions and Services IBERIA SL

Partner Name: ATOS IT SOLUTIONS AND SERVICES IBERIA SL	
Company website: atos.net	
Type: Large-Enterprise	

Partner profile

Atos Research & Innovation (ARI) is the R&D hub for emerging technologies and a key reference for the whole Atos group. With almost 30 years of experience in running Research, Development and Innovation projects, we have become a well-known player in the EU context. Our multidisciplinary and multicultural team has the skills to cover all the activities needed to run projects successfully, from scientific leadership to partnership coordination, from development of emerging technologies to the exploitation of project outcomes, with a strong focus on dissemination, innovation adoption and commercialization.

Our company is a founding member of the European Technology Platform NESSI (Networked European Software and Services Initiative). It is a major partner in Future Internet-related initiatives being member of the FI PPP Steering Board and Industrial Advisory Board. Since 2014, Atos IT is a founding member and member of the Board of Directors of the Big Data Value Association (BDVA), assuming the roles of Vice-presidency and Deputy Secretary-general. We are also member of the 5G PPP Steering Board.

Additionally, we are members of NetWorld2020, NEM, EFFRA, ERTICO, CELTIC, NIS, EOS, ESCO, LSEC, ETSI, OW2, OASIS, AIOTI, Cloud Security Alliance, Eurocities, etc. Finally, we are a core member of the KICs EIT HEALTH, EIT DIGITAL, and EIT MANUFACTURING. At national level, we are currently holding the Presidency and Secretary of PLANETIC for ICT, as well as the Vicepresidency of es. Internet for Future Internet technologies, and is member of several others, such as PESI, Logistop, eVIA for Health and Independent Living, Nano-Med or the Spanish Railways Technology Platforms (PTFE).

The Homeland and Security Defence (HSD) sector within ARI coordinates the R&I activities in the security sector, based on experience gained with clients that include national and regional security bodies, intelligence agencies, international bodies (such as the UN, NATO and the EU) and also all types of organizations that address or deal with citizen safety, critical infrastructures, crisis management, crime fighting, law enforcement or border intelligence. The key strengths and special areas of experience span from crisis and emergency management to cross border management and interoperability, simulation of forward-looking security scenarios, economics of security or security societal issues. The team of experts of the HSD Sector has been performing essential security and crisis management projects for many years (e.g. DRIVER, ZONESEC, PACT, VALUESEC, CIRAS, FORCE, RECOBIA, FOCUS, VIRTUOSO, etc.) aiming to close the gaps between technology, IT and the society security related needs and challenges.

CVs of involved key researchers / staff members

Mr Francisco Gala (male) is the Head of the HSD unit for Atos Research and Innovation. Francisco holds a MSc in Environmental Sciences, PRINCE2 certification and an MBA. He has over 12 years of international experience (Spain and the UK), and a multidisciplinary profile with direct involvement in many sectors: ICT, utilities, civil engineering and environmental protection. In the most recent years Francisco has worked in several ICT “lab to market” RTD projects, both national and European (AVANZA, INNPACTO, RETO50, BIVENTO etc.). Some of the most relevant topics include the integration of remote sensors with ITS and SmartCities and their metrological and legal validation, instant Identification of H.E. (high emitters), and smart GIS and mapping solutions.

Mr Jose Maria Miranda Orte (male) received the Master in Science in Aeronautical Engineer in 2007, Specialization in Air Vehicles and Missiles from the UPM (Polytechnic University of Madrid). He is currently member of Methods and Tools Department in Airbus Defense and Space, Flight Test Division. His research interests include the application of photogrammetry and computer vision in several areas like: weapons release, flares dispensing, parachutists and load release through rear ramp, aircraft trajectory, in-flight measurement automatic determination of lifting-surfaces structural deformation, automatic determination of relative aircraft position and closure rates for application in in-flight refuelling tasks, estimation of vibrations in Hose & Drogue refuelling systems, computer

assisted guidance for in-flight refuelling ARBS (Aerial Refuelling Boom System) operations, signal processing, pattern recognition. He has some patents, US8788124B2 and ES2436726A2 System and method for the calculation of the approach speed during air to air refuelling operations and currently in process, Methods of characterization of oscillations using artificial vision techniques. He also participated in the development of forensic analysis tools for Spanish Home Office that allows facial recognition in surveillance systems.

Mr J. Ignacio Molina (male) is an analyst and software developer for the Homeland Security and Defence Sector (HSD) of the Research and Innovation arm of Atos with the European Commission. Ignacio holds a Bachelor of Science degree in Physics from the Universidad Complutense de Madrid. He has more than 20 years of experience working with ATOS and a multidisciplinary profile with direct involvement in sectors as telecommunications (IMS-NGIN) or homeland security and defence. Ignacio's developing strengths are JA-VA and Python and he is beginner with deeplearning for computer vision. In the most recent years Ignacio has worked in several European HSD projects into H2020 framework. The most recent are BODEGA (border checks with human factors expertise in order to enhance efficiency, border security and traveller satisfaction) and TOXI-TRIAGE (Integrated and adaptative responses to toxic emergencies for rapid triage: engineering the roadmap from casualty to patient to survivor).

Role in the project

- **WP1:** ATOS will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** ATOS as a technology provider, will contribute to the development of the participatory process and will be involved in the formalization of assessment framework methodology.
- **WP4:** ATOS will contribute to the technical development visual computing toolkit for the early-stage detection of fire ignition. ATOS will implement and integrate the media processing component within the platform.
- **WP5:** ATOS will contribute to the creation and maintenance of Big-data framework.
- **WP8:** ATOS will contribute to the integration of software components developed in WP4 and **WP5** within SILVANUS architecture specification
- **WP9:** ATOS will engage with the pilot owners to provide hands on support on technology interventions.
- **WP10:** ATOS will carry out internal and external dissemination activities.

Relevant publications, and/or products, services or other achievements

Atos has released numerous material available on specific capabilities such as cyber, biometrics, command and control centres, emergency management. Furthermore, the Atos Scientific Community has published, among others, the following white papers below:

- Security for “Bring your Own” Concepts (June 2013)
- Data Analytics as a Service (March 2013)
- Digital Preservation in the Age of Cloud and Big Data (September 2014)
- Information Overload (August 2013)

Atos security management portfolio encompasses a full-spectrum service approach designed to respond to constant changes in ministries, emergency response organizations, border managers, intelligence chiefs, and other security managers. The most relevant products are:

- GEMMA. For Public Safety Answering Points (PSAP) and Emergency Response Organizations (ERO), ensuring timely reaction whilst maintaining responses relevance is critical to save lives. With GEMMA, its emergency management system, Atos supports response organizations with emergency call response procedures. GEMMA helps improving cooperation between command and control centers and field personnel. It can cover emergency response from call taking and dispatching to first-responder action
- CLASSYS - The Atos Civil & National Security (CNS) portfolio encompasses many varying technological solutions aimed at providing physical and cyber security solutions. The addition of the new solution coming from CLASSYS improves significantly current portfolio of services and complements Atos CNS solutions. The CLASSYS solution provides Atos with greater insight and opportunities in deploying security solution in current clients in this sector where Atos has been a key player for many years..

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
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DRIVER+	DRIVER+ (Driving Innovation in Crisis Management for European Resilience (FP7) that aims to develop and boost the uptake of innovative solutions to address the operational needs of practitioners dealing with Crisis Management (CM). https://www.driver-project.eu/)	DRIVER+ is able to offer multiple remenents for Crisis Management, from sources for Crisis Management, from planning to the execution and evaluation of trials. Atos is the coordinator of DRIVER+ (CM). https://www.driver-project.eu/
TOXI-TRIAGE	TOXI-TRIAGE (integrated and adaptive responses to toxic emergencies for rapid triage: engineering the roadmap from casualty to patient survivor. http://toxi-triage.eu/) (H2020) addresses the operational, technological, ethical and societal dimensions of CBRN response and recovery. It provides a solution to improve civil preparedness in the event of a catastrophic chemical, biological, radioactive, or nuclear (CBRN) incident in Europe.	Toxi Triage offers tools for the management of disaster events that could be adapted to be used for the coordinated response to wildfires
E-FLY	E-FLY developments will develop a new service for Critical Infrastructure monitoring and inspections combining UAV, Edge and Cloud Computing Services, which will be validated on real inspection pilots on Ferrovial pipeline infrastructures. (www. http://e-fly.eu/)	The edge-devices deployed in drones could be used to for early detection of fires, as well as creating map risks (prevention phase) and links to infrastructure management (e.g. inspection of vegetation growth under electrical pylons)
ZONESEC	ZONESEC – Towards a EU framework for the security of wide zones (2014-2017). FP7-SEC-considered critical infrastructure) could 2013-1.6-3. European framework for wide-zones surveillance taking into consideration costs, complexity, vulnerability, societal acceptance, and ethics. (http://www.zonesec.eu/)	The protection of wide zones (initially considered critical infrastructure) could be exported for the prevention of wild-fires. This can be combined with the UAVs of E-FLY
RESISTAND/STRATEGY	STRATEGY project will develop a pan-European framework of pre-standardisation activities for systems, solutions and procedures. It will address crisis management, sustainable tests and evaluation frameworks that can improve the crisis management and disaster resilience capabilities	The outputs of FORTORI could be used for the standardisation activities in STRATEGY and/or follow the pre-standardisation path set by the parent project RESISTAND. Also, STRATEGY could steer any standardisation activity generated by FORTORI

Individual exploitation plan

In alignment with the exploitation strategy of Atos, the exploitation plan will be the application of that strategy for the specific case of FORTORI, implying that Atos foresees taking FORTORI outcomes to market as follows:

- Consulting and development services: The internal knowledge of the technologies resulting from the participation in the project will let Atos being in an excellent position to offer consulting and development services for other companies willing to customize and integrate the FORTORI technologies in their own IT infrastructures
- Improve Atos portfolio with FORTORI components: Atos has a very broad portfolio of solutions where FORTORI could be applicable

Communication strategy for promoting project outcomes

The first step is to approach the market communicating internally across all Atos business units project assets and results (e.g. via innovation workshops, digital show, etc.) and then to promote the adoption of innovative solutions and emerging technologies bringing R&D project results closer to market. There is a systematic and permanent process in place to detect promising assets from R&D projects; to present them to the Innovation Board where most promising are evaluated by business units and experts; and to set up a 3-5 years commercialization roadmap. Other activities will be establishing partnerships increasing our competitiveness, having the opportunity of exchange know-how with research institutions, public administrations, SMEs and industrial partners. This project will be carried out by the R&D team who will ensure a continuous research in that area after the project.

Atos also plans to perform internal dissemination of the results and ideas of the project through the Ascent Journey and the biannual Journey 2021 and 2022 reports.

Description of significant infrastructure and major items of technical equipment relevant to the project

N/A

4.1.7 EMC INFORMATION SYSTEMS INTERNATIONAL

Partner Name: EMC Information Systems International

Company website: <https://www.delltechnologies.com>

Type: Large-Enterprise



EMC Information Systems International is a member of the Dell Technologies unique family of businesses, which serves a key role in providing the essential IT infrastructure for organizations to build their digital future, transform IT and protect their most important asset, information. Dell Technologies enables its enterprise customers' IT and digital business transformation through trusted hybrid cloud and big-data solutions, built upon a modern data centre infrastructure that incorporates industry-leading converged infrastructure, servers, storage, networking, IoT and cybersecurity technologies. Dell Technologies believes in promoting standards, openness and choice, and is actively involved in driving standards and initiatives, through consortia like EdgeX Foundry, OpenFog, of which Dell is a founding member, and the Industrial Internet Consortium.

The Dell EMC's European research team is based in the Centre of Excellence in Ireland and plays an integral role in driving Dell Technologies' future networks and cloud security research agenda, through research and innovation in strategic application areas. The team reports directly to the Office of the CTO, influencing the strategic focus areas of the business in emerging technologies and ecosystems. Many of the team's efforts focus on use cases in key industry verticals, such as connected vehicles, telecommunications, healthcare and finance, all of which are fast becoming consumers of high-performance computing infrastructure.

Since its establishment in 2011, the research team in Ireland has positioned itself as a core contributor on 14 EU-funded FP7 and H2020 projects, such as the successfully completed projects, SOLAS, ESCUDO-CLOUD, CUTLER, NEAT, and ongoing projects, BRAINE, LifeChamps, TRUSTS, SLICENET, SERENA, TERAPOD and MOSAICrOWN (Big Data PPP). The team applies its expertise in state-of-the art technologies, such as big data and cloud environments with privacy-preserving selective data sharing and collaborative analysis (BRAINE, MOSAICrOWN, ESCUDO-CLOUD), secure containerisation of edge-to-cloud distributed AI analytics and securing the data sharing platform (SERENA, LifeChamps, TRUSTS) and threat analysis of hybrid cloud big data infrastructure for public administrations (CUTLER). Many of the results derived from these research initiatives have directly influenced Dell Technologies product, service and solution offerings.

CVs of involved key researchers / staff members

David Bowden (Male) is a Principal Research Scientist with Dell ORO Research Europe based in the Centre of Excellence in Ireland. His primary areas of research are semantic models, IoT sensor & video analytics and edge to cloud orchestration. He has also held positions as a Consultant Software Engineer and Advisory Solutions Architect. David has a first-class M.Sc. in Artificial Intelligence and another in Cloud Computing from CIT. Prior to joining Dell Technologies, David worked in a broad range of industries from Airlines to Banking, Public Utilities to Broadcasting. He has developed solutions for many types of platforms from micros to mainframes, primarily in software development, but also in systems integration, infrastructure, SCADA/IoT and UI design. In total David has over 40 years' experience in the IT industry.

Aidan O'Mahony (Male) is a Principal Research Scientist with Dell Technologies Research Europe based in the Centre of Excellence in Cork, Ireland. Prior to this role Aidan worked as a Principal Software Engineer on Dell Technologies PowerMax and VMAX Operating System development where he led projects in the area of data reduction and encryption. He has also held roles in automotive diagnostics as well as encryption acceleration firmware development in Intel Corporation. In his current role he has worked on the MOSAICrOWN EU funded project. Aidan is pursuing a Ph.D. in the Electrical and Electronic Engineering department in University College Cork in the area of hardware acceleration for financial applications. He completed his M.Sc. in Software Development in Cork Institute of Technology where he was awarded student of the year in 2015 and he received a first-class B.Sc. in Computer Science in 2007 from UCC where he was nominated science student of the year. Aidan holds one patent in the area of data reduction with a second patent filed in the same technology area.

Merry Globin (Female) is a Research Scientist with Dell ORO Research Europe based in the Centre of Excellence in Ireland. Her primary areas of research include AI, IoT and Knowledge Bases. She has a M.Sc. in Data Science and Analytics from UCC. She has worked as a software engineer, developing applications for clients in the healthcare and retail domain and has 5 years of experience in total.

Ger Hallissey (Male) is Research Manager for the Dell Technologies Research Europe group based in the Ireland CoE in Ireland. He is responsible for the technical management of all Dell Technologies' European based collaborative research programmes, which includes a number of EU funded projects, as well as managing strategic academic and industrial partnerships. He also has an active role driving the adoption of technology research into Dell Technologies' products, services and solutions. He joined EMC in 1998 and throughout his EMC/Dell Technologies career, he has held engineering management responsibilities in manufacturing, supply-chain, product development and research. Prior to joining EMC, he worked as a researcher in an Enterprise Ireland funded Advanced Technology Programme at University College Cork; where he was responsible for designing, developing and commercialising energy conversion solutions for industrial applications. He has a B.Sc. in Electrical Engineering, a M.Sc. in Electrical Engineering (Power Electronics) and a master's degree in Business Administration, all from University College Cork, Ireland and holds two technology patents.

Role in the project

- Dell will be focusing primarily on the SILVANUS platform, and how a cloud-to-edge architecture can be implemented. Dell has considerable experience in this area, both from H2020 projects, such as SERENA and BRAINE, and its internal development of leading-edge hardware solutions, such as the POWEREDGE XE2420. The concept is to process the data at the edge where it is ingested, and to reduce network data transmission and latency. To achieve this the BRAINE architecture has introduced the concept of an Edge Micro Data Centre, which allows ML algorithms not only to be run, but also trained at the edge using hardware accelerators such as GPUs and FPGAs. Dell sees SILVANUS as the ideal opportunity to develop and apply this new type of data centre in challenging environments.
- Dell Technologies has a long history of managing data and extracting valuable information from it. SILVANUS provides the opportunity to develop and apply the concept of a distributed metadata index that pulls together heterogeneous data, from multiple sources, into one homogeneous data model of the domain. Much of this data is unstructured and must be analysed, annotated and intelligently indexed so it can be effectively searched and retrieved. The research group in Cork has many years of experience in developing data models, using technologies such as RDF, and is actively engaged with standards organisations, such as the W3C. In SILVANUS, Dell will be able to work with likeminded partners to develop the concept of a distributed data model and metadata index, and efficiently allow data to be located and moved to where it is needed.
- Healthcare and the wellbeing of individuals is an emerging area where new technologies, such as wearable IoT sensors, can help improve people's life expectations. This starts at the moment the first responder arrives at the scene of an emergency. Dell has, and continues to, engage in research projects to develop practical solutions in this area, and will work with health industry partners in the SILVANUS project to actively monitor and respond to people's health in hazardous environments.

The following list of specific contributions are envisaged to DELL

- **WP1:** DELL will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP3:** DELL will contribute to the development of SILVANUS semantic framework in collaboration with EAI, CTL and HB.
- **WP4:** DELL will actively contribute to the overall development of edge-analytics.
- **WP5:** DELL will lead the workpackage activities and will coordinate the contribution from technical partners.
- **WP8:** DELL will integrate the technical outcomes from WP3, WP4 and WP5 into the project platform
- **WP9:** DELL will engage with stakeholders for monitoring the progress of continuous pilot demonstration.
- **WP10:** DELL will disseminate and communicate the project results to both internal and external stakeholders

Relevant publications, and/or products, services or other achievements

- J. O'Sullivan and D. Buckley. "IIC Testbeds - a Blueprint for Delivering Innovation and Ecosystems". In: Inaugural IIC Journal of Innovation (Dec. 2015)
- S. La Porta, J. Blanco, R. Chabukswar, K. Paridari, H. Sandberg, and M. Boubekeur. "Cyber-Physical-Security Framework for Building Energy Management System". In: ICCPS 2016. Vienna, Austria, April 11-14 2016

- D. Bowden, N. O'Mahony, et al., A cloud-to-edge architecture for predictive analytics, Workshop on Data Analytics Solutions for Real-Life Applications (DARLI-AP), Lisbon, 2019.
- Q. Wang, T. Truong, Z. Bozakov, et al., Enable advanced QoS-aware network slicing in 5G networks for slice-based media use cases, IEEE Transactions on Broadcasting, Vol. 65, Issue 2, Feb 2019.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
LifeChamps [Project ref. 875329]	<p>A Collective Intelligence Platform to Support Cancer Champions. Began in Q1 2020 and will run for a 3-year period. The project aims to improve the quality of life for cancer patients by monitoring and analysing selected health metrics. It utilizes context-aware data and a large-scale analytics framework, based on the collection and use of streaming data. The ambition is to enable predictive AI and Deep Learning modelling, analysis, and aggregation of data to ultimately deliver multi-dimensional QOL solutions for oncology patients.</p>	<p>This project is developing an HPC cloud solution for using AI to analyse the health of cancer patients. We intend to extend this work to actively monitor the health of fire fighters to provide a real-time data feed to the SILVANUS platform.</p>
BRAINE [Project ref. 876967]	<p>With the increasing quantities of data generated at the edge, from IoT devices and cameras, there is a need to process that data at the point of ingestion. BRAINE is an innovative project to develop powerful Edge Micro Data Centres (EMDCs), and encompasses the complete solution stack: from AI enabling hardware, to containerised application deployment and orchestration. Because of their innovative liquid cooling solution and compressed design, BRAINE's EMDCs are ideally suited to provide HPC computing in challenging environments that require hermetically sealed enclosures; and are specifically designed to support containerised machine learning workloads using GPUs and FPGAs. The solution moves the power of a small conventional datacentre out to the edge, to decrease processing latency and vastly reduces data transmission requirements.</p>	<p>Dell will utilize the knowledge learned in developing Edge Micro Data Centres to deploy infrastructure capable of handling high throughput of ML workloads close to the fire front.</p>
MOSAICrOWN [Project ref. 825333]	<p>A H2020 research and innovation project that began in Q1 2019 and will run for a 3-year period. The project aims to develop a set of privacy preserving tools to enable a collaborative data market where data can be securely shared and analysed by multiple parties while preserving the confidentiality and integrity of the data itself. Dell Technologies will produce a demonstrator for a connected autonomous vehicle use case, implementing and validating the data protection mechanisms resulting from the project.</p>	<p>This project developed new vocabularies and knowledge models in RDF, which can be modified and enhanced for the SILVANUS project. Additionally, we will utilize work we have done with the NiFi dataflow engine to transmit RDF graphs by serializing them into JSON-LD.</p>
SERENA [Project ref. 767561]	<p>A H2020 innovation project that began in Q3 2017 and will run till Q2 2021. The project focuses on the development of an intelligent manufacturing system to optimise operations in a smart manufacturing environment, by means of multi-level IoT sensing, predictive analytics, remote factory control and augmented reality for operator assistance. Dell Technologies focuses on the development of a plug-and-play hybrid cloud data storage and processing platform, with edge-to-cloud security and analytics capabilities.</p>	<p>The SERENA project allowed us to experiment with ML workload orchestration from an edge-to-cloud, in a single homogeneous Docker Swarm. Kubernetes has emerged as the dominant container orchestrator, and we will utilise the knowledge gained from SERENA to update the platform for SILVANUS using Kubernetes.</p>

First Responders and High-speed Navy Boats	Over several years Dell, along with other partners, has internally funded several IoT projects researching into the health of emergency personnel in hazardous environments, typically IP67. The projects investigated whether it would be possible to use commodity Bluetooth sensors, fitted into heavy duty protective clothing, to monitor the health of emergency personnel. The technique used a variety of different sensors to build a view of the persons health when exposed to certain adverse environmental conditions.	We intend to extend this work to provide a holistic view of the health of fire fighters in real-time, which can be presented to fire chiefs in forward command centres.
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Individual exploitation plan

Dell Technologies Research Europe will present regular internal updates on SILVANUS to corporate executives, the corporate innovation council and product groups. In particular, activities within SILVANUS will be coordinated with similar activities at Dell Technologies. Dell Technologies understands the challenges that face the digital transformation underway across all markets from healthcare, to manufacturing, IoT, energy, to retail and finance. Tools for enabling the autonomous acquisition, monitoring and allocation of datacentre or Cloud resources to transient tasks are central to optimizing the fine-grained use and control of available resources, thereby managing the Total Cost of Ownership (TCO) of a service. SILVANUS aims to make advances in this area.

Communication strategy for promoting project outcomes

Dell Technologies organizes forums on a regular basis for discussing critical technology issues and capabilities with customers, partners and prospects across Europe and around the world. These forums will provide a significant opportunity for communicating the strategies and technologies developed in this project. Dell Technologies also actively participates in industry forums, including presenting leadership events in datacentre, virtualization and IoT technologies. Dell Technologies is very active in standardisation efforts and in standards bodies and will pursue opportunities for standardisation. In particular Dell is a member of the Industrial Internet Consortium (IIC) and is a founding member of the INFINITE innovation platform, one of IIC's approved testbeds. Dell is also a platinum member of the Cloud Foundry cloud application platform and a partner of the Open Container Initiative (OCI) which aims to create open industry standards around container formats and runtime. Dell is a sponsor member of the OASIS consortium and an executive member of the Cloud Security Alliance (CSA)

Dell Technologies will communicate project results internally (140,000 employees) and externally using web-pages, social-media tools, visual media, newsletters and publications

Dell Technologies regularly participates at industrial conferences, panels and workshops and will use these opportunities to communicate the goals and results of SILVANUS. Dell Technologies plans to showcase the results of the project at many leading trade shows and industry conferences, such as Mobile World Congress, VMware World, and its own flagship event "Dell Technologies World", which is held annually in Las Vegas and attracts audiences of 20,000 ICT professional customer and partners. Dell Technologies regularly publishes white papers on next generation technologies and plans to use this mechanism to present SILVANUS project results to external audiences.

Dell Technologies will use its global network of customer briefings centres, one of which is co-located with the research team in Cork, Ireland, to present SILVANUS results to customers. It provides an excellent opportunity to get valuable feedback from customers and encourage follow-up requests for further information on new technologies.

Description of significant infrastructure and major items of technical equipment relevant to the project

- Dell Technologies AI-ready solutions: <https://www.dellTechnologies.com/en-ie/solutions/artificial-intelligence/index.htm> By offering the industry's most comprehensive portfolio of AI-capable systems, servers, storage, solutions and services, Dell Technologies enables organisations to take control of data and accelerate time to faster, better, deeper insights. With the intelligent technologies in modern infrastructures with AI capabilities, and with corresponding AI services, Dell Technologies makes AI adoption faster, easier and more collaborative. Dell Technologies gives organisations a choice of flexible and scalable solutions, small and large, opening the AI market to organizations of every size. Purpose-built workstations, servers, storage and Dell Technologies Ready Solutions for AI provide opportunities to address AI-focused use cases that advance business goals. For years, Dell Technologies has been the undisputed leader in data management, data protection, data storage and compute — the infrastructure building blocks necessary to store, protect and execute against the valuable

data that is the fuel for AI. We continue to aggressively innovate in these areas. In addition, we are ourselves an early adopter and advisor when it comes to AI strategy and best practices.

- Dell Technologies Ready Solutions for Data Analytics: <https://www.dellTechnologies.com/en-ie/solutions/data-analytics/index.htm> Dell Technologies Ready Solutions for Data Analytics provide an end-to-end portfolio of predesigned, integrated and validated tools for big data analytics. Consisting of high-performance Dell Technologies infrastructure, these solutions have been: Designed to simplify deployment and operation of big data analytics projects; Calculated to lower costs and to ensure a strong return on investment; Optimized for performance and scalability.

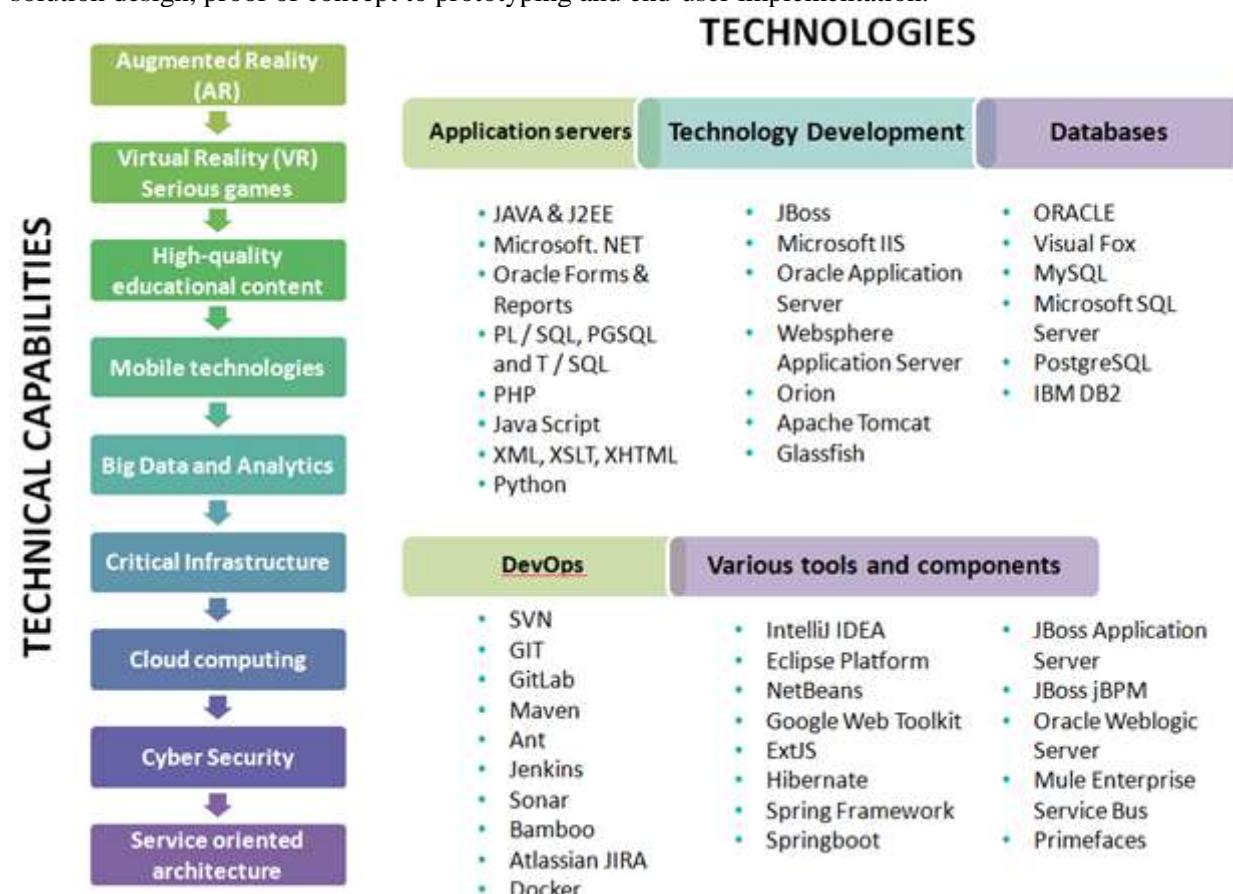
4.1.8 Software Imagination & vision

Partner Name: Software Imagination & Vision	 <i>Software Imagination & Vision</i>
Company website: www.simavi.ro	
Type: Large-Enterprise	

Partner profile

Software Imagination & Vision (SIMAVI) is a large IT company, established after the division of SIVECO Romania SA – a large software company founded in 1992. SIMAVI has proven experience in the following fields of activity: R&D, Education & eTraining, eHealth, Security, eAgriculture, Customised Applications, ERP & BI, eCustoms, and Government with +1500 commercial clients and +300 successful projects in Europe, Middle East, North Africa, CIS area.

SIMAVI staff consists of IT specialists with complementary technological capabilities: IoT, Analytics, Big Data, Data mining, Cloud computing, Decision Support Systems, User interfaces, UX design, Virtual Reality (VR), Augmented Reality (AR), Serious Games and Training. Our team is covering all stages of projects development from solution design, proof of concept to prototyping and end-user implementation.



SIMAVI is a member of several prestigious associations in the field of ICT like [The European Alliance of IoT Innovation \(AIOTI\)](#) and [Big Data Value Association \(BDVA\)](#)

Reference EU Commission Projects

SIMAVI is implementing several framework projects for EU Commission organizations:

- **BTRAIN** for Directorate-General Taxation and Customs Union and
- **TrainUser** for DG HR, DG Just, Court of Justice, EASA, EFCA and FRONTEX.
- The **OP Portal** developed for the EUROPEAN COMMISSION, Office for Official Publications of the European Communities.
- **The Community Research & Development Information Service (CORDIS) project** was provided 3rd level helpdesk for all software related issues.

R&D Expertise

SIMAVI also has an exceptional track record in R&D&I projects, being involved as technological provider and as coordinator in more than **35 Horizon 2020 projects** <https://www.simavi.ro/en/rd-projects>.

Products

- **AeL Cloud Learning** dedicated to education for synchronous or remote training and evaluation of knowledge.
- **Authoring Tool** – content creation platform that enables creation of interactive lessons in minutes
- **INOVAGRIA** – farm management system created for managing the activity of agricultural, vegetable or animal farm
- **SIVADOC Lite** – document management solution that facilitates the creation, registration and distribution of documents in a controlled manner
- **EAS – Complete Enterprise Application Suite** solution for large and medium-sized organizations with 50 integrated components for managing business

Tools

- Real-time Early Detection and Alerting Framework for collecting, processing and storing online data related to terrorist activities
- Social Media Data Acquisition Engine
- Machine Learning Based Event Information Fusion
- Collaborative virtual community of practice
- Face recognition biometrical tool for secured access
- Access management system for ticketing (metro stations, stadium, concert, events)
- Decision Support System for air quality management control
- IoT Smart devices reading data tool
- Tool for tracking people with special health conditions and measuring biological parameters

CVs of involved key researchers / staff members

Monica FLOREA, PhD (female) currently acts as Head of the European Projects Department and has been leading participation in Horizon 2020 (RED-Alert – project coordinator, SMILE, FLOD-Serv – project coor-dinator, NEWTON, SpeechXRays - Security, Flexmeter – LCE), FP7 (Link2Safety, TER-ENCE, Eurocancercoms), ITEA (Establish, ETS, GUARANTEE; TWIRL, LifeWear), LLP (RENOVA, CO-MAVET), AAL (Brain@Home, Follow.Me, ProMe), FP6 projects (ALIS, LD-CAST, P. Cezanne), etc. Her duties include the coordination of projects co-financed by European Commission and collaboration with national and international bodies in the framework of European Union programs. She has two degrees from University “Al.I Cuza” of Iasi, Computer Science and Finance and Banks, a Master Degree in Distrib-uted Systems - University Aix Marseille II, PhD in Management, being also PMP and ITIL Foundation V3.0 certified, and Management of Risk Registered Practitioner. She is coordinating the NESSI Romania initiative. She is a member of the Advisory Board for Research and Development and Innovation of the National Ministry of Research since 2014. She has 20 years of experience in ICT sector and project management. She acts as Project Manager in many European projects, being responsible for the management, Quality Assurance and Risk Management Strategy.

Lacramioara Pamela BARSETI (female) has a university degree in Automation at the Bucharest Polytechnic University - Faculty of Control and Computer Science .She has several membership positions on profes-sional bodies such as IBM Business Partner, HP Sales and Service Partner, Oracle Certified Partner, Mi-crosoft Certified Partner, Partner of the National Association of IT specialists in the Public Administration in Romania (ANIAP), UNESCO

Partner (United Nations Educational, Scientific and Cultural Organization), Member of the EITA (European Information Technology Association), Member of the Advisory Group for Information Society Technologies - ISTAG, Member of the Romanian Association for Electronic Industry and Software (ARIES), Member of the American-Romanian Chamber of Commerce (AmCham), Member of the French -Romanian Chamber of Commerce She is IBM PS/2 certified and Liebert UPS Advisor. As Manager of SVAP Department and a certified Project Manager (Prince 2 Foundation) she was directly involved especially at national level in projects such as:

- Entrepreneurship Education - the key to SMEs competitiveness (Romania)
- Professional training and promotion of the use of new technologies in order to increase adaptability of employees and managers at all levels in the field of electrical on the current demands of the labour market (Romania)

Răzvan Nicolau (male) is a Technical Leader within the eLearning Department. He has a bachelor's degree in Engineering - Faculty of Automatic Control and Computer Science (Computer Science Department) with-in University Politehnica of Bucharest. He attended technical and management trainings: BeJUG: Javapolis, IBM: Essentials of Rational Unified Process; Oracle: Developing Architectures for Enterprise Java Applications Ed1 , Fusion Middleware 11g: Build Applications with ADF I; DEVOXX Belgium; Bittnet Systems: Custom Course Docker and Jenkins. He has certifications for: Sun Certified Programmer for the Java 2 Platform, Business Analysis, IBM: Certified Solution Designer, Rational Unified Process v7.0, Oracle: Oracle Database SQL Certified Expert, Oracle Database 11g Administrator Certified Associate, Oracle Certified Master - Java EE 5 Enterprise Architect, Prince2 Foundation – APMG International, ITIL – APMG International. He has a high level of expertise in coordinating the development team, analysis, specification, software architecture, development, and technical assistance activities for projects in the field of eLearning, with thousands of end users. Răzvan is responsible for identifying and developing project management methodology, best practices, and standards, for coaching, training, and oversight of individuals leading projects and for coordinating communication across projects. Răzvan has 12 years of experience in working on national and European projects. He worked for two years in Brussels at the European Commission, and he also contributed to projects in Azerbaijan and Morocco.

Iacob Crucianu (male) is currently Technical Leader for JAVA and AI technologies in the CAD Department. Mr. Iacob Crucianu has a university degree in Applied Mathematics provided by the Faculty of Mathematics, University "Al. I Cuza" Iasi, and possesses a solid and proven experience in integrated information systems design and development, including technical leadership and project management, team coaching and mentoring, presales solutions architecture, and hands-on applications and databases development and configuration. He has also a vast experience in conducting Research and Development projects in Image Processing, Pattern Recognition and Machine Learning. His role in the project will be of IT stream coordinator and software architect involving activities related with analysing and designing of the software system, software development life cycle monitoring, quality assurance of the technical solution and development team coordination.

Razvan GLIGA (male) has a master's degree in computer science at the "Lucian Blaga" University -Sibiu. He has more than 25 years of experience in software industry, holding different roles from Software Engineer to Architect, Team Leader, Project Manager and Release Manager. With solid background in various projects from small to nationwide deployments, Razvan has good understanding of enterprise processes and is proficient in software development processes such as DevOps, Agile, and RUP. He is currently involved in different project in which he analyses user requirements, develops requirements specifications collaborates with developers and project manager to establish the technical vision and analyse trade-offs between usability and performance needs, coordinates the technical team and provides technical solutions for software development.

Role in the project

Expertise: SIMAVI provides services on the whole life cycle of projects: analysis of users' requirements, design, development, testing, implementation, end-users training and technical assistance, and system maintenance.

SIMAVI main capabilities:

- Software developer
- Solution Integrator
- AR/VR and digital content development for training
- Business Plan and Exploitation of project results
- Support in pilot implementation

Specific contribution of SIMAVI will include the following.

- **WP1:** SIMAVI will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** SIMAVI will coordinate with Romanian stakeholders on the participatory process.
- **WP3:** SIMAVI will coordinate the workpackage activities in collaboration with HB, MDS, CTL. The training programmes developed using AR/VR platforms will be delivered to the fire fighters.
- **WP5:** SIMAVI will contribute to the big-data framework setup and maintenance.
- **WP8:** SIMAVI will contribute to the integration of the project outcomes within the project platform
- **WP9:** SIMAVI will engage with the stakeholders and deliver hands-on support for the pilot demonstration.
- **WP10:** SIMAVI will contribute to the overall project dissemination, communication strategy. The exploitation of the training programme will be carried out through stakeholder engagement and consultancy activities.

Relevant publications, and/or products, services or other achievements

- **Monica Florea**, Cristi Potlog, Peter Pollner, Daniel Abel, Oscar Garcia, Shmuel Bar, Syed Naqvi and Waqar Asif, “Complex Project to Develop Real Tools for Identifying and Countering Terrorism: Real-time Early Detection and Alert System for Online Terrorist Content Based on Natural Language Processing, Social Network Analysis, Artificial Intelligence and Complex Event Processing” chapter 9 within “**Challenges in Cybersecurity and Privacy - the European Research Landscape**” book.
- Jeremy Pitt, Mihai Sanduleac, **Monica Florea**, “Transforming big data into collective awareness for transformative impact on society”, IEEE Computer Society, Volume 46, Issue 6, p.40-45 (2013), ISSN: 0018-9162.
- Otilia Bularca, **Monica Florea**, Ana Maria Dumitrescu “**Smart metering deployment status across EU-28**”, International Symposium on Fundamentals of Electrical Engineering 2018, Bucharest, 1-3 November 2018, IEEE Xplore.
- Nour El Mawas, Marilena Bratu, Dorothea Caraman, Cristina Hava Muntean, CIREL “Investigating the **Learning Impact of Game-based Learning** when Teaching Science to Children with Special Learning Needs”.
- Diana Bogusevschi, Irina Tal, Marilena Bratu, Bogdan Gornea, Dorothea Caraman, Ioana Ghergulescu, Cristina Hava Muntean and Gabriel - Miro Muntean “**Water Cycle in Nature: Small-Scale STEM Education Pilot**, EdMedia - Innovative eLearning Conference, June 2018” - Outstanding Paper Award

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
Search and Rescue - Emerging technologies for the Early location of Entrapped victims under Collapsed Structures and Advanced Wearables for risk assessment and First Responders Safety in SAR operations (SU-DRS02-2018-2019-2020 - Technologies for first responders) 2020 - 2023	The S&R project will design, implement, and test through a series of large-scale pilot scenarios a highly interoperable, modular open architecture platform for first responders' capitalising on expertise and technological infrastructure from both CONCORDE and IMPRESS FP7 projects. The governance model of S&R will be designed to operate more effectively, and its architectural structure will allow to easily incorporate next generation R&D and COTS solutions which will be possibly adopted in the future disaster management systems.	Knowledge in developing dedicated solutions for first responders
CREST - Fighting Crime and Terrorism with an IoT-Enabled Ecosystem of Advanced Intelligence, Operations, And Investigation Technologies (HORIZON 2020) 2019-2022	CREST's overall objective is to improve the effectiveness and efficiency of LEAs intelligence, operation, and investigation capabilities, through the automated detection, identification, assessment, fusion, and correlation of evidence acquired from heterogeneous multimodal data streams. Such data streams include (but are not limited to) Surface/Deep/Dark Web and social media sources	Mobile command and control centre for improving the operational capabilities of the intervention teams.

	and interactions, IoT-enabled devices (including wearable sensors), surveillance cameras (static, wearable, or mounted on UxVs), and seized devices and hard disks.	
CONNEXIONS - CORrelating big heterogeNeous data in a NEXt-generation Investiga-tion and predictIOn platform for aNalysis and Simulation in mixed reality environ-ment (HORIZON 2020 SEC-12-FCT-2016-2017 - Tech-nologies for prevention, investigation, and mitigation in the context of fight against crime and terrorism) 2018-2021	CONNEXIONS aim to develop and demonstrate next-generation detection, prediction, prevention, and investigation services. These services will be based on multidimensional integration and correlation of heterogeneous multimodal data, and delivery of pertinent information to various stakeholders in an interactive manner tailored to their needs, through augmented and virtual reality environments.	Multidimensional integration and correlation of state of the art services for intervention teams
FLOOD-serv - Public FLOOD Emergency Awareness SERVICE (HORIZON 2020 - INSO) – Coordinator 2017-2020	FLOOD-serv created a system that can access different flood-related datasets across a broad number of different sources (sensors, social media and open data) and make sense of them on different mobile technologies – tablets and smartphones but also on laptops and PCs – in a way that helps the end users (public authorities, emergency personnel and citizens).	Platform for disaster management and citizen awareness

Individual exploitation plan

SIMAVI will exploit the project results through its network and communication channels and will align this activity to the company's strategic objective, that is to maintain the position of regional leader as software integrator. SIMAVI promotes the innovative solutions and businesses opportunities by foreseeing already in the strategic research stage the future needs of its customers. The exploitation strategy will take into account the business relationships already developed with the clients of the company and will be oriented in the same time on the potential clients identified on different security occasions (seminars, conferences, workshops, trade fairs, etc). Such events may be appropriate opportunities to promote the results of different complex projects with various technologies in which SIMAVI contributed as technological partner to the development and integration of the solutions.

Communication strategy for promoting project outcomes

SIMAVI, as technological partner, will carry out communication and dissemination activities during the whole timeframe of the project and beyond, in order to support the project objectives. The dissemination plan will combine complementary actions that altogether should raise awareness at all levels of society and will engage decision-making entities and end-users to embrace the project and to give valuable feedback. Dissemination activities will start shortly after the beginning of the projects prior to the products development in order to get early customer feedback and to adapt them accordingly. Among others, the following activities are planned:

Social networks: Announcements of the project participation in public events, key achievements, publications and software releases will be published through SIMAVI's social network communities like Facebook or LinkedIn.

Publications: The project outcomes will be disseminated through online or paper print publications and newsletters will be addressed to capture the attention of a wider audience.

Events: SIMAVI will participate in specific events (workshops, seminars, forums, innovation events, exhibitions and conferences) relevant to the project, where the projects results will be presented for a full exposure of the efforts and to identify potential needs or requirements to address in future. The following events will be monitored:

1. **DevCon** <https://www.dev-con.ro/>
2. **International Academic Conference on Development in Science and Technology** <http://www.academicsworld.org/Conference2020/Romania/2/IACDST/>
3. **CODECAMP** <https://codecamp.ro/bucharest-2019-11-09>

Description of significant infrastructure and major items of technical equipment relevant to the project

n/a

4.1.9 EDP NEW R&D - Centre for New Energy Technologies

Partner Name: EDP NEW R&D	
Company website: https://www.edp.com/en	
Type: Large-Enterprise	

EDP NEW R&D - Centre for New Energy Technologies is EDP's Research and Development Center. EDP – Energias de Portugal is an integrated energy utility, with a global presence that includes operations in Europe (especially focused in Portugal and Spain but with relevant positions in France, Belgium, Italy, Romania, Poland and UK), in the United States and in Brazil. EDP NEW R&D is a subsidiary of the EDP Group with the mission to create value through collaborative R&D in the energy sector. EDP NEW R&D is entirely committed to research and development with a strong focus in technology demonstration projects. The result of an internal reorganization process in 2014, EDP NEW R&D centralizes the Group's R&D activities and is established inside EDP LABELEC – EDP's laboratorial facilities and technical excellence centre. EDP NEW R&D has carried out work in several EU H2020 in all the Energy value chain, adopting an integrated and sustainable approach towards disruptive solutions that empower its partners and bring value to the shareholders. EDP NEW R&D, amongst other areas, is very active in the topics of renewable energies, smart grids and digitization, Energy and environment and CO₂ footprint reduction. EDP CNET has proved competencies in cross-cutting topics, such as project management, use cases writing, architecture design, scalability and replicability analysis, new business models' analysis and development, validation of technologies in laboratorial environment or demonstration in real conditions.

CVs of involved key researchers / staff members

Alexandre Neto (Male) holds a Master's Degree in Electrical Engineering from Instituto Superior Técnico - Lisboa and an MBA from Sorbonne Business School, in Paris. He has more than 15 years of experience in the Energy sector, in Smart Grids and Demand Side Management services. Alexandre worked internationally for 10 years in companies such as EDF, Engie, Alstom Grid/GE or Nissan, where he managed innovation projects on Smart Grids, Smart Metering, Demand-Response, Energy Management Systems development or Storage solutions. In 2016, he joined EDP NEW R&D where was part of the team of several H2020 projects and since 2019 he has been focused in supporting the digital transition in the Energy sector. Alexandre will manage and articulate the use cases writing and tools development with the Utility's perspective of overhead lines guard and safety normative and economic return; besides this, Alexandre will lead KPI acquisition and calculation process among Cova da Beira pilot, in Portugal, providing support for the analytical and impact measurement tasks.

Inês Marques (Female) holds a Master's Degree in Electrical and Computer Engineering from Instituto Superior Técnico - Universidade Técnica de Lisboa. She has over 11 years of experience in the Energy sector, mainly as a Data Scientist with a demonstrated history of working in the utilities industry. Inês has a large experience in project management of R&D projects of Analytics, Big Data, Machine Learning, IoT solutions and Smart Grids. She is also skilled in Business Intelligence, Data Management and Big Data Analysis. In 2019 she joined EDP NEW R&D where she is part of the team working in Big Data projects. Inês will handle the modelling, testing and demonstration of all digital tools applied to Cova da Beira pilot, in Portugal.

Luísa Serra (Female) holds two master's degrees in mechanical engineering, before Bologne (1994) and after (2019), the first from Faculdade de Ciência e Tecnologia da University of Coimbra, the second from Instituto Superior Técnico (IST) – Universidade Técnica de Lisboa. She has an MBA from Portuguese Catholic University and Nova School of Business and Economics (Lisbon MBA). She is currently a PhD student in Sustainable Energy Systems at IST, where she is attending classes on Big Data and Machine Learning. She is an advanced researcher at MARETEC (IST). She has more than 25 years of experience, mainly in the Energy sector. She has worked in tech-

nical project and design, electrical systems, logistics, Risk management, Sustainability management and Ethics management. In 2019 she joined EDP NEW R&D where she is part of EU funded POCITYF team and SPARCS and she is deputy at the Digital Energy Area. Luísa will handle the logistic integration of the tools to be demonstrated in Cova da Beira pilot, in Portugal, as well help on cost-benefit analysis and application of new business models to Cova da Beira pilot.

Manuel Pio Silva (Male) is currently EDP NEW R&D project manager in EU H2020 eNEURON project, assisting in the same project the development of cross-sector interfaces for the subjects of use cases design and Energy carriers demonstration. He has done also consulting and operational works in ICT systems in flagship project SENSIBLE. He has worked in IT billing systems consulting area and has more than a decade of experience in Energy systems, namely wind resource evaluation and exploitation, control and information systems. He worked for more than eight years in process information systems and real-time data. He holds a five-year degree in Electrical and Computer Engineering from Instituto Superior Técnico - Universidade Técnica de Lisboa and a MSc in Business Management from Instituto das Ciências do Trabalho e da Empresa, Lisbon. Manuel will manage the interaction between NEW R&D, its third-parties and the consortium, he will facilitate the work among Cova da Beira pilot and with the rest of the areas of project, supporting the Scalability and Replicability, Regulation and Communication purposes and a proper and integrated Exploitation plan for Cova da Beira pilot.

André Coelho (Male) is currently working as senior specialist in Asset Inspection at EDP Labelec. With experience on electrical grid assets and energy production systems, his fields of expertise includes LiDAR and infrared data collection (both on helicopter and UAV) and specialized data analysis. He has also been responsible for technical specifications of LiDAR (for helicopter and UAV) inspection systems as well as AI image recognition applications for asset defects identification. André holds a Master's Degree in Electrical Engineering from the Lisbon Technical University, Portugal, with a major in Power Systems and minor in Systems, Decision and Control. In his Master Thesis he developed a production output model for PV Systems with solar tracking. Before working on Asset Inspection area, André worked in modelling and numerical software simulation of electrical power systems, in high-voltage testing and as a consultant on innovative energy systems projects.

Role in the project

- WP1: EDP will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- WP2: EDP will engage with AdP, TP and IST during the participatory process for the aggregation of user requirements. Additionally, the forest landscape models passing through the Portugal region will be visually modelled in 3D led by VMG.
- WP3: EDP will contribute to the development of SILVANUS semantic framework along with the development of training methodology for Phas A and Phase C pilot demonstrations.
- WP4: EDP in collaboration with 3MON, RINI, VMG and TRT will contribute to the UAV pilot deployment for remote inspection of pilot location. The fire danger index developed in WP2, will be modelled from the vegetation growth near electric infrastructure.
- WP5: EDP will oversee the development of big-data framework and contribute to the development of decision support system and response coordination for Phase A trials.
- WP7: EDP will promote the EU governance policy for securing critical infrastructure pasing through the forest regions.
- WP8: EDP will contribute to the platform integration activites.
- WP9: EDP will lead the Phase A trials across the project. More specifically, will closely collaborate with stakeholders from Portugal in the pilot organization and evaluation assessment.
- WP10: EDP will contribute to the public dissemination and communication activites. EDP will engage with energy utilities stakeholders across Europe, running infrastructure through farms, forests and agricultural regions and promote the exploitation activites.

Relevant publications, and/or products, services or other achievements

N/A.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FOR- TORI
RePLANTLeafs (2019-2022)	Survey and assessment of the Portuguese forest through the implementation of collaborative strategies for integrated forest and fire management. These strategies will give rise to new products, processes and services, largely supported by digital technologies, contributing to the reduction of fire risk and improving companies' management and decision-making processes forestry and energy.	Transfer of technology and use previous experience on wildfires prevention and fighting collaboration and energy grids to evolve approaches, algorithms and technical devices for Energy utilities.
EU H2020 Smart4RES (2019-2023)	Forecasting models based in AI for renewable energy sources and decision-aid tools for operation of storage systems and electrical grids management	Development of AI models and decision-aid tools to support utilities and improve the operation and management of physical assets
EU H2020 eNEU- RON (2020-2024)	Digital tools definition regarding AI and Environmental signals IoT, Demonstration	Cross-sector collaboration, involving multiple organizations and logistics

Individual exploitation plan

NEW R&D works with all EDP business units leveraging the knowledge acquired in each research project. The knowledge acquired in this project is expected to enhance the means to avoid wildfire ignition due to physical contact between vegetation and electric overhead lines and also to safely reduce the means applied to maintain the safety corridors around these company's assets. Furthermore, EDP NEW R&D expects to transfer technology to other Energy areas applying safety techniques that could result in an efficient improvement of both Energy application and Safety prevention (E.g. recognition of vegetation growth avoiding decrease of wind turbines' efficiency due to shear effect, besides placing danger to both machine and organic body).

Regarding overhead lines surrounding vegetation, AI detection of vegetation species and its growth calculation is expected to reduce more than 15% the maintenance costs related with the observation activity. Allied to proper and coordinated forestry maintenance strategy in the region, e.g. involving grazing activity, Utility cost may decrease by 25%.

Furthermore, the use of drones to perform aerial inspections, replacing namely helicopters, and with higher degree of autonomy (less human intervention needed and less risk) and of digitization (enabling more automatization of the analysis with better results) will allow EDP to explore and develop new services to improve the management of utilities' physical assets.

Communication strategy for promoting project outcomes

Marketing plan				
Target	Goal	Media channel	Message	KPI and target value
Shareholders	Sustainability	Internal video	We use technology to reduce the risk of save your investment We address climate change risks	'Likes' on video placed on internal social media. Target >100 out of 3000
Energy consumers	Sophistication	Public media video on TVs and social networks of about 15 sec.	You are using green energy from social responsible production to distribution	Number of video views from more than 7 sec. Target > 30kViews

Municipalities (investors)	Confidence	Local magazines and e-magazines and national newspapers	We contribute to increase the country welfare and the life quality in the regions do the most to save your county	Number of complaints about the advertisement. Target < 3 out of 300 countries.
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Events to present the project outcomes:

1. CIRED - International Conference on Electricity Distribution

Were all the evolution on Energy grids worldwide are presented. EDP NEW R&D plans to present there all the developments related with vegetation species detection and growth calculation demonstrated in Cova da Beira pilot.

2. Enlit Europe (European Utility Week)
3. International Conference on Forest Fire Research

After reaching to results that guarantee the compliance with

Description of significant infrastructure and major items of technical equipment relevant to the project

EDP uses fixed wing drone and LIDAR system on helicopter to acquire images, which plans to be used as a starting point for application of other kind of technologies.

4.1.10 Aguas de Portugal

Partner Name: AdP VALOR, Serviços Ambientais, S.A.	
Company website: www.adp.pt/en/	
Type: Large-Enterprise	

Partner profile

AdP VALOR, Serviços Ambientais, S.A. is a Shared Services Company of Águas de Portugal Group, a leading group in the environmental sector in Portugal. The company's mission is to provide shared services to the Group water utilities, looking for synergies and size factors to effectively address the environmental related societal challenges. The core AdP Group activity involves the integrated management of the urban water cycle and spanning all of its respective stages, ranging from water abstraction, treatment and distribution for public consumption to the collection, transport, treatment and disposal of urban and industrial wastewaters, including their recycling and reuse. The Group is responsible for the management of several thousand infrastructures including more than 150 WTP, 1 000 WWTP, and 2 500 water and wastewater pumping stations in Portugal. Through its different utilities, the Group has a nationwide presence, from the north to the south of Portugal, providing services to 80% of the Portuguese population through municipalities that simultaneously serve as shareholders in the companies managing multi-municipal systems (bulk systems), and directly serving the populations through municipal systems (retail systems) providing water and sanitation services.

The Group has recently announced its plan to become energy neutral by 2030, which makes it the first group in the world in the water sector with a strategy to achieve energy neutrality in 2030 based on consumption reduction through energy efficiency measures and by producing the energy necessary for its activities through 100% renewable energy self-production.

The experience of AdP Group in R&D and innovation activities include participation in several National and International projects, and international awards recognition (e.g. Water and Energy Exchange - WEX Global, Leading Utilities of the World - LUOW). AdP distinguishes itself as a support company to provide added value to the AdP utilities developing cutting edge innovative and smart solutions, with special focus on smart technologies.

CVs of involved key researchers / staff members

Mrs. Marta Carvalho (Female) is AdP VALOR Innovation Catalyst. She is an Environmental Engineer with an MSc in Hydraulic and Water Resources and advanced training in Project Management and Negotiation working for 20 years on the water and sanitation sector. She has strong experience in project management in the urban water cycle,

waste management, climate change mitigation and adaptation. Benefiting from a personal and professional context that allowed her to acquire flexibility, creative thinking and entrepreneurial competencies, presently she is the Innovation Catalyst of AdP - Águas de Portugal Group, seeking to bring new approaches, efficiency and sustainability to the business. Under this role, she has coordinated or participated in more than two dozen of different projects and applications for national & European R&I funds on water and water related subjects. At present she is coordinating COVIDTECT, a project that seeks to use urban wastewater as an early warning system for the spread of the SARS-CoV-2 virus in the community in Portugal.

Mr. Nuno Brôco (Male) is the Vice-presidente of AdP VALOR. Started his professional career in 1997, chemical engineer graduated and MSc in biotechnology. After graduation, post-graduation and brief university teaching and research experience, he join Suez Group in 1999, developing his career during 10 years in a multinational context having a full vision on Suez activity from project, commercial, head of production department and finally as country manager. Since 2009, integrated Águas de Portugal Group having the responsibility of Head of Engineering Department. From 2017 to 2020 he has cumulatively been appointed as board Member of the largest national company responsible for wastewater treatment (Águas do Tejo Atlântico). Since 2018 he is also responsible for AdP Corporate I&I activity. Since 2020 he is the Vice-president of the company.

Mr. Carlos Brito (Male) is working as AdP Valor's I&D Engineer. He is a versatile Civil Engineer with an MSc in Hydraulics and Water Resources, has been developing his career in an international context, especially across Europe, Middle East and South East Asia. Mr. Carlos has been involved at various project levels, from design to leading project and site teams, requiring coordination and managing of multidisciplinary international teams on major projects with the goal of delivering a consistent high quality service to clients, including ADB. Has also been responsible for the preparation of several technical and commercial proposals, ensuring that all client's requirements have been filled as fully as possible and that the organization has given itself the best possible chance of success. In addition to technical responsibilities, have taken the lead in key business assignments including business development, direct collaboration in Artelia's Dubai branch commercial strategy definition and participation in several International Water Summits.

Role in the project

- **WP1:** AdP will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** AdP will as an end-user will engage in the participator process and contribute to the formalisation of end-user requirements.
- **WP3:** AdP will engage in the training programs organized within the project to evaluate the effectiveness of preparedness and prevention activities carried out in Portugal pilot demonstration.
- **WP6:** AdP will actively contribute to the rehabilitation of forest regions following the impact of forest fires.
- **WP7:** AdP will contribute to the EU governance policy on forest management. AdP will uniquely deliver the perspective of critical infrastructure service operators and identify the environmental factors post fire suppression.
- **WP8:** AdP will contribute to platform design specification, integration and testing and validation as an end user.
- **WP9:** AdP will actively contribute to Phase A and C trials within Portugal in collaboration with TP and IST.
- **WP10:** AdP will participate in the public dissemination and communication strategies.

Relevant publications, and/or products, services, or other achievements

- Carvalho, M., Martins, B., Coelho, J.P., Brôco, N., Ribeiro, A.K., Magalhães, A. and Luís, A. Climate change adaptation: a pragmatic approach for assessing vulnerability. IWA Publishing 2019. Water Practice & Technology Vo.14, No.1.
- Brôco, N., Carvalho, M., Coelho, J.P., Management tool to assess, benchmark and support energy efficiency actions in more than 800 WWTP. IWA Publishing 2019. Water Practice & Technology Vo.12, No.3.
- Brôco, N., Carvalho, M., Electrical Energy Consumption: Performance assessment in Águas de Portugal WWTP, 2014. Water and Energy Exchange, Madrid, Spain, 25-27 February.

- Marchionni, V., Lopes S., Lopes N., Mamouros L., Brôco, N., Covas, D, Cost Functions for Different Water Supply and Wastewater Systems Asset, 2014. World water congress & exhibition of IWA, Lisbon, Portugal, 21-26 September.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
FRISCO (Portuguese FCT; 2020-2022; running). Assess and manage post-fire contamination risks on water resources and WTP facilities. FRISCO will develop knowledge on the interface between fire, vegetation, soils and water, to assess the impacts of fire on the provision of hydrological services by forests; and take fire into account in assessing the impacts of climate and land use changes on water resources.	Partner. AdP will lead WP3 - characterize post-fire contamination episodes and use historical water quality data to map their occurrence. AdP will contribute to exploitation and dissemination actions.	Knowledge on fire impacts on water resources, allowing the identification of critical assets that need special attention within SILVANUS.
PYROLIFE (Marie Curie; 2019-2023; running). Innovative Training Network that aims at training a new generation of interdisciplinary experts in integrated fire management. Key to the project is transfer of knowledge and strengths between countries, scientific disciplines, and between science and practice. It combines how the North solves community problems with the fire knowledge of the European South.	Secondment. AdP will follow the work of two PhD students and host them during a period of 4 months each working on 1) environmental impacts of fire on carbon flow & water quality; 2) Understanding perceptions of wildfire risks & related land management.	Knowledge on fire impacts on water resources, allowing the identification of critical assets that need special attention. Knowledge on social perceptions of wildfires based on social innovation approaches
ENKI (company's Equity) Engineering Knowledge Integration is a simple and functional platform with a customizable, user friendly environment for integration and communication. It aggregates and manages data, producing useful information, both for AdP Group and for the Portuguese water stakeholders, representing a significant step forward regarding information and knowledge sharing in the water sector.	Coordinator: Platform allows the integration of different sources of data to produce useful information to support decision making among different stakeholders (water utilities and national authority)	Experience on integration tools and platforms; relevant KPI to consider when using tools that support decision making.

Individual exploitation plan

- AdP Group manage several thousands of assets in remote areas. These utilities are obligated to do forest fuel management and report it to relevant authorities on a weekly basis. Having a tool to do this automatically will allow to save significant labour hours and fuel control actions due to more accurate information.
- By preventing that AdP assets (water abstractions, water treatment plans, pumping stations, water reservoirs, wastewater treatment plants, etc.) get damaged by forest fires, millions of Euros will be saved.
- A relevant externality is that these fuel management activities will contribute to deliver water supply service without interruption.

Communication strategy for promoting project outcomes

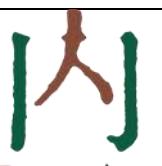
- Participation in scientific conferences.
- Dissemination of the project and its results in AdP website, social media and other internal channels of communication (including mailing list).

Organize demonstration workshops with water utilities and national authorities.

Description of significant infrastructure and major items of technical equipment relevant to the project

N/A.

4.1.11 TERRAPRIMA

Partner Name: Terraprime - Serviços Ambientais	 Terraprime
Company website: https://www.terraprima.pt/en	
Type: SME	

Terraprime - Serviços Ambientais (TPAmb) is a spin-off from Instituto Superior Técnico. It was created by Tiago Domingos, its director, whose vision identified an opportunity for the provision of environmental services by agricultural activity when considering three factors: (1) knowledge acquired by IST on the potential of permanent pastures planted with biodiverse legumes (PPSBRL) in promotion of soil carbon sequestration; (2) the Portuguese State's need to respond to its Kyoto Protocol commitments; (3) existence of practical knowledge of agricultural management and of the opportunities and limitations that are posed to the contribution of environmental services to their financial viability. The convergence of these factors set the tone for the creation of TPAmb in 2008 and defined its mission: **to design and economically enable integrated systems for the assessment, reduction and compensation of environmental impacts resulting from human activities.**

Part of TPAmb activities are set in Quinta da França (QF), a 500 ha farm located in the Centro region, in the parishes of Peraboa and Teixoso, near Covilhã. The main activities in QF are: **agricultural exploitation; forestry activities; research and development activities in the physical and natural sciences.**

The main agricultural activities in QF are: production of beef cattle (90 breeding cows and 2 bulls); and sheep milk production (500 adult ewes and 26 breeding males). QF has invested in improving the operating conditions and quality of its products, notably by changing the production system to integrated production, modernizing the equipment (milking parlour, farm machinery, fencing, irrigation equipment, etc.) and by increasing livestock.

TPAmb has a branch in Porto Alto (Alentejo region) in order to be physically closer to the Terraprime farmer network and the innovation entities with whom it has a strategic collaboration (namely IST, INIAV and University of Évora).

CVs of involved key researchers / staff members

Tatiana Valada (female), PhD in Environmental Engineering from IST, works on sustainability assessments of agricultural systems. She has experience in the monitoring and modelling of soils, particularly soil carbon, as well as productive pasture-based systems. She is also an expert in LCA, having applied this approach in multiple projects and papers to pasture production, bioenergy and innovative animal feeds. She was a post-doc at the Catholic University of Leuven (KULeuven), Belgium, where she acquired significant experience in managing large-scale European projects, particularly projects funded by Horizon 2020.

Nuno Ribeiro Rodrigues (male) has a Master Degree in Environmental Engineering by Instituto Superior Técnico, Lisbon (IST). He began his researching activity at IST in sustainable farming, namely in extensive forage systems. He worked in Extensity project, managing the contact with the farmers. Nuno also worked in other IST research projects such as Biopast, Rural Value and Agriadiag, acting as consultant, researcher and trainer. Nuno was a permanent worker at Terraprime enterprises (Agriculture Company and Environmental Services). He worked as management, technician and agriculture researcher. In Terraprime, Nuno also worked as manager in the national project with the Portuguese Carbon Fund, which promoted soil carbon sequestration by changing farming practices (sown biodiverse permanent pastures, rich in legumes and surface shrub control with no tillage methods). Nuno worked as a researcher, at University of Aveiro, in the European project ADAPT-MED about internalizing climate change adaptation measures in policy making processes, which had Baixo Vouga Lagunar as the Portuguese case study. Currently, Nuno is working in Terraprime enterprises again. He is responsible for managing the research projects of PDR2020 and Portugal 2020 and is responsible for managing the team allocated to these projects. Nuno is also responsible for the financial management of two of the Terraprime Group companies and gives supports to farms and livestock production units. He also gives training to Trainers in Environmental Assessment of Farms. Nuno also

participates in the writing of scientific project reports in English and other publications such as scientific articles, presentations and leaflets. Develops a geographical database in ArcGIS 10.2 and WebSIG. Processing aerial photographs acquired at low altitude by Drone for the production of orthophotomaps and vectorization of vegetation areas (AgiSoft and ArcGIS 10.2). His primary researcher subjects are Pasture Ecology; Environment and Carbon Sequestration; Sown Biodiverse Permanent Pastures, Rich in Legumes; Agriculture Sustainability; Climate Change; Geographic Information Systems; and aerial mapping using UAV. Nuno carries out a lot of field work, namely in drone flights, soil sampling and farm monitoring.

Ivo Gama (male) has a degree in Biophysical Engineering - Environmental Planning and Management, specialty in Natural Systems Planning and Management, by the University of Évora. His curricular training has a strong component of territory assessment and characterization, geographic information systems (GIS) and spatial analysis tools, for the environmental, biophysical and land-use planning domains. His professional curriculum specialized in Geographic Information Systems, where he worked in the Remote Sensing Group of the Portuguese Geographic Institute (IGP) and in the Information Systems Technologies Company - CONEXA. Since 2011, he works in the company Terrapríma (Environmental Services and Agricultural Services) as information system manager. His competences comprehend research, and development of technological services and tools for agro-forestry systems management assistance. He also works in the development of decision support systems indicators for agricultural sustainability. He's part of the Terrapríma action plan for development and implementation of services and tools in the framework of the Fourth Sustainable Revolution, namely, integrated systems for precision agriculture objective. He worked in two major innovative projects of the Portuguese Carbon Fund (FPC) for the remuneration of environmental services for carbon sequestration in the soil – Terrapríma/FPC Projects Dynamics of Soil Organic Matter on Sown Biodiverse Pastures and Scrubland. More recently, he participates in several research and development projects, namely ModelMeat project, in which he worked in a development of an integrated online platform tool for agriculture data management and environmental performance - carbon footprint for extensive livestock farms; and in two Portuguese Operational Groups, for precision agriculture: GO Fósforo - Increasing the viability of sown biodiverse pastures through optimization of phosphate fertilization; and in GO Solo - Development of an expedited low-cost soil organic matter evaluation method for sown biodiverse pastures

Sara Manso (female), has a degree in Forest Engineering - Natural Management by Instituto Superior de Agronomia (ISA). She did some pontual forest inventory between 2006 and 2008 for Arboris. She was an applied scientific research in ISA under the theme "estimation for the accumulation of shrub biomass after fire in Portugal". She worked with Geographic Information Systems during her entirely professional carrier, but mostly when she was working for Remote Detection and Geo Analysis Lab (ISA), Remote Sensing group of the Portuguese Geographic Institute (IGP) and in the company CONEXA - Tecnologias e Sistemas de Informação Lda. Since 2011 she is working for Terrapríma enterprises as technician in greenhouse gas emissions inventory, carbon sequestration and carbon footprint, analyses of cork-oak landscapes from a climate perspective (FAO), support to management projects, facilitator of communication between technician and farm organizations. She is also responsible for the payment request to PDR2020. Sara carries out field work, namely in forest inventory, soil sampling and drone flights. Between 2015 e 2016 she had also worked for Associação para o Desenvolvimento do Instituto Superior Técnico (ADIST) as a consultant for the agriculture and forest sector of Regional Program for Climatic Change of Açores (PRAC), were she was responsible for agriculture, forest and land-use estimation of greenhouse gas emissions for regions, identification of climate change mitigation measures and cost-benefit analysis for the application of mitigation measures under different scenarios. Between 2017 and 2018, she had worked as technician at MediNet project (Mediterranean Network for Reporting Emissions in Cropland and Grassland) were the main actions were: characterization and comparison of institutional arrangements for croplands and grazing land management reporting; selection of cropland and grassland types and management systems, tracking changes in activity data, gains and losses in living biomass and deadwood, gains and losses in soil organic carbon.

Jorge Palma (male), M.Sc. in Environmental Engineering (IST) and Licenciatura (equivalent to B.Sc.) in Computer Science and Multimedia Engineering (Instituto Superior de Engenharia de Lisboa). Information technology manager with extensive experience in planning and implementing information systems, data models and online geographic information systems using open source technologies, administration of linux systems and computer networks. He has participated in numerous projects in the areas of environmental modelling and web technologies, namely in irrigation forecasting, weather forecasting, implementation of WebGIS platforms for online data/maps visualization, construction of sites for various uses, database creation, among others. He has collaborated with several public and private entities, namely IST, Instituto Superior de Agronomia, Força Aérea Portuguesa, Câmara Municipal de Lisboa, Ângulo Sólido, Runtime Revolution, among others.

Role in the project

- **WP1:** TP will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** As a landowner, TP will share insights on the challenges of forest fires and share operational experience in combating forest fire. TP will contribute to the formal requirements to be identified within the project.
- **WP9:** TP will provide infrastructure access to conduct Phase A and Phase C trials within the project. A detailed description of the envisaged pilot description is provided below.
- **WP10:** TP will contribute to the overall dissemination and exploitation activities.

Terraprima's role in this pilot-project is to implement a demonstrative action plan at Quinta da França farm, so that it becomes a place for operational experimental test site, using grazing interventions for fire prevention, in order to achieve project objectives and for upscale to other farms/areas of the territory. Terraprima also will assess appropriated spaces to facilitate and upscale the demonstration activities, interacting with the surrounding municipalities areas.

Tasks	Descriptions
Territory assessment	Photointerpretation and processing of aerial photography and satellite imagery, automatic classification (supervised and unsupervised) of land use/occupation for natural and infrastructure classes. Map production.
Drone (UAV's) flights	Drone flights to survey of aerial images (VIS and NIR) and production of orthomorphics and digital terrain models (DTM).
Satellite imagery	Satellite imagery (sentinel2) analysis and processing, with the production of several derived maps, such as the vegetation indexes or soil moisture indexes.
Wildlife triggering cameras	Installation of video and photo cameras for automatic wildlife trigger.
Biomass modelling	Models for biomass evolution (increase / decrease), in herbaceous, shrubs and trees strata.
Animal sensor collars	Installation of collars in grazing animals, with sensors for geolocation and automatic system alerts (geofence and animal behaviour), using IoT. Production of hotspot maps and grazing history.
Electric fences	Installation of electric fences for dynamic grazing management, through an expeditious (and cheaper) setup. Conditional animal grazing, regarding the orientation in relation to linear and non-linear infrastructures and buildings, with the aim for biomass managing in those zones (herbaceous and scrub control).

Designation [Components]	Unit value €	Quantity #	Value without VAT	Type
Animal sensor collars	190,00	65	12350	Equiment
Lora Gateways	500,00	2	1000	Equiment
Wildlife triggering cameras	150,00	5	750	Equiment
Electric fences	2,35	2500	5869	Equiment
Automatic weather station	5000,00	1	5000	Equiment
		Total	24969	

Tasks	Descriptions	Fo-cus	Ac-tion Lev-els
Territory assessment	Photointerpretation and processing of aerial photography and satellite imagery, automatic classification (supervised and unsupervised) of land use/occupation for natural and infrastructure classes. Map production.	NC AC	L1 L2

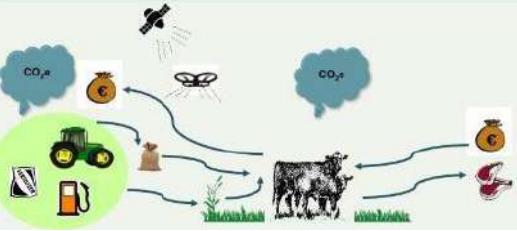
Drone (UAV's) flights	Survey of aerial images (VIS and NIR) and production of orthomatics and digital terrain models (DTM). Drone flights to monitor the fire perimeter and fire aftermath.	NC AC	L1 L2
Satellite imagery	Satellite imagery (sentinel2) analysis and processing, with the production of several derived maps, such as the vegetation indexes or soil moisture indexes, integrated in an online Terraprima tool.	NC AC	L1 L2
Fire surveillance cameras	Installation of cameras with filters and sensors that identify fire outbreaks with automatic mechanisms of alerts, using IoT.	NC AC	L2
Wildlife triggering cameras	Installation of video and photo cameras for automatic wildlife trigger.	NC	L2
Forestry inventory	Inventory of herbaceous, shrub and tree species, in a regular grid of geolocalized sampling points, with identification of specific richness and functional groups and the condition of the development of plant extracts at each point.	NC	L1 L2
Soil samples	Rapid and massive soil sampling, using specialized Terraprima equipment for this purpose, with subsequent soil analysis and consequent production of high spatial resolution maps of soil nutrients and the assessment of soil carbon sequestration.	NC	L1 L2 L3
Wet spots and corridors restoration	Identification, maintenance and recovery of riparian vegetation, namely associated with main water lines and temporary / permanent ponds.	NC	L1 L3
Modelling	Implementation of artificial intelligence (AI) models to automatically predict plant biomass evolution (increase / decrease), in herbaceous, shrubs and trees strata. Implementation of artificial intelligence (AI) models to automatically forecast Soil Organic Matter.	NC	L2
Sown permanent pastures -installation	Install sown biodiverse permanent pastures, with specific seed mixtures appropriate to the different locations. Permanent pastures are an important component in territory segmentation and, therefore, in resilience to forest fires.	NC	L2 L3
Sown permanent pastures - management	Management and maintenance of permanent pastures using appropriate animal grazing, supported by precision farming tools, namely monitoring with drones, satellite imagery, or sensor-collars on grazing animals, all integrated in Terraprima's online software platform.	NC	L2 L3
Sown permanent pastures - fertilization	Use of precision agricultural management technology for spatially differentiated fertilization (Variable Rate Technology – VRT) in order to optimize fertilizer application and therefore reduce economic cost and environmental impact.	NC	L3
Animal sensor collars	Installation of collars in grazing animals, with sensors for geolocalisation and automatic system alerts (geofence and animal behaviour), using IoT. Production of hotspot maps and grazing history.	NC	L2 L3
Electric fences	Installation of electric fences for dynamic grazing management, through an expeditious (cheaper) setup for conditioning animals grazing, regarding the orientation in relation to linear (e.g. fences) and non-linear (e.g. buildings) infrastructures, with the aim for biomass managing in those zones (herbaceous and scrub control).	NC AC	L3
Weeding	Use of an experimental demonstration zone for the application of a treatment with herbicide application around linear (e.g. fences) and non-linear (e.g. buildings) infrastructures to control herbaceous and shrub biomass.	NC AC	L2 L3
Fast intervention fire vehicle	Equip a light vehicle with fire fight tools for first rapid intervention, equipped with water auto-tank, extinguishers and other light fire fight tools.	NC AC	L3

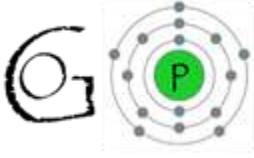
Ter-prima online platform	Online integrated geographic information system tool for agricultural information management and farm environmental assessment performance, namely carbon footprint.	NC AC	L1 L2
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Relevant publications, and/or products, services or other achievements

- Sarmento, N., N. Rodrigues, T. Valada, L. Barradas, O. Rodrigues, T. Domingos (2014). Avaliação ambiental de explorações agrícolas: manual de formação do software DIALECTE para Portugal. Instituto Superior Técnico e Terraprima – Serviços Ambientais, Lda. Lisboa, 112 páginas.
- Sarmento, N., N. Rodrigues, T. Valada, L. Barradas, O. Rodrigues, T. Domingos (2014). Avaliação ambiental de explorações agrícolas: manual de formação do software DIALECTE para Portugal - ANEXOS. Instituto Superior Técnico e Terraprima – Serviços Ambientais, Lda. Lisboa, 84 páginas.
- Ivo Gama, Marjan Jongen, Nuno Rodrigues, Ricardo F. M. Teixeira, Tatiana Valada, Tiago Domingos, Tiago G. Morais (2019). 3.2 Subtema Principal – Pastagens Semeadas Biodiversas: Um paradigma para as soluções para o clima baseadas na natureza. In Alterações Climáticas – Boas Práticas de Engenharia, Ordem dos Engenheiros. Pp. 72-89.
- Morais, TG; Teixeira, RFM; Rodrigues, NR; Domingos, T. (2018). Carbon Footprint of Milk from Pasture-Based Dairy Farms in Azores, Portugal. Sustainability 2018, 10, 3658. (doi:10.3390/su10103658).
- Morais, TG; Teixeira, RFM; Rodrigues, NR; Domingos, T. (2018). Characterizing Livestock Production in Portuguese Sown Rainfed Grasslands: Applying the Inverse Approach to a Process-Based Model. Sustainability 2018, 10, 4437. (doi:10.3390/su10124437).
- Vilar, P.; Morais, T.G.; Rodrigues, N.R.; Gama, I.; Monteiro, M.L.; Domingos, T.; Teixeira, R.F. Object-Based Classification Approaches for Multitemporal Identification and Monitoring of Pastures in Agroforestry Regions using Multispectral Unmanned Aerial Vehicle Products. Remote Sens. 2020, 12, 814.
- Teixeira, Ricardo FM, et al. "A conceptual framework for the analysis of engineered biodiverse pastures." Ecological Engineering 77 (2015): 85-97.
- Morais, Tiago G., et al. "Characterizing sown biodiverse pastures using remote sensing data with machine learning." EGU General Assembly Conference Abstracts. 2020.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
 <p>"AGRIDIAG: Agri-environmental farm diagnostic tool "Dialecte" in vocational training", funded by Lifelong Learning Programme "Leonardo Da Vinci".</p>	<p>Diagnostic agri-environmental tool.</p> <p>Environmental training.</p>	<p>Agri-environmental tools.</p> <p>Environmental training and workshops.</p>
 <p>MODELMEAT: Model of environment optimization and product quality for services to support competitiveness of agents in the extensive animal production sector (2016/2019). Funded</p>	<p>Developing integrated decision support systems.</p> <p>Carbon footprint tools.</p>	<p>Developing integrated decision support systems.</p> <p>Carbon footprint tools.</p> <p>Life Cycle Assessment.</p> <p>Soil carbon sequestration assessment.</p> <p>Farm environmental performance.</p>

<p>by the Portugal 2020 Program (SI I&DT). https://www.terraprima.pt/en/projecto/20</p> <p>The main goal of the project is to develop a decision support system for integrated sustainability management in the extensive livestock production sector</p>		
 <p>GO FOSFORO: Increasing the viability of sown biodiverse pastures through optimization of phosphate fertilization. Funded by PDR2020. https://www.terraprima.pt/en/projecto/22</p> <p>Main goal is to implement tech-based low-cost methods for evaluating real phosphorus needs by using remote data sensing.</p>	<p>Soil phosphorus mapping.</p> <p>Differential fertilization.</p> <p>Environmental good fertilization practices dissemination.</p> <p>Optimize the use of fertilizers.</p> <p>Improved grasslands.</p> <p>Remote sensing – satellite data analysis.</p> <p>Drone (UAV's) flights - aerial imagery.</p> <p>Drone (UAV's) flights - aerial imagery.</p>	<p>Tools and methodologies for differential fertilization (VRT).</p> <p>Soil phosphorus mapping assessment and application.</p> <p>Environmental good fertilization practices dissemination workshops.</p> <p>Environmental and economic improvement through the VRT use of fertilizers.</p> <p>Improved grasslands.</p> <p>Remote sensing – satellite data analysis.</p> <p>Drone (UAV's) flights - aerial imagery.</p>
 <p>GO SOLO: Development of an expedited low-cost soil organic matter evaluation method for sown biodiverse pastures. Funded by PDR2020. https://www.terraprima.pt/en/projecto/24</p> <p>The goal of GO SOLO is to an expedited and low-cost method for SOC mapping and assessment of carbon sequestration in sown biodiverse pastures.</p>	<p>Soil organic matter high resolution mapping.</p> <p>Expedited low-cost techniques for soil organic matter evaluation.</p> <p>Remote sensing – satellite data analysis.</p> <p>Drone (UAV's) flights - aerial imagery.</p> <p>Spectrometry approaches for SOM</p>	<p>Tools and methodologies for soil sampling and SOM analysis.</p> <p>Soil carbon sequestration assessment.</p> <p>Soil organic matter high resolution mapping.</p> <p>Remote sensing – satellite data analysis.</p> <p>Drone (UAV's) flights - aerial imagery.</p>

	analysis (VIS as NIR)	
 <p>“GO SILVPAST Cost-efficient implementation of silvo-pastoral mosaics of Quercus pyrenaica” will test and develop a method for the implementation of silvo-pastoral mosaics, using remote sensing approaches, that supports agricultural and forestry activity in areas of Pyrenean oak, which typically have low agricultural value. Funded by PDR2020. With partners Terrapríma Sociedade Agrícola, Lda, Associação Transumância e Natureza, Multinatura, Lda, ÁPIS, Companhia Agrícola e Pecuária, S.A., Sociedade de Desenvolvimento da Quinta do Colmeal, UNAC – União da Floresta Mediterrânea, Faculdade de Ciências da Universidade de Lisboa.</p> <p>https://www.terraprima.pt/en/projecto/23</p>	Biodiversity indicators to monitor grazing approaches for forest and forest ecosystems management and fire prevention and restoration. ecosystem restoration	Optimization of extensive grazing as a nature-based solution and tool for fire preventing approaches for forest and forest ecosystems management and fire prevention and restoration.

Individual exploitation plan

- Model development and artificial intelligence base mapping tools.
- Provide advice on increasing environmental and economic performance.
- Equip Terrapríma's farm with automatic surveillance forest fire detection and forest fire first intervention tools.
- Preventive strategies in agroforestry decision making through capacitate the territory mosaic for resilience to wildfires.
- Developing automated tools for biomass reports, operational control management advisory and risk warnings.
- Developing cheap animal grazing geofence.
- Improving animal sensor collars functionalities.
- Estimate soil carbon sequestration and the relation with the economic potential remuneration for this environmental service, related to the forest fire resilience.
- Integrate Terrapríma's online platform with new fire risk and biomass management module tools.

Communication strategy for promoting project outcomes

- Publication of scientific papers in national and international journals, and participation in scientific conferences.
- Dissemination of project results in Terrapríma web page, farmers network and social networks.
- One of the direct results of the current project is the capacity of Terrapríma to provide advice on increasing environmental and economic performance. The turnover is expected to increase through the provision of consulting services to farms.
- Demonstration workshops with stakeholders in QF farm.

Description of significant infrastructure and major items of technical equipment relevant to the project

The buildings in QF include the milking parlour; sheep feeding lot; hay storage hall; three corn silage storage silos; building with office and meeting room; support housing; permanent housing for shepherds; and housing for guests. The following agricultural equipment in QF stands out: three agricultural tractors (two of 90 cv. and one of 55 cv.); commercial light vehicles; 10 ton trailer; centrifugal fertilizer spreader; Variable Rate Technology Fertilizer Spreader; corn sower; plant protection product sprayer; disc harrow; three irons plough; three watering pivots; three

winder-type watering machines; one scrub shredder; one backhoe loader; one utility vehicle (UTV) with an automatic soil sampler; and two rotor drones and one fixed wing (UAV's). Terraprima also have several IT equipment and servers, cloud maintenance services and online platforms software as service.

Pilot Description

The Portuguese Pilot targets Energy and Water Utilities' critical infrastructures safety, as well as fire prevention as energy infrastructures are as a potential cause of wildfires in the surrounding forest. Two linked objectives drive the demo implementation. First, to provide utilities with a set of tools to effectively maintain safety areas between critical infrastructures and vegetation; second, to establish autonomous procedures that enable fuel management planning and reducing safety areas maintenance costs, based on remote sensing (using satellite and UAV) and early warning systems.

The pilot will be located in Cova da Beira region, centred in TerraPrima agro-technological farm. TerraPrima will also interact with the surrounding municipalities, mainly Fundão, Covilhã and Belmonte, assessing the most appropriated spaces to facilitate the demonstration activities. The demonstration activities will be led by EDP, that will also be focused on its overhead-lines safety corridors in the region and joint strategies with AdP to keep a low budget maintenance program. On its hand, AdP will be working on its water and waste water facilities in the region, located in fire-prone areas. The strategy of both utilities takes not only a technological perspective but especially an ecosystem approach. IST-ID, with research expertise in the region and its biological diversity, will support species taxonomy and their growth characterization around critical infrastructures in the demo. These are the two main biological aspects that will model the maintenance strategies for the utilities, technologically supported by SILVANUS consortium (CTL, MDS, VMG). The consortium partners, besides having a long record of pattern recognition on images using Deep Learning, will collaborate with AdP and develop next level chronological scenarios for the vegetation in critical infrastructure surroundings, this work will enable both EDP and AdP to estimate when it is best to set a maintenance measure, by cutting the bushes or by grazing. Additionally, this will also provide useful KPI including the cost of the maintenance actions and maintenance prioritization among facilities, as well as communication in real time with relevant stakeholders and authorities. TerraPrima in partnership with IST-ID is handling a long-term strategy of using grazing interventions for fire prevention and will take this opportunity for a CBA analysis of this activity. In demonstration phase, TerraPrima agro-technological farm will be the initial test-bed, for all use cases in the Portuguese pilot, working as a lab. environment due to all facilities available, helping to prepare thus the final demonstrations. Final demonstrations will take place in more realistic spots in Cova da Beira.

The cost of safety areas around overhead lines is above 0.75 Million in case of EDP⁴³. If one sums up the costs for AdP and other utilities having critical infrastructures in European forest regions, the costs, would reach hundreds of million Euro. The conclusions on the strategies from this demo are expected to help decreasing by 20% the maintenance cost of critical infra-structures surroundings, per year.

Pilot site description: Cova da Beira is the region located in Interior-Este part of Portugal. It borders on the North with the subregions of Serra da Estrela and Beira Interior Norte, on the East with Beira Interior Sul, on the South with Beira Interior Sul along with Pinhal Interior Sul and on the West with Pinhal Interior Norte. It comprises 4 counties: Belmonte; Covilhã, Fundão and some parishes of Castelo Branco. It is much known for its top-quality agriculture products. Besides some industry, the region has strong agriculture and forestry activities.

Cova da Beira combines a strong implantation of the industry in an area with a strong rural influence, resulting in a rural region of high population density. The asymmetry in land distribution is revealed by the presence of large side-by-side properties with a generalized smallholding.

The landscape is very diverse, due to the hydrographic network that influences land uses and their distribution. Today most of the area is occupied with intensive agriculture and fruit farming (apple, peach, cherry). The landscape is strongly compartmentalized, marked by the agricultural land uses and the granitic outcrops with oak woodland patches.

This is a region of abundant water resources, characterized by a great inter-annual irregularity. The watering perimeter of Cova da Beira was implemented to respond to this variability, covering an area of about 14 440 ha. The main water sources are the Sabugal and Meimoa dams. The irrigation blocks of Covilhã, Fundão, Fatela and Capinha, have an equipped surface of 5 695 ha.

⁴³ Public source: <https://www.theportugalnews.com/news/edp-invests-850-thousand-euros-in-risk-reduction/54484>

In the past century, since the 1950's, the limited economic dimension of the small farm holdings was a driver of the rural exodus. The emigration of the youngest and the increasing aging of the residents, reduce the manpower available on family farms, which caused rural abandonment and a reduction in the demand for land.

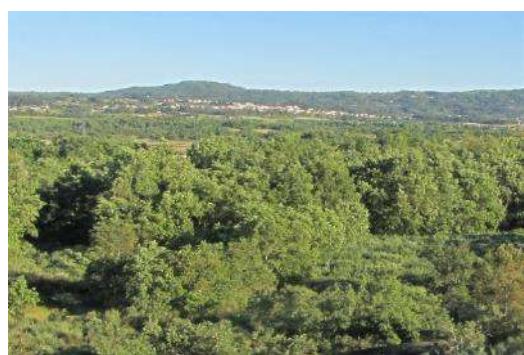
At the end of the sixties, there was a rise in uncultivated land, which associated to a growing difficulty in hiring shepherds forced a reduction in the number of herds, causing a decline in the value of the pastures and an increase in the risk of fires.

Today, one of the main problems from the point of view of the rural economy is the weak associative capacity of farmers in the region. This affects their investment capacity, limiting the development of economies of scale or the introduction of new technologies, and difficulties in commercialization.

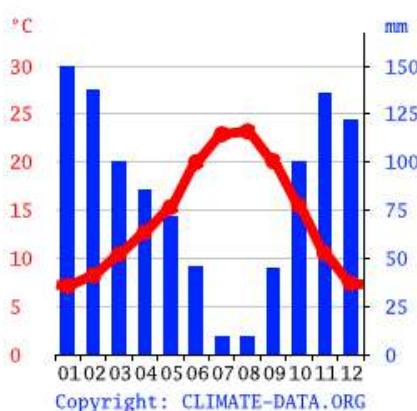


Ecological and biodiversity description:

The landscape at Cova da Beira is characterized by two main altitudinal zones: a large relatively flat valley at the centre, which is surrounded by mountain ranges. The flat area is composed by a mosaic of agricultural land uses, including pastures, cropland, and orchards, but also forest patches, including oak forests and pine plantations. The mountain areas overlap two important Nature 2000 sites, the Special Area of Conservation (SAC) of Serra da Gardunha (PTCON0028) and the SAC of Serra da Estrela (PTCON0014), the latter also classified as Natural Park. The valley is crossed, from northeast to southwest, by the river Zêzere. The Zêzere has its source in the Serra da Estrela mountain range and is an important tributary of the Tagus. The river margins host riverine habitats of high ecological value, with alder (*Alnus glutinosa*) and ash (*Fraxinus excelsior*) populations. The mountain areas surrounding the valley are characterized by forest habitats, listed in the Habitats Directive, of chestnut (*Castanea sativa*, habitat 9260) and deciduous oaks (*Quercus robur* and *Q. pyrenaica*, habitat 9230). Fruit orchards and maritime pine plantations are also an important land use in this zone. Recent fires have had an important impact in large tracts of the mountain ecosystems, calling for preventive measures to regulate future fire damage and restoration measures to recover the native habitats, their biodiversity and the ecosystems services they provide, including water flow regulation, control of soil erosion, and habitats for wildlife, namely wild pollinators.



Annual weather pattern:



The climate is warm. The winter months are much rainier than the summer months. The climate here is classified as Csa by the Köppen-Geiger system. The average annual temperature is around 14 °C and the average yearly rainfall is 991 mm.

Copyright: CLIMATE-DATA.ORG

Historical report on Wildfires:

Portugal ranks among the European countries that are more vulnerable to the impacts of climate change and is witnessing an intensification of phenomena such as drought, desertification, and coastal erosion, along with increased risks of flooding and wildfires. Extreme climate conditions contribute towards such risks, especially heat-waves, peaks in precipitation and storms with their interrelated strong winds, which may be expected to continue to impact on the Portuguese territory, with increasing frequency, intensity and duration of these extreme events. On the other hand, the rural exodus that occurred in Portugal mainly in the second half of the twenty-century contributed to land abandonment and widespread afforestation, especially in the interior North and Centre of the country, contributing also to increasingly frequent and more severe wildfires.

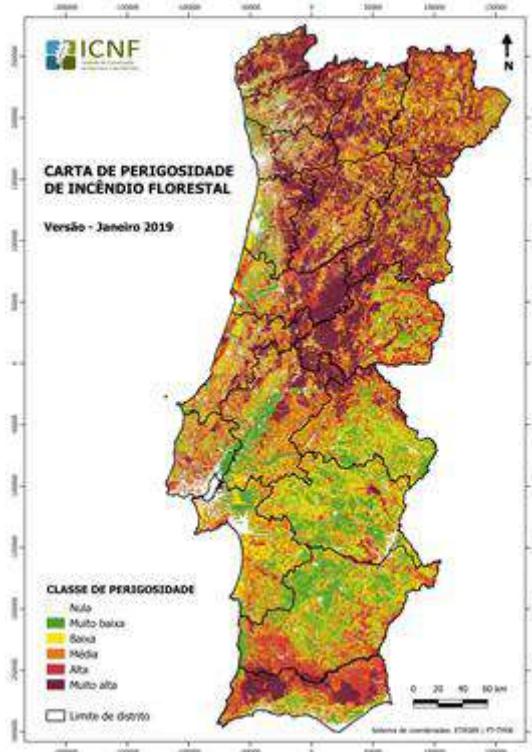


Figure: Forest fire hazard Map (Portugal)

Rural fires have destroyed thousands of hectares in Portugal. This is not a new phenomenon, but in recent years the number of dead people has increased (particularly in 2016 mega fires where more than 100 people have died). Since 2017, according to the Portuguese Law n. 76/2017 owners, tenants or entities that, for whatever reason, hold land adjacent to buildings in rural spaces, are obliged to proceed with fuel management.

Almost all parishes from the Cova da Beira region have been classified as first priority for monitoring fuel management in the context of rural fire prevention by the Portuguese fire management authorities. This context underlies the importance of Cova da Beira region regarding to fire vulnerability.

Available infrastructure [KPIs]:

- No. of fire fighters
- Water hydrants
- Equipment
- Operational capacity
- Coordination setup among teams

Demonstration scenario:

The main objective of the pilot is to demonstrate the implementation of cost-effective fire prevention and restoration actions that also benefit nature conservation. Fire prevention measures often focus on the reduction of biomass load without concerns for biodiversity conservation and ecosystem functions. That is the case of unselective understory biomass removal which causes, for instance, the loss of habitat for insect fauna, including auxiliary species, and the disruption of soil hydrological functions. This pilot will tackle those trade-offs by testing and demonstrating actions aimed at optimizing the synergies between landscape management for fire prevention and the safeguarding of biodiversity and ecosystem functions.

Cova da Beira region demo will provide the conditions to demonstrate SILVANUS Phases A and C ambition applied to two essential resources: water and energy, by integrating ancient agricultural practices with digital technologies, to develop and implement state of the art, close to nature, management approaches to fire prevention and restoration. The use of digital technologies, will be focused on remote detection, including satellite imagery and fully autonomous devices helping to implement all the processes to assure that safety boundaries between Nature and Human critical infrastructure are respected. Some of these fully autonomous devices are drones and robots with recharging bases.

The AdP - Águas de Portugal group activity involves the integrated management of the urban water cycle including all the stages, ranging from water abstraction, treatment and distribution for public consumption to the collection, transport, treatment and disposal of urban wastewater. In this subregion, several dozens of AdP facilities are located in remote, isolated areas, surrounded by vegetation which maintenance is hard to keep, making them vulnerable to wildfires. Any wildfire can easily put in danger these facilities and, besides destroying the natural heritage, jeopardize the access to water and/ or sanitation services to the population. So, keeping the critical facilities surroundings clean of vegetation is a continuing challenge, that needs constant fuel management work to minimize the risk.

Due to their number and dispersion, gathering, harmonising and processing data able to evaluate fire risk on a continuous basis involves spending many work hours and resources that could be replaced by automated and independent risk evaluation solutions.



Figure: Example of a fresh water treatment plant surrounded by vegetation

In the past, some worldwide known cases of overhead lines electrical disruption through trees, triggering wildfires, have been reported. Like in many other remote regions, overhead electrical lines cross Cova da Beira, either medium-voltage (MV) or low-voltage (LV). Safety corridors in the middle of the trees' bunches need to be maintained as well some tree to cable critical distances. This maintenance becomes an Hercules's work since the risky area is

extensive and efficient techniques need to be applied both to keep the schedule of the works and maintenance costs as low as possible



Figure: Overhead lines safety corridors

Phase A: Fire prevention actions: Landscape assessment and monitoring and maintenance of fire-smart landscapes

The pilot will work on two complementary approaches contributing to Phase A objectives: the use of remote sensing tools to monitor fire risk and guide management actions, and the use of in-situ close to nature approaches to maintain fire-smart landscapes, that is, landscapes that are less fire prone and more fire resilient, while also creating spaces for biodiversity

Regarding the use of remote sensing tools, remote sensing should be used for detection and monitorization of natural vegetation growth integrated with assets management to support fire control. This solution will be particularly helpful to safeguard infrastructures and facilities, by generating early warnings for management interventions (e.g., cutting vegetation) based on regular vegetation monitoring combined with factors that induce unacceptable levels of risk (like asset vulnerability, climate conditions, among others).

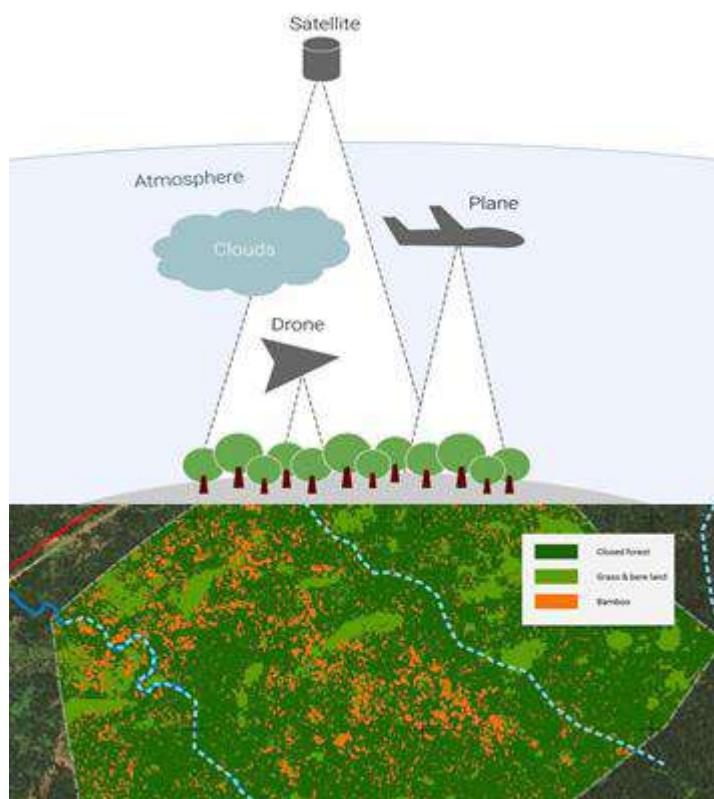
The remote sensing solution integrates the following goals:

0. High resolution mapping of vegetation cover and change
1. Development of indicators based on remote sensing data to support management
2. Establish fuel control actions
3. Follow up vegetation growth
4. Implement new fuel control actions when needed
- 5.

Complementary, an algorithm for risk of ignition assessment, as well as a set of alert reporting models and dashboards, will be developed that will trigger preventive fuel control actions, based on the optimization between cost-efficiency and risk assessment.

The proposed technology incorporates the following aspects:

1. **Need for remote sensing services:** whenever working with sustainable resources, for example when managing forested landscapes (forestry conservation, forestry certification, and reforestation), remote detection applications become a source of information in support of decision-making.
2. **Remote sensing:** in contrast with local observation, remote detection enables information acquisition without any direct contact, with clear advantages for gathering data and produce information regarding inaccessible and distant landscapes, such as forests.
3. **Methodology:** Remote detection integrates multiple detection sensors that may be installed in data collection equipment such as satellites, planes and drones



For the overhead lines we propose to develop a use case, running periodic data collection, in a specific forest area, through orthophotos and LIDAR images either by drone or helicopter. The data will then be treated and analysed with the relevant algorithms based mostly in Neural Networks and some other Machine Learning techniques. The goal is to produce regular assessments on vegetation cover, growth rate, and water content to schedule and optimize management actions.

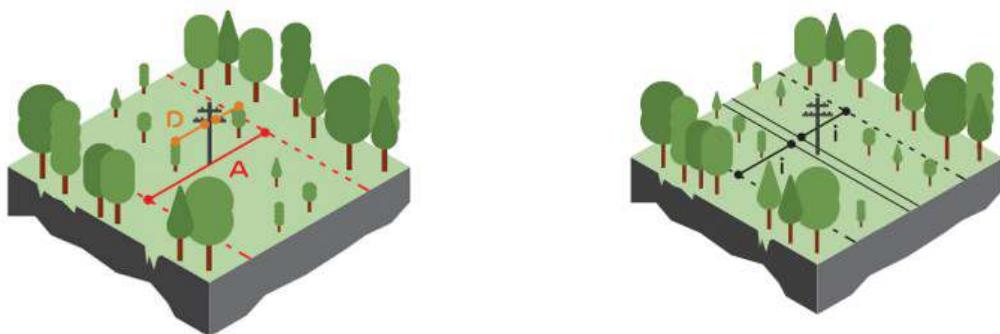


Figure: Some safety areas that need to be settled (pole to trees and line projection on the field)

The promotion of fire-smart landscapes, based on close to nature approaches, will rely on the use of grazing by large domestic herbivores (e.g., cattle, sheep, goats, horses), complemented with mechanical biomass removal, to regulate biomass load and growth, maintain discontinuity areas, for fire spread regulation, and foster habitat diversity for wild species. The use of livestock grazing to manage fuel-breaks is a common practice in the Mediterranean. This demonstrator will apply this approach to the maintenance of safety corridors beneath electric lines and in the area surrounding key water facilities. Moreover, the use of grazing approaches in these areas could be combined with the installation of biodiverse pastures, creating new spaces for animal grazing, while providing floral resources to wildlife and protecting soil from erosion and avoiding soil water loss. The effects of grazing

approaches on biodiversity and soil will be monitored by means of remote sensing approaches combined with in-situ data for indicator calibration and validation.

Natural activity needs locals' engagement. This is an activity that is been carried out with the support from local authorities, namely Cova da Beira Association of Municipalities – see letter of support. The citizens are invited to schedule and perform the mentioned activities within the area and periods agreed. During the project, training sessions will be held foreseeing the preparation of local engaged people to these activities and the assessment of long-term training measures and KPIs (time to reach agreement for services, pasture area consumed/day...) to keep the described processes related to prevention of wildfires efficient.

- Environmental assessment of fire danger index
- Training activities to enhance preparedness

Phase C: Restoration and rehabilitation of natural resources within burnt area

- Ecological restoration services
- Water and wastewater facilities description

Contribution to national priorities:

Include reference to national policies

Lei n.º 76/2017, 2017-08-17

[**Diário da República n.º 40/2020, Série II de 2020-02-26**](#)

4.1.12 3MON s. r. o.

Partner Name: 3MON, s.r.o.	
Company website: https://www.3mon.sk	
Type: SME	

Partner profile

3MON is a Slovak SME focusing mainly on the Firefighting sector for forest fires and saving lives using IT technologies. 3MON is working with two kinds of customers: businesses (B2B) and governmental bodies (B2G). 3MON supplies ground and aerial firefighting equipment, fire ignition products, remote site fuel/water logistics, military fuel/water systems, and mobile shelters. 3MON focuses on coordinating the units on the mission by the firefighter, police, and rescue services department. One of its main products is the GINA System which is a map software technology for computers, tablets and mobile devices. GINA enables its users to navigate through difficult terrain, coordinate teams, and exchange information effectively.

The GINA System helps both professional and volunteer firefighters to get to the scene of an accident faster and more efficiently. The software allows different components of rescue teams to communicate with each other and share information in real-time without overloading their radio systems. The system is easy to integrate with all types of emergency services like emergency number 112.

3MON also deals and has experts in the field of fire prevention with electric signalization of fire. We provide a service in Fire Protection and Safety and Health.

CVs of involved key researchers / staff members

- **Ing. Simona Kalinovská** (CEO) - Founder and Project Manager

With a spark of passion, she successfully underwent a preparatory course for volunteer firefighters in Bratislava, Slovakia. After completing this course, she realized that this was the direction she wanted to take in her personal and professional life. She created her own business to provide services in Fire Protection, Safety and Health and save lives thru IT technologies and firefighting equipment.

She has more than 10 years of experience in the field of Fire Protection and Forest Fire with a special Ground firefighting module of professional Firefighters. She is attended with a professional first responder on training in the forest or mountains by an action like searching missing persons, security operations with police officers, preparing special military training tools for the training centre in the Ministry of Defence.

She is an ambitious person who is still trying to develop, she was attended several specialized trainings and became an expert in the field of Fire Protection, Civil Defence, and Civil Engineering. In the last 12 months, she is working also a volunteer in the country with pandemic COVID-2019. With her team she created a special IT software for the repatriation centre for patients. They edited important data and cooperated with the Slovak Government.

- **Ing. Jozef Husek** - Head of Technical Department

He is working as a professional firefighter in the Ministry of Interior - Fire Department for more than 10 years. During the free days between shifts, he is working as Head of technical support for company 3MON, Ltd. His main specialization is Mountain Rescue Service – Rescue operations by helicopter rope techniques and special air and ground firefighting in the forest. In the special operations. He is using the knowledge for a special module of Geographic Tactical support and for the GINA solutions. He has implemented all GINA tablets for Slovakian firefighters. He has also attended a special CMI course – Course of civil protection in Split (Croatia) – Certificate for the Community Mechanism Introduction Course within the Union Civil Protection Mechanism Training Programme.

Role in the project

- **WP 1, Task 1.1** – 3MON will participate in general project coordination activities.
- **WP 2, Task 2.1,2.5 and 2.6** – 3MON will contribute to the sustainable forest management services and assessment framework from the viewpoint of Command-and-Control systems and services.
- **WP 3, Task 4.1-4.4, 4.6** – 3MON will take part in data collection and pre-processing, UGVs monitoring of the wildfire, UAVs deployment for remote sensing and data aggregation via the GINA system.
- **WP 8, Task 8.1-8.5** – 3MON will contribute to the design of the overall architecture, information sharing protocols and interfaces as well as services and overall platform integration.
- **WP 9, Task 9.1-9.55** – 3MON will participate in all three phase trials (A/B/C) as well as in the cross-cutting trials. It will bring real deployable equipment including UAVs, UGVs (Colossus), tablets deployed in emergency vehicles and GINA installations - central, dispatch, mobile version, tablet version, real-time integration with devices and robots. 3MON will primarily participate in the Slovak trial in close cooperation with TUZVO, UISAV and PLAMEN but also with other SILVANUS project members.
- **WP10, Task 10.1, 10.2 and 10.5** – 3MON will enact dissemination activities and contribute to self-sustainable models for the CASD and standards and compliance for interoperability of the SILVANUS platform.

Relevant publications, and/or products, services or other achievements

- **GINA CENTRAL⁴⁴** - In the event of an emergency, send and navigate your units to the site, establish live information links and ensure their protection and safety.

GINA Central is designed to provide a modern dispatch and command & control tool. The platform is based on a collaborative map with instant updates. GINA Central allows interactions with other units in the terrain and enables the operation dispatcher to collect all mission-critical datasets.

⁴⁴ <https://3mon.sk/en/gina-central/>

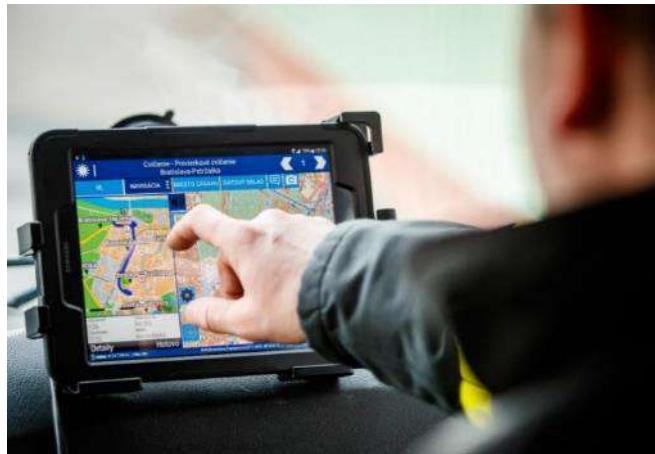


The user can see what is currently happening in the field thanks to common operation map data and routing in real time for all participants. Vehicle statuses, field report channels, photos, a timeline of livestreams – all of this is quickly accessible and updated in real time.

All information is secured on the client side (server) and meets the highest security standards (SSL 8 and ISO 27001).

FUNCTIONALITY:

- Dispatching
- Real-time GPS location overview
- Shortest path routing/navigation
- Managing and directing tasks
- Field reports and performance
- Live sharing of data sets
- Built-in map features (drawings, icons, multimedia)
- Geographical and analytical features (filters, “heat” maps, and more)
- **GINA Tablet⁴⁵** - for the staff in terrain. Link all parts of an integrated rescue unit together for faster arrival time to the scene. Faster arrival by 66%, Installed in 2500 emergency vehicles, Less radio communication by 70%.



FUNCTIONALITY:

En route:

- Simple receiving of the dispatch list
- Status dispatching with confirmation
- Statuses do not depend on a radio signal
- Real time tracking for all cooperating units
- Navigation

⁴⁵ <https://3mon.sk/en/gina-tablet-2/>

- Current traffic situation
- Possibility to directly call the announcer of the incident

At the scene:

- Mutual coordination of the unit's arrival
- Possibility to take, edit and transmit photos
- Shared operational view with map drawings
- Points of interest "POI"
- Access to building evacuation plans
- Operational cards for buildings

Post intervention:

- Photo archive
- Unit path view
- Directory of phone numbers
- Route history

- **Robot Colossus**⁴⁶ – is a multi-purpose support robot for interventions in places with a high risk of danger, with versatile use for firefighters, the army and industrial security. It is characterized by its resistance to temperatures up to 600 ° C, solid and durable construction made of aviation aluminum.



HIGHLY EFFICIENT – the COLOSSUS robot is the most powerful electric robot in the world, resistant to heat waves and with excellent properties in the field.

- Forward and backward movement on different types surfaces at a speed of 3.5 km / h
- Ability to climb stairs up to a slope of 40 °
- Ability to go through doors 78 cm wide and more
- Ability to rotate on the spot and overcome obstacles up to a height of 30 cm

HUGE PERFORMANCE – 16,000 watts of total power. He is able to pull and print 1,000 kg and its load capacity is 500 kg. That all with a battery that lasts 12 hours of use (6 batteries 29.8 - 46 Ah).

The COLOSSUS robot was designed and manufactured in our workshops in France.

HIGH ADAPTABILITY – The robot can be adapted to a specific task by changing equipment in less than 30 seconds, with one person and without needs of special tools:

⁴⁶ <https://3mon.sk/roboty/robot-colossus/>

- Water mount installation: 10 seconds
- Material carrier, assembly / disassembly: 20 seconds
- Carrier for passenger transport: 20 seconds
- Controllable bumper for intrusion into rooms or to clear obstacles: 20 seconds

PROPERTIES (fixed):

- Dimensions (length x width x height) 170 x 78 x 76 cm
- Weight (without equipment) 500 kg
- Speed 3.5 km/h
- Load capacity up to 500 kg
- Endurance up to 12 hours depending on the environment
- Ability to overcome obstacles up to a height of 30 cm
- Pitch 40 °
- Lateral inclination up to 35 °
- IP67 resistance
- control range up to 600 meters
- electromagnetic brakes and tactical rails for equipment

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FOR-TORI
GINA Installation in Slovakia for the Firefighting Brigades	360 installations in emergency vehicles	Connected to the GINA Central and Emergency Number 112.
Civil Defence – GINA CENTRAL	Installation for pandemic COVID-19	Have all information about first responder and all number about posit patients
Training with special Ground forest model of Forest fires	Personal tracking and navigation on the forest fire – quick rescue from the place of fire. Rescue by helicopters.	Orientation in terrain, all information in one device.
Mountain Rescue	Rescue people from under the avalanche and navigate back to the HQ.	Shortening the helicopter pick-up time.
Emergency Department – “KATKOM” cooperation with Emergency from Austria	Coordination of rescue of persons from a traffic accident of a mass number of wounded persons	Classification and sorting person of level the injuries.

Individual exploitation plan

We plan to develop and integrate our existing solutions and develop a new platform for editing information of citizens from the terrain to the SW and share this information with the Control room for the Police authority and firefighters in European countries.

Communication strategy for promoting project outcomes

We are a member of volunteer Firefighters, cooperating with The Young Entrepreneurs Organization of the European Union (JEUNE) to share our experiences from projects and apply in another countries. Ms. Simona Kalinovska is Head of the Security and Innovation committee at JEUNE. The Portuguese firefighters are interested in our solutions. We plan to provide training in Portugal to share our knowledge and experiences.

Description of significant infrastructure and major items of technical equipment relevant to the project

The goal of the project is the early detection of a fire in the forest and to immediately notify the nearest fire station for a quick arrival at the fire scene. For effective and fast decision-making, the commander needs a source of information. For visual control and weather monitoring, we propose to use a drone with real-time streaming to the operating center - GINA CENTRAL. The commander has an actual picture of the fire and the terrain as well. The commander can coordinate his unit and fighting with the fire as quickly as possible and successfully protect the unit from fire. The solutions will be tracking all firefighters with personal trackers or GINA TABLETS. In hard-to-reach terrain, we plan to use the electric robot with special water cannon for efficient firefighting.

System diagram of communication between the involved equipment



4.1.13 Catalink Limited

Partner Name: Catalink Limited
Company website: http://catalink.eu/
Type: SME



Partner profile

Catalink Limited is a Software Development SME founded in 2017. The company designs and develops complex cyber-physical systems targeted for data stream analytics, business automation, security, energy efficiency, and emissions reduction. The company has established a multi-disciplinary team, offering expertise in data science, machine learning, semantic technologies, performance optimization, multimedia analysis, situational awareness, as well as project management. Examples of implemented solutions include converged (optical and wireless) network management systems, customized Internet-of-Things (IoT) platforms, smart fleet energy management services, as well as business automation processes. The company also has a broad expertise in computer vision, image processing and multimedia applications, such as human activity detection and recognition from wearable and surveillance cameras (CCTV), video concept extraction, semantic segmentation for crisis event detection in visual content, content-based image retrieval and dynamic texture recognition.

The company has established a solid foundation on the application of machine learning and artificial intelligence for meeting various end-user needs. Catalink engineers deliver cutting-edge solutions for learning and reasoning from

incomplete, large and heterogeneous sets of data, delivering solutions for trends prediction, anomaly detection, and situation awareness. Example applications include network traffic, road traffic, telemetry, security and others.

Furthermore, company members have well established expertise in a series of aspects relevant to information exploitation and data correlation. These include: information encoding, data pre-processing, pattern recognition, knowledge representation, event correlation, context awareness, situational awareness, and decision support. Examples of outcomes include realistic and scalable solutions that fulfil actual end-user needs, for instance in the areas of network management, pervasive computing and user profiling.

Catalink places emphasis on its R&D activities, rendering them the foundation of its service and product portfolio. Its members have strong experience in successfully carrying out research in ICT at both national and international level. Catalink has established synergies with several stakeholders from industry and academia, which guarantees its ability to always deliver novel, cutting-edge and high-quality research activities.

CVs of involved key researchers / staff members

Dr. Konstantinos Avgerinakis (M) received his Diploma degree in computer and telecommunication engineering from the University of Thessaly in 2009, and the Ph.D. degree in Electrical Engineering from the University of Surrey in 2015. He is the head of the research and development in the computer vision and deep learning department with Catalink Ltd since 2019. His current research interests include computer vision and statistical video processing for event detection and recognition, human activity and facial expression recognition. Currently, Konstantinos Avgerinakis is the technical manager of H2020 ICT V4Design and deputy technical manager in H2020 ICT MindSpaces, while he participated in many other European projects (i.e. ROBOR-DER, SUITCEYES, Dem@Care, beAWARE). He co-authored more than 30 publications in refereed journals and international conferences, while he has also served as a reviewer in H2020 FET proposals as well as a high number of international journals and conferences.

Expected contribution to the project: Within SILVANUS, Konstantinos will work on the design and implementation of the appropriate algorithms for smoke and fire detection from CCTV, satellites and Unmanned Aerial Vehicles. Computer vision and machine learning tools are going to be leveraged to deploy benchmark and state-of-the-art technologies. Konstantinos will also be responsible for communicating and disseminating Catalink's SILVANUS developments to potential stakeholders and investors in the domain of AI and deep learning intelligence for fire and smoke detection.

Mr. Pavlos P. Kosmides (M) received his Diploma degree (2008) in Information & Communication Systems Engineering from the University of the Aegean (Samos - Greece), and he is currently pursuing a Ph.D. degree at the School of Electrical and Computer Engineering of the National Technical University of Athens (NTUA). Since 2008, he has been actively involved in several European and National research projects (FP7 SOCIETIES, FP7 EMERALD, H2020 InLife, H2020 Magneto, H2020 SocialTruth, Greek national projects WikiZen and Carma), focusing on optimal allocation of computational and network resources, Internet of Things technologies, Intelligent Transport Systems and context-awareness. For the period 2016 – 2017, he joined the IoT Lab group of the Cyprus University of Technology as a Research Fellow, participating at the iHEERO European project and was also granted a project under the open call for experimentation from the OrganiCity EU project related to Smart Parking for people with disabilities that took place in the smart city of Santander. His research interests lie in the fields of IoT, distributed context management, context access control in Smart Space environments, context inference, and heterogeneous wireless networks. He has 40 scientific publications in these fields. He is a member of the EENA Network of researchers.

Expected contribution to the project: Within SILVANUS, Pavlos will work on the implantation of the platform, as well as the integration and monitoring of technical activities. He will design the appropriate blueprints to enable the implementation of the visualization platform as well as the aggregation of multisensory data and their analytics. Pavlos we also be responsible for communicating and reporting to the project coordinator Catalink's technical and financial progress towards the implementation of the project.

Dr. Efstratios (Stratos) Kontopoulos (M) received his Ph.D. in Artificial Intelligence from the Aristotle University of Thessaloniki in 2011. He also holds a BSc in Mathematics from the Aristotle University of Thessaloniki (2003) and an MSc (Dist) in Computer Science from the University of Essex, UK (2004). He has participated in several interdisciplinary national and international research projects as project coordinator, principal investigator, task and work-package leader and has more than 60 publications in refereed journals and international conferences. He currently works as a knowledge scientist at Catalink. Having worked both in academia and industry, he has extensive theoretical and practical experience in semantic technologies, knowledge representation and reasoning.

Expected contribution to the project: Within SILVANUS, Stratos will focus on analyzing the use cases domain of discourse in order to design and deploy the required semantic knowledge representation models (taxonomies/ontologies/knowledge graphs). He will also participate in deploying the required semantic infrastructure.

Mr. Panagiotis Mitzias (M) received his M.Eng. in Electrical and Computer Engineering - with a specialization in Computer Science - from the Aristotle University of Thessaloniki, Greece, and, since then, he has been working as a software engineer and a research associate on Semantic Technologies. His technical and research expertise mainly covers the fields of Knowledge Representation and Reasoning, Semantic Web technologies, Ontologies, and Rule-based Systems towards Decision Support. More specifically, his technical prowess lies in the practical deployment of Semantic Web technologies in various application domains. From 2014 to 2019, he had been working as a Research Associate at the Information Technologies Institute (ITI) of the Centre for Research and Technology, Hellas (CERTH), with participation in highly interdisciplinary EU-funded projects in various diverse domains, like, e.g., border surveillance, disaster management, digital preservation, decision support, e-health, and digital libraries, amongst others. He has published several papers in international conferences, scientific journals and book chapters. Expected contribution to the project: Within SILVANUS, Panagiotis will work on deploying the required semantic infrastructure (triple store, queries, rule-based semantic reasoning, interfaces), along with the mechanisms for interoperating with the rest of the platform.

Expertise and skillset

- Visual analysis from aerial (drones) and Satellite (SAR) images for the detection and localization of fire crisis events;
- Visual analysis from static surveillance cameras (CCTV) for fire and smoke detection;
- Data fusion and semantic reasoning for predicting fire crisis events in social media and multisensory data;
- Data crawling from social media and crisis risk assessment based on textual and visual analysis;
- Dashboard application for visualizing fire crisis events;
- Foster the cultivation of risk prevention culture to EU society - stakeholder communication;
- Fire safety knowledge and engineering;
- Governance and insurance models for preventive strategies.

Role in the project

- WP1: CTL will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- WP2: CTL will engage with the stakeholders for the aggregation of user requirements
- WP3: CTL will contribute to the semantic framework specification and formalisation of SILVANUS knowledge repository.
- WP4: CTL will contribute to the data collection process in collaboration with CMCC, DELL and other technical partners.
- WP5: CTL will lead the activity on real-time monitoring of response coordination
- WP8: CTL will contribute to the integration of the project platform.
- WP9: CTL will oversee the pilot demonstration of Phase A and C within the project (including Greece).
- WP10: CTL will leverage on the existing dissemination and communication channels to promote the project outcomes to wider audience. The knowledge developed and gained within the project will be further utilized to enhance the market share of existing products.
-

Relevant publications, and/or products, services or other achievements

- Kaltsa, V., Avgerinakis, K., Briassouli, A., Kompatsiaris, I., & Strintzis, M. G. (2018). Dynamic texture recognition and localization in machine vision for outdoor environments. *Computers in Industry*, 98, 1-13.
- Avgerinakis, K., Giannakeris, P., Briassouli, A., Karakostas, A., Vrochidis, S., & Kompatsiaris, I. (2017). LBP-flow and hybrid encoding for real-time water and fire classification. In *Proceedings of the IEEE International Conference on Computer Vision Workshops* (pp. 412-418).
- Giannakeris, P., Avgerinakis, K., Karakostas, A., Vrochidis, S., & Kompatsiaris, I. (2018, June). People and vehicles in danger-A fire and flood detection system in social media. In *2018 IEEE 13th Image, Video, and Multidimensional Signal Processing Workshop (IVMSP)* (pp. 1-5). IEEE.
- E. Kontopoulos et al. (2018). Applying Semantic Web Technologies for Decision Support in Climate-Related Crisis Management. *2nd Int. Conf. on Citizen Observatories for natural hazards and Water Management (COWM 2018)*, 27-30 November 2018, Venice, Italy.

- E. Kontopoulos et al. (2018). Ontology-based Representation of Crisis Management Procedures for Climate Events. *1st Int. Workshop on Intelligent Crisis Management Technologies for Climate Events (ICMT 2018), collocated with the 15th Int. Conf. on Information Systems for Crisis Response and Management (ISCRAM 2018)*, 20-23 May 2018, Rochester, NY, USA.
- Avgerinakis, K., Briassouli, A., & Kompatsiaris, I. (2012, November). Smoke detection using temporal HOGHOF descriptors and energy colour statistics from video. In *International workshop on multi-sensor systems and networks for fire detection and management*.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
H2020 ICT-01-2019 CPSo-Saware: Aims at developing models and software tools for allocating computational power/resources to Cyber-Physical Systems and devices, relying on AI support for strengthening reliability, fault tolerance and security at system level.	<ul style="list-style-type: none"> • Computer vision and machine learning tools for deploying deep learning and AI algorithms. • Data streaming from multimodal sensors. • Data aggregation and data annotation from mobile applications. • Data fusion and semantic reasoning from multisensory data. 	SILVANUS will capitalize on Catalink's experience from its participation in CPSoSaware to deploy computer vision and machine learning algorithms for fire and smoke detection. Data aggregation and data fusion techniques will also be used to process fire and smoke data from CCTV, UAV and satellite sources.
H2020 SU-SEC-IA-2018 PREVISION: Aims to empower the analyses and investigations of LEAs with novel tools and solutions for handling and capitalizing on the massive heterogeneous data streams that must be processed during complex crime investigations and threat risk assessment.	<ul style="list-style-type: none"> • Design and development of semantic models and relevant technologies. • Deployment of respective semantic infrastructure. • Computer vision and deep learning algorithms for smoke and fire detection. • Deep learning and AI tools for crisis event detection and identification of people or vehicles in danger. 	SILVANUS will leverage all PREVISION techniques and experience to deploy state-of-the-art fire and smoke detection systems, as well as for deploying the required semantic infrastructure.
H2020 MG-RIA-2018 Trustonomy: Its aim is to maximise the safety, trust and acceptance of automated vehicles by helping to address technical and non-technical challenges through a well-integrated and inter-disciplinary approach, bringing domain experts and ordinary citizens to work closely together.	<ul style="list-style-type: none"> • Computer vision and machine learning tools for deploying deep learning and AI algorithms. • Data streaming from multimodal sensors. • Data aggregation and data annotation from mobile applications. • Data fusion and semantic reasoning from multisensory data. 	SILVANUS will exploit Catalink's experience from its participation in Trustonomy to deploy computer vision and machine learning algorithms for fire and smoke detection. Data aggregation and data fusion techniques will also be used to process fire and smoke data from CCTV, UAV and satellite sources.

Individual exploitation plan

Catalink will exploit the project's results by improving its research and development in computer vision, AI tools and semantics. Catalink plans to exploit software modules of the SILVANUS project related to AI and semantics, to acquire new clients and EU-funded projects. The knowledge that will be obtained through the project will increase the applicability of other projects in similar areas and will increase the knowhow of the team with a sustainable, long-term positive effect.

Communication strategy for promoting project outcomes

- Contribution to dissemination material content.
- Facilitate engagement with a range of stakeholders, involving them in current work and potential future project work;
- Participation in industry-relevant events, international conferences, EU and National Clusters.

Description of significant infrastructure and major items of technical equipment relevant to the project

- Computer vision server for deploying the fire and smoke detection modules.

4.1.14 Synthesis Center for Research & Education Ltd

Partner Name: SYNTHESIS Center for Research & Education Ltd	
Company website: www.synthesis-center.org	
Type: SME	

Partner profile

We are Cyprus' leader in social entrepreneurship and social innovation, with an emphasis in Community Resiliency & Community Continuity. We create and implement research and educational projects of social impact (particularly in the fields of employment, entrepreneurship, migrant integration and social inclusion, Risk, Crisis and Disaster Management, sustainable development) and manage "Hub Nicosia," a pioneering social innovation hub which houses and supports organizations, entrepreneurs and enterprises with a social and Environmental mission.

We also provide non-formal education to youth and adults. Our beneficiaries are people who are at the risk of social exclusion, including NEET youth, migrants, people with disabilities, residents of remote rural communities or those with fewer opportunities. Our work focuses on developing a combination of knowledge, values and skills which will mobilise youth and adults to fully engage in civic, political and economic life with the ultimate goal of sustainable development and social inclusion.

As an accredited Vocational Education & Training provider, we focus on the development of training programmes that can empower small enterprises and their employees, as well as the general population, with an emphasis on community resiliency & community continuity in the face of risk, crises and disasters, including first aid and first responders awareness courses.

In a world surrounded with conflict, radicalisation and exclusion of many forms, we are active in actions that improve individual lives, enhance social inclusion, build bridges, and inspire hope.

We are active in Youth and Adult learning, School Education, VET & Business Consultancy, Social Enterprise support, Research and Policy, Active Ageing & Health Education, Migrant Inclusion and Integration, Risk Crisis & Disaster Management, Prevention and Countering of Violent Extremism and Radicalization.

CVs of involved key researchers / staff members

Irene Kampa – Maltezopoulou:

- **Education:** Master of Arts (MA) in International Mass Communication / Master of Science (MSc) in Risk, Crisis & Disaster Management
- **Career profile/Experience:** Senior Business Consultant / Senior Trainer in the fields of Risk, Crisis & Disaster Management, Health & Safety, Security, First Aid & First Response, Business Continuity, Business Resiliency, ISO 31000.
- **Role in the organisation:** Vocational Education & Training Manager / Project Manager / Senior Trainer
- **Expected contribution to the project:** Contributions referring to the community engagement aspect of the project, community resiliency & continuity in the face of forest fires, prevention / deterrence / mitigation of forest fires, community and environmental recovery.

The Key Researcher has previous research experience in wild forest fires with a thesis on the 2007 Wild Fires of the Peloponnese Region in Greece and their effect on the communities and residents.

Role in the project

- **WP1:** SYNC will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).

- **WP2:** SYNC will contribute to the participatory process and will engage with the stakeholders. The expertise from past collaborations will be brought forward to formalize the challenges encountered by public administration authorities in combating forest fires.
- **WP3:** SYNC will actively contribute and lead the development of training activities to be delivered for the end-users.
- **WP7:** SYNC will promote the public governance policies on forest management
- **WP9:** SYNC will participate in Phase A trial demonstration and will evaluate the effectiveness of the training activities
- **WP10:** SYNC will contribute to the project dissemination and communication activities.

Relevant publications, and/or products, services or other achievements

Crisis and Disaster Impact upon Society and Social Processes in a Region of Greece, 2008 (Institute of Lifelong Learning, Leicester University, UK)

Nationally Accredited and Certified VET programs designed by SYNTHESIS in the Environmental Field:

- Infrastructure Safety & Security
- Risk and Crisis Management
- Social Media Management
- Pandemic Management

List of relevant previous projects or activities, connected to the subject of this proposal

Name of EU programme	Reference number and title of the action/project	Name of your institution	Role in the project (Applicant or Co-Applicant)	Amount awarded (Euro) (*)	Action/project webpage
Erasmus Plus KA2	2016-1-DE04-KA205-013704 “Harnessing the power of digital media tools to prevent the radicalisation of vulnerable youth (CONCORDIA)”	SYNTHESIS Center for Research and Education	Partner	31,415.00	http://www.concordia.website/
Erasmus Plus KA2	2016-1-PL01-KA202-026837 “Technical and Vocational Skills Development”	SYNTHESIS Center for Research and Education	Partner	12,915.00	https://www.facebook.com/groups/196500074087353/
Erasmus Plus KA2	2016-1-DK01-KA202-022320 “A European Entrepreneurship VET Model and Assessment Framework for Ethnic Minorities (EVA)	SYNTHESIS Center for Research and Education	Partner	30,065.00	https://eva-project.eu/om/
Erasmus Plus KA2	2017-1-BG01-KA204-036319 “Exchange of Practices for Disadvantaged People (ERFAL)”	SYNTHESIS Center for Research and Education	Partner	8,320.00	http://erfalproject.eu/

Erasmus Plus KA2	2017-1-AT01-KA201-035041 “SkillDisplay - Show what you can do!”	SYNTHESIS Center for Research and Education	Partner	25,528.00	https://www.skilldisplay.eu/
Erasmus Plus KA2	2017-1-IS01-KA204-026532 “Innovative Language Learning within the framework of practices for socio-cultural inclusion and empathy enhancement in adult education (LINGUA+)”	SYNTHESIS Center for Research and Education	Partner	43,358.00	http://www.linguaplusproject.eu/
Erasmus Plus KA2	2017-1-TR01-KA204-046125 “First Aid Language Kit for Migrants (FALK)”	SYNTHESIS Center for Research and Education	Partner	25,026.00	http://falkproject.eu/
Erasmus Plus KA2	2017-2-IT03-KA205-011264 “You (th) Stand Up!”	SYNTHESIS Center for Research and Education	Partner	17,690.00	https://www.facebook.com/youthstandupEU/
AMIF	776029 — PandPAS — AMIF-2016-AG-INTE “Pre and Post – Arrival Schemes to facilitate inclusion and prevent xenophobia and radicalization (PandPAS)”	SYNTHESIS Center for Research and Education	Partner	152,738.22	http://www.pandpasproject.eu/
Erasmus Plus KA2	2018 – 1-UK01-KA202-047909 “Next Generation Women Technology Entrepreneurs (Biz-Miz)”	SYNTHESIS Center for Research and Education	Partner	26,722.00	http://bizmiz.eu/
Erasmus Plus KA2	2018-1-DK01-KA202-047060 “Work-VR: Piloting virtual reality for language in the context pf employability”	SYNTHESIS Center for Research and Education	Partner	39,935.00	https://www.work-vr.eu/
Erasmus Plus KA2	2018-1-PT01-KA202-047266 “Building Key Competences Through Challenge Based Learning (NEUROGUIDE)”	SYNTHESIS Center for Research and Education	Partner	24,527.00	https://www.neuroguide.eu/

Erasmus Plus KA2	2018-1-DE02-KA204-005030 "Design Thinking as a Means to Innovative Product Development in Adult Learning (D-Learning)"	SYNTHESIS Center for Research and Education	Partner	28,172.00	https://www.facebook.com/d.learning.2020/?ref=page internal
Erasmus Plus KA2	2019-1-IS01-KA202-051133 "Breakout Challenges for Developing Transversal Skills (Xcape)"	SYNTHESIS Center for Research and Education	Partner	26,784.00	https://xcape.online/
Erasmus Plus KA2	2019-1-IT02-KA201-062254 "GREEN S.E.E.D.S. - Sinergy and Environment to Empower Decentralized Schools"	SYNTHESIS Center for Research and Education	Partner	50,050.00	https://www.greenseeds.eu/
Erasmus Plus KA2	2019-1-IT02-KA204-063109 "Promoting migrants' democratic participation and integration (PROM-PAR)"	SYNTHESIS Center for Research and Education	Partner	29,590.00	http://prompar-civiceducation.eu/
Erasmus Plus KA2	2019-2-FR02-KA205-016178 "Empowering Youth to Unite and Stand Up against Hate and Violence (YOUTH2UNITE)"	SYNTHESIS Center for Research and Education	Partner	47,560.00	https://www.youth2unite.com/
Erasmus Plus KA2	2019-1-IT02-KA203-062403 "TESEO - Arianna's strands in the digital age"	SYNTHESIS Center for Research and Education	Partner	30,410.00	https://www.teseoproject.eu/
Erasmus Plus Knowledge Alliances	612501-EPP-1-2019-1-IT-EPPKA2-KA "Valorisation of ancient farming techniques in resilient and sustainable agriculture (VALOR)"	SYNTHESIS Center for Research and Education	Partner	113,000.00	https://erasmus-valor.eu/
Erasmus Plus KA2	2020-1-FI01-KA204-066474	SYNTHESIS Center for Research and Education	Partner	30,280.00	

	Education as a Constructor of Social and Cultural Sustainability for the 21st century				
Erasmus Plus KA2	2020-1-DK01-KA201-075136 Designing with Lego: The Eco-Cities of Tomorrow	SYNTHESIS Center for Research and Education	Partner	34,519.00	
Erasmus Plus KA2	2020-1-HR01-KA202-077758 Hacking the Code for Women in STEAM	SYNTHESIS Center for Research and Education	Partner	28,917.00	
Erasmus Plus KA2	2020-1-NL01-KA202-064745 Enabling Social Entrepreneurs to Scale their Impact Internationally	SYNTHESIS Center for Research and Education	Partner	49,339.00	
Erasmus Plus KA2	2020-1-EL01-KA204-078850 Empowering Civil Society Through a Learning Environment	SYNTHESIS Center for Research and Education	Partner	15,300	
Erasmus Plus KA2	2020-1-ES01-KA204-082640 Adult Inclusive Design	SYNTHESIS Center for Research and Education	Partner	21,734.00	
Erasmus Plus KA2	2020-1-IT01-KA202-008550 INNOVATIVE COLLABORATIONS	SYNTHESIS Center for Research and Education	Partner	27,859.00	
Erasmus Plus KA2	2020-1-FI01-KA201-066641 Virtual reality Education & Game based Achievements in classrooms	SYNTHESIS Center for Research and Education	Partner	43,628.00	

Erasmus Plus KA2	2020-2-UK01-KA205-079508 Mobilising Against Extremism through Countering and Diverting Radicalisation of Young People	SYNTHESIS Center for Research and Education	Partner	36,311.00	
AMIF	957902 — MUMS at WORK — AMIF-2019-AG-CALL Enhancing social integration and employability of Migrant Mothers - MUMS at WORK	SYNTHESIS Center for Research and Education	Partner	113,113.98	
AMIF	957695 — RaCIP — AMIF-2019-AG-CALL RACIP - Raising Capacity for Inclusive People	SYNTHESIS Center for Research and Education	Partner	102,552.76	
HORIZON 2020	101004640 — NEW ABC — H2020-SC6-MIGRATION-2018-2019-2020 / H2020-SC6-MIGRATION-2020	SYNTHESIS Center for Research and Education	Partner	175,558.25	

Individual exploitation plan

The project will allow for the enhancement of knowledge and skills referring to environmental sustainability, forest management, and overall safety for forest / rural areas. In addition to the above, it will update the technological competencies of the organization in relation to new forest monitoring and fire management tools, methods, applications, and equipment.

Communication strategy for promoting project outcomes

- Civil Protection
- Ministry of Interior
- Forest Protection Department
- Volunteer Firefighters
- Fire Brigade Authority
- Rural Community Councils

To be developed

- Online Conference

Description of significant infrastructure and major items of technical equipment relevant to the project

N/A

4.1.15 Expert.AI

Partner Name: Expert System SpA	
Company website: www.expert.ai	
Type: SME	

Partner profile

Expert System is a leader in Artificial Intelligence applied to text with more than 20 years of experience in Natural Language Understanding.

We started from a garage before it became a cliché. Today, we are a global company committed to innovation and to providing our customers and partners with concrete results and tangible business value.

We work with some of the largest organizations and government agencies throughout Europe, the Americas and the Middle East. Analysts, data scientists and computational linguists worldwide recognize the value of our patented AI-based NLU technology and its unique approach, which combines semantics and machine learning as the highest performing, most pragmatic way to address even the most complex unstructured information management use cases. Expert System supports numerous research projects in the field of artificial intelligence to promote technological advancement and the process of digital transformation in government and other sectors. Collaboration between organizations, public administrations, university departments and cutting-edge companies activates important synergies between different skills and knowledge to create innovative technological solutions and new business models in support of economic growth.

At Expert System, we consider technological innovation a key strategic asset for business development. With Cogito Lab locations in both Europe and the United States, Expert System is positioned to actively participate in research projects in these markets.

CVs of involved key researchers / staff members

Mr. Masucci Vincenzo (male) In 06/2000 Degree in Physics - University of Naples, Federico II 06/2000. He Works in Expert System since June 2012 as Branch Manager at Expert System Naples, Senior Project Manager. His main activities and responsibilities are: Technologies and languages of Semantic Web, Knowledge Management, Methods and criteria for distributed simulation, Computer vision.

Mr. Gallo Paolo (male) is Sr Sw Engineer- Solutions Architect. He works in Expert System since March 2007. His main activities and responsibilities are feasibility study for new projects, gathering user and system requirements, scouting of existing solutions and Pattern Identification, Architecture definition, guide the team to consistency and creativity throughout the software development lifecycle.

Partner Expertise

Artificial Intelligence/Cognitive algorithms based either on Ontologies/Taxonomies or Neural Networks, in order to categorize and to extract insights from contents in the following domains:

1. *Intelligence Domain:*
 - a. analysis of citizens mood/feeling coming from social networks, so to understand about intention to start wild fires
 - b. discovering from “available” sources about interested organizations and governments that officially use fires for deforestation,
 - c. Ex-Post analysis of historical events either from social network or official (off-line) contents so to understand best practice and apply reasoning for future dedicated tasks for prevention (Ex-Ante analysis)
2. *Health Domain:*
 - a. analysis of tech/medical contents so to extract correlation between diseases and contaminants derived by mass combustion and also diseases, symptoms due to particular exposures/situation
3. *Climate Change:*
 - a. analysis of tech/medical contents so to extract correlation between Climate changes and potentially derived growth of fires on dedicated GEO areas

4. *Smart-Cities:*

- a. analysis of citizen moods and feelings coming from social networks about the creation of eco-sustainable habitats and compliant with surroundings

5. *Marketing & Communications:*

- a. analysis the style of writing (behavioural algorithms) on citizens opinions so to understand about their “social & interaction” habits and interests so to consequently developing an effective pro or counter (web) campaign together with psychologists and sociologists.

All the above-mentioned categorization and extraction capabilities can be potentially merged with ones coming from GIS or GEO devises so to have a real picture of the problem and apply an added value reasoning on top.

Role in the project:

- **WP1:** EAI will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** EAI contribute to the formalization of stakeholder requirements. Specifically, in collaboration with PSNR, the challenges of combating wildfire in Italy and the associated health impact encountered by front-line fire fighters will be addressed.
- **WP3:** EAI will lead the activity on the development of SILAVNUS knowledge specification
- **WP4:** EAI will contribute to the data collection and normalization process in collaboration with CMCC, CTL, HB, DELL among others.
- **WP5:** EAI will contribute to the development of data driven decision support system
- **WP8:** EAI will participate in the platform integration activities
- **WP9:** EAI will overall the pilot demonstration activities planned within the project in Italy.
- **WP10:** EAI will disseminate the project outcomes through their network. The knowledge gained within the project will strengthen the development of current products.

Relevant publications, and/or products, services or other achievements

- R. Setola, S. Bologna, E. Casalicchio, V. Masucci; An Integrated Approach For Simulating Interdependences; Second Annual IFIP Working Group 11.10 International Conference on Critical Infrastructure Protection, George Mason University, Arlington, VA, USA, Mar. 2008.
- R. Setola, S. Bologna, E. Casalicchio, V. Masucci; Critical Infrastructure Protection II; Editors: Mauricio Papa, Sujeet Shenoi Collection: Computer Science
- V. Masucci ; F. Adinolfi; G. Di Poppa; A. Tofani; P. Servillo; Critical Infrastructures Ontology based Modelling and Simulation, Third Annual IFIP Working Group 11.10 International Conference on Critical Infrastructure Protection Dartmouth CollegeHanover, New Hampshire, USA March 22 - 25, 2009
- V. Masucci, Semantic interoperability among federated simulators of critical infrastructures – DIESIS Project, WIT Press / Computational Mechanics; 1 edition (February 9, 2012), [http://www.amazon.com/Critical- Infrastructure-Security-Assessment-Prevention/dp/1845645626](http://www.amazon.com/Critical-Infrastructure-Security-Assessment-Prevention/dp/1845645626) (2011)
- Vincenzo Masucci et al. MixedEmotions: An Open-Source Toolbox for Multimodal Emotion Analysis. IEEE Transactions on Multimedia (2018)

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
SIEX (Semantic Information Exchange) - Prevention of and fight against Crime (ISEC) 2007-2013	Project to enhance the quality of the information exchanged by Law Enforcement Agencies by offering a semantic engine that analyses both requests and responses sent and received within the context of the Swedish Initiative	Methodology to apply standardization of terms shared between end-users and stakeholders based on English Ontology and Taxonomy
ANITA (Advanced Tools for fighting online illegal trafficking - https://www.anita-project.eu/ – H2020 SEC 2019	Project focused on designing and developing a novel knowledge-based user-centred investigation system for analysing heterogeneous (text, audio, video, image) online	AI algorithms enabling the analysis of social networks mainly for mood/emotions discovering. Applying surface crawling techniques to download web contents

and offline content for fighting illegal trafficking of drugs, counterfeit medicines, NPS and firearms

Individual exploitation plan

EXPSYS will exploit project results in the context of their product offering. Based on a knowledge graph with over 400K lemmas, 300K concepts and 80 types of relations that render 3M links, Expert System's core technology Cogito© (<https://expertsystem.com/learning-center/technology>) has the ability to understand unstructured text in a way similar to how a domain expert reads. Cogito leverages the embedded knowledge graph together with natural language understanding algorithms to read, comprehend and learn from any text, out of the box, and can be extended and customized to specific domains of application. From extracting information from social media to supporting the identification of specific language, slangs and conversations across different channels, we support end-users to get the most out of the different information assets, improving their efficacy and maximizing impact. As an SME in the FORTORI consortium, EXPSYS plans to expand their presence in the market and evolve their product and service offer for the benefit of the European potential FORTORI domain end-users.

Communication strategy for promoting project outcomes

- Publish research results in impact journals and relevant conferences in the areas of ontology engineering and language processing
- Invite to project related events institutions directly involved in health issues. They may be at different levels: local, national, and international.
- Disseminate project related information via Expert System social media channels in particular via Expert System Twitter Account (https://twitter.com/Expert_System) and Expert System Linkedin Account (<https://www.linkedin.com/company/31251/>)
- Disseminate project's results and achievements during conference and events related to FORTORI domain in which Expert system will be involved directly or through the associations to which it is affiliated
- Participation in industry-oriented language technology forums, such as the Language Technology Industry Summit
- new EU-level collaboration e.g. in the context of the European Defense Agency (EDA)

Description of significant infrastructure and major items of technical equipment relevant to the project

For FORTORI proposal, COGITO will be implemented as a semantic engine delivered within the solution as a Web Service/API which can be deployed over a physical or virtualized infrastructure and using both a cloud or “on premise” delivery model.

4.1.16 ITTI s.p.o

Partner Name: ITTI s.p.o	
Company website: https://www.itti.com.pl/en/home/	
Type: SME	

Partner profile

ITTI is an IT company (SME) providing software solutions for the companies and institutions in Poland and in other countries (www.itti.com.pl). The company operates since 1996 and is located in Poznan, Poland. Currently, ITTI has a team consisting of ca. 60 persons.

The main goal of ITTI is develop and provide innovative applications and dedicated software solutions which are adjusted to customer needs, e.g. systems supporting management of warehouses and production process, solutions for crisis management and telemedicine, as well as systems supporting space situational awareness and space missions.

ITTI has over 15 years of experience in international R&D projects which has been done in the following programmes: Horizon 2020 (formerly also FP7, FP6 and FP5), European Defence Agency (EDA) programmes (e.g. Joint Investment Programme on Force Protection, Joint Investment Programme on CBRN) as well as Action Grant CIPS II and NATO Industrial Advisory Group studies. In the last 5 years the company has been involved also in the activities dedicated for European Space Agency. The company has also been active in some Polish applied research

projects co-funded by industry and the Polish Ministry of Science and Higher Education or National Centre of Research and Development. Additionally, it is worth to mention that ITTI has been also involved in the projects for The European Union Agency for Network and Information Security (ENISA). In R&D activities the company cooperates closely with numerous universities and research institutes based in Poland as well as around Europe.

ITTI employees possess the following certificates: PRINCE2 Certificate Foundation and Practitioner(Projects IN Controlled Environments), ITIL Foundation Certificate (IT Service Management Best Practices), ITIL Service Manager Certificate; ISO 27001 Lead Auditor Certificate (Information Security), TOGAF (Enterprise Architecture), CISA Certificate (Security), Auditor of Quality Management System based on ISO 9001:2008.

CVs of Key personnel

Prof. Michał Choraś (male) obtained his Doctor of Science (habilitation) degree in computer science from AGH Cracow in 2014, and since 2015 he holds the professor position at University of Science and Technology (UTP) in Bydgoszcz. Earlier, he obtained M.Sc. and PhD in telecommunications from UTP in Bydgoszcz in 2002 and 2005, respectively. He also works as researcher, senior consultant and project manager at ITTI Sp. z o. o. His interests include cyber security, information management and pattern recognition in several domains, such as image processing, security (network security, urban security, biometrics) and safety (crisis management, critical infrastructures). He has been involved in EU FP7 projects (e.g. INTERSECTION, INSPIRE, TACTICS, CAMINO) and EDA projects (e.g. ATHENA). He coordinated FP7 project CAMINO on cyber crime and cyber terrorism. He is an author of over 160 reviewed scientific publications, including a number of publications regarding methods for cyber security, pattern recognition, image processing and security/safety applications. He is also a reviewer and Programme Committee member for over 35 journals and over 35 conferences. Currently, he is a vice-chair of IMG-S Thematic Area 7 on cyber security.

Dr Rafal Kozik, Ph.D. Eng. (male) is a consultant and researcher at ITTI Sp. z o.o. He is also an assistant professor in the Department of Telecommunication of University of Technology and Life Sciences in Bydgoszcz (UTP). In 2013 he received his Ph.D. in telecommunications from University of Science and Technology (UTP) in Bydgoszcz. Since 2009 he has been involved in number of international and national research projects related to cyber security, critical infrastructures protection and data privacy (e.g. FP7 INTERSECTION, FP7 INSPIRE, FP7 CAMINO). His current research focuses on a cyber security, crisis management, critical infrastructure protection, and artificial intelligence for computer vision solutions. He is an author of over 70 reviewed scientific publications, including a number of publications concerning cyber security.

Role in the project

- **WP1:** ITTI will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** ITTI will contribute to the development of climate sensitive forest models in addition to stakeholder engagement.
- **WP3:** ITTI will actively contribute to the workpackage activities including the development of knowledge representation models, development of training activities using AR/VR systems along with contribution to citizen engagement program.
- **WP4:** ITTI will contribute to the deployment of data collection from EO and in-situ sensors.
- **WP5:** ITTI will contribute to the security of big-data framework
- **WP8:** ITTI will participate in the integration activities
- **WP9:** ITTI will oversee the pilot demonstration activities
- **WP10:** ITTI will internally and externally disseminate the project outcomes.

Relevant publications

- Kozik R., Choras Michał, Puchalski D., Renk R., Q-Rapids framework for advanced data analysis to improve rapid software development, Journal of Ambient Intelligence and Humanized Computing, Online First, Springer, 2018
- Kozik R., Choras Michał , Puchalski D., Renk R., Platform for Software Quality and Dependability Data Analysis, in: Zamojski, W. et al. (Eds.): Contemporary Complex Systems and Their Dependability, Proceedings of the Thirteenth International Conference on Dependability and Complex Systems DepCoS-RELCOMEX, 306-315, AISC, Springer, July 2-6, Brunów, Poland, 2018.

- Choras Michal , Kozik R., Machine Learning Techniques for Threat Modelling and Detection in: Ficco M. and Palmieri F. (Eds): Security and Resilience in Intelligent Data-Centric Systems and Communication Networks, Elsevier, 179-192, 2017.
- Choras Michal, Wozniak M., Concept Drift Analysis for Improving Anomaly Detection Systems in Cybersecurity in: Bernik I. et al. (Eds.): Advances in Cybersecurity 2017, 35-42, CECC 2017, Ljubljana, University of Maribor Press, 2017.
- Choras Michal, Kozik R., Renk R., Holubowicz W., A Practical Framework and Guidelines to Enhance Cyber Security and Privacy , in: Herrero A., Baruque B., Sedano J., Quintan H., Corchado E. (Eds), International Joint Conference CISIS'15 and ICEUTE'15, Advances in Intelligent Systems and Computing, 485-496, ISBN 978-3-319-19712-8, Springer 2015.

Relevant past projects

- **H2020 Q-Rapids** (Quality-aware rapid software development) focuses on increasing the quality in the software development stage. Machine learning and big data techniques are used to analyse, predict and improve software development process.
- **H2020 MAGNETO** (Technologies for prevention, investigation, and mitigation in the context of fight against crime and terrorism) – the main goal of the project is to develop technologies and solutions supporting Law Enforcement Agencies in the task of processing massive heterogeneous data in a more efficient manner, effectively enabling their transformation into solid and court-proof evidence. ITTI role in the MAGNETO is Innovation Management, leading requirements and architecture specifications, realization of the authorization and accountability module, participation in trends analysis, operational and situational awareness and system integration.
- **FP7 CAMINO** (Comprehensive Approach to cyber roadMap coordINation and development) - the major goal of the project is to provide a realistic roadmap for improving resilience against cybercrime and cyber terrorism. The project aims also at building a long-term cyber research community (CAMINO think tank) in order to ensure sustainability of the developed roadmap. ITTI (prof. Michał Choraś) coordinates the CAMINO project.
- **DG Home CIPHER** focused on security and trust in privately held information systems at European level. The main objective was to develop a methodological framework which contains recommendations designed to prevent cyber-crime and to react in case a malicious cyber-attack that has been attempted. Global European regulatory and technological roadmap, containing recommendations for policymakers was also developed.
- **FP7 TACTICS** (Tactical Approach to Counter Terrorists in Cities) focused on the integration of new research results in the area of behaviour analysis, characteristics of the possible urban-based targets and situational awareness into a decision-making framework. This framework comprises of a set of tools and related processes, supporting security forces in efficient and effective response to a given security threat.

4.1.17 VENAKA MEDIA GbR

Partner Name: Venaka Media GbR	
Company Website: http://venaka.co.uk	
Type: SME/Industry	

Venaka Media Limited (VMG) is a SME specializing in the provision of software and services for multimedia processing and communications systems. By exploiting modern software and hardware technologies together with open middleware platforms, VMG engineers have successfully delivered several commercial platforms that fulfil projects and customers' requirements. VMG technology is a result of extensive R&D activities performed in cooperation with well-known academic research teams. The product-oriented core competencies of VMG include cloud-oriented video coding, media analytic solutions for security services, multimedia data mining, and end-to-end multimedia communications.

The team members of VMG have collectively more than 30 years of experience in identifying problems and engineering optimal solutions. VMG has vast expertise across several technologies including media analysis, signal processing, feature indexing, big data analytics and loosely coupled distributed system design. The product-oriented core competencies of VMG include expertise in developing application across several platforms including desktop solutions, mobile applications along with complementary technologies that support front-end system design using HTML5, CSS3, jQuery and AngularJS for enhanced visualisation of large-scale information.

The innovation potential of VMG involve the high-level abstraction of system functionalities that delivers simplified solutions to the customers and enables wide-range adoption of research outcomes. System design architects at VMG have several years of experience in the creation and management of distributed network infrastructure across diversified deployments including stand-alone model as well as in a cloud environment such as Amazon EC2. VMG personnel brings extensive research background and track record acquired through participation in UK and EU funded project, as well as, long standing co-operations with renowned industrial players as United Technologies, Motorola, Philips and Siemens. VMG also actively participates in several standardisation activities including the participation in ISO/IEC/JCT 1/SC29/WG 11 (MPEG) group and Open Network Foundation (ONF) for SDN, TM Forum (TMF) Distributed Management Task Force (DMTF)

CVs of involved key researchers / staff members

Prof. Ebroul Izquierdo (male), PhD, MSc, CEng, FIET, SMIEEE, MBMVA, is CEO of VMG. For his thesis on the numerical approximation of algebraic-differential equations, he received the Dr. Rerum Naturalium (PhD) from the [Humboldt University](#), Berlin, Germany. He has been a senior researcher at the [Heinrich-Hertz Institute for Communication Technology \(HHI\)](#), Berlin, Germany, and the Department of Electronic Systems Engineering of the [University of Essex](#). Prof. Izquierdo is a Chartered Engineer, a Fellow member of The Institution of Engineering and Technology (IET), a senior member of the IEEE and a member of the British Machine Vision Association. He was a past chairman of the IET professional network on Information Engineering. He is a member of the Visual Signal Processing and Communications Technical Committee of the IEEE Circuits and Systems Society and member of the Multimedia Signal Processing technical committee of the IEEE. Prof. Izquierdo is or has been associated editor of the IEEE Transactions on Circuits and Systems for Video Technology (from 2002 to 2010), the IEEE Transactions on Multimedia (from 2010 to date). He is member of the editorial board of the EURASIP Journal on Image and Video processing (from 2004 to date), the Journal of Multimedia Tools and Applications (2008 to 2014) and the Journal of Multimedia (2009-2014), the Journal of Computer Engineering International (2008 to date) and the Info-communications Journal (2008 to 1015). He has been guest editor of the Elsevier journal Signal Processing: Image Communication, The EURASIP Journal on Applied Signal Processing and the IEE Proceedings on Vision, Image & Signal Processing. Prof. Izquierdo has been member of the organizing committee of several conferences and workshops in the field of image and video processing including The IEEE International Conference on Image Processing (ICIP), The IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP), The IEEE International Symposium on Circuits and Systems (ISCAS), The IEEE Visual Communications and Image Processing Conference (VCIP) and The IEEE International Conference on Multimedia & Expo (ICME). He has chaired special sessions and workshops in ICIP, ICASSP, ISCAS, VCIP and ICME. He has been the general chair of the European Workshop on Image Analysis for Multimedia Interactive Services, London 2003 and Seoul 2006, the European Workshop for the integration of Knowledge, Semantics and Content, London 2004 and 2005, the Mobile Multimedia Communications Conference MobiMedia, Algero 2006, the International Conference on Content Based Multimedia Indexing, London 2008, the IET Conference on Visual Information Engineering, Xian 2008 and the International Conference on Imaging for Crime Detection and Prevention, London 2015.

Prof. Izquierdo has been involved as principal investigator in many EU funded projects including, Race Panorama, Cost211, Cost292, FP5 SCHEMA, FP5 Sambits, FP6 MESH, FP6 Papyrus, FP6 RUSHES, FP7 PetaMedia, FP7 Sala+, FP7 SARACEN, FP7 NextMedia, FP7 Eternal, FP7 VideoSense, FP7 Advise, FP7 Cubrik, FP7 Ecopix. He has coordinated several other large cooperative projects including FP6 aceMedia, The Cost292 Action, FP5 BUS-MAN, FP6 K-Space, FP7 3DLife, FP7 EMC2 and FP7 Reverie. He has been also involved in several UK funded projects including EPSRC VideoAnnotation, TSB Thira and EPSRC Prometheus, EPSRC VideoCoding.

Dr. Krishna Chandramouli (male), PhD (Lon), PhD (Lon), M. Tech, B. E, MIET, is a technical director at VMG with more than 15 years of research experience in the field of computer vision technologies. He holds dual PhD degrees from University of London in 2009 with specialization in Semantic Video Analytics and in 2019 on the interoperability of metadata models. He is a recognized expert in the use of video processing for semantic analysis of multimedia content. His expertise on Big Data Analytics has been gathered over many years of participation in

several international benchmarking activities that are related to Media standardisation as MPEG. Dr. Chandramouli has executed several key projects in the domain of knowledge representation for geospatial content analysis, media transmission and forensic security for big-data platform. He has also been a key contributor for EU funded projects namely, FP6 NoE K-Space, FP7 IP MESH, FP7 STReP PAPYRUS, FP7 STReP RUSHES, FP7 NoE PetaMedia and FP7 NoE 3DLife, FP7 Advise, FP7 LASIE, H2020 SafeShore, H2020 COGNITUS, H2020 MAGNETO, H2020 DEFENDER, H2020 PERSONA. Recently he has been nominated to represent UK COST management committee of Leading Platform for European Citizens, Industries, Academia and Policymakers in Media Accessibility (LEAD-ME) project (CA19142). His on-going contribution to the field of Media Accessibility will facilitate establishing cross-cutting priorities in AI and Interactive Technologies within Europe and beyond. Dr. Chandramouli has undertaken scientific consultancy for several UK SME organisations (Vision Semantics Limited, Venaka Media Limited, Ecode Networks, Instronix Limited and CBRNE UK) in the field of software design, development, implementation and project execution. His technical expertise in the field of software architecture design and product development is completed with programming skills in Python, Java, C/C++ and Go. He is also an expert in deploying distributed big-data framework for data storage and indexing using NoSQL. He is also an expert in system integration functionalities including microservice development using containers such as Dockers and test-driven development. The backend expertise is completed by the front-end programming models using JavaScript framework including AngularJS, ReactJS. The full-stack expertise of Dr. Chandramouli includes data management protocol services using publish/subscribe models and data compression standards including ProtoBuf for high-speed communication between the front-end and back-end systems. Dr. Chandramouli is also a member of MPEG ad-hoc group for Media Orchestration (MORE) and is an active contributor to MPEG-21 smart contract standards development. He is also a recognised subject expert at British Standards International (BSI) for Systems and contributes towards standards development. He has published more than 50 papers in highly reputed peer-reviewed conferences, journals, books with IEEE, ACM and Springer. He is a member of IET, IEEE, IEEE Computer Society, ACM and ONF. He has also organised special sessions in CBMI 2017, ICMR 2018 and is a guest editor of Large-scale multimedia signal processing for security and digital forensics special issue with Multimedia Tools and Application (MTAP) journal published by Springer. His current research interests include machine learning, big data video analytics, media engineering, time series analysis, information science and knowledge modelling for surveillance applications.

Dr Tomas Piatrik (male), PhD, MSc, is a senior researcher at VMG with expertise in image and video processing. He has actively participated in several EU funded research projects including K-Space, MESH, PetaMedia, 3DLife, Cubrik and support actions SALA+, NextMedia, Eternals and Conecta2020. His work in these projects focused mostly on multimedia analysis and retrieval, machine learning, biologically inspired computing, image processing, and video analytics. Furthermore, Tomas has been an organiser of the annual grand challenges on Video Surveillance under the MediaEval benchmarking initiative since 2012. His recent research activities have been focused on image and video processing for surveillance applications as part of the work for EU funded projects VideoSense, Advise, LASIE, SafeShore, PERSONA and MAGNETO. Furthermore, he has been cooperating with Karolinska Institute in Stockholm on image processing for detection of cancer metastases. Tomas has published over 40 technical papers and reports in various international conferences and book chapters. He has been also acting as an executive board member of the Vision & Imaging Technical and Professional Network as part of the Institution of Engineering and Technology (IET).

Role in the project

- **WP1:** VMG will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** VMG will contribute to the participatory process through stakeholder engagement. Additionally, VMG will also develop 3D visualization models and toolkit for capturing the forest landscape of the pilot demonstration sites. The 3D visualization will be integrated within the command and control centre of SILVANUS platform.
- **WP4:** VMG will contribute to the low-cost computational deep-learning models for edge analytics.
- **WP5:** VMG will contribute to the data driven decision support system.
- **WP8:** VMG will participate in the platform integration
- **WP9:** VMG will oversee the Phase A and B pilot demonstration. In addition, will also coordinate and lead the international pilots from Brazil, Australia and Indonesia.

- **WP10:** VMG will exploit the project outcomes through engagement with stakeholders as outlined in Section 2.2.

Relevant publications, and/or products, services or other achievements

- X. Zhang, K. Chandramouli, D. Gabrijelcic, T. Zahariadis and G. Giunta, "Physical Security Detectors for Critical Infrastructures Against New-Age Threat of Drones and Human Intrusion," 2020 IEEE International Conference on Multimedia & Expo Workshops (ICMEW), London, United Kingdom, 2020, pp. 1-4, doi: 10.1109/ICMEW46912.2020.9106043.
- X. Zhang and K. Chandramouli, "Critical Infrastructure Security Against Drone Attacks Using Visual Analytics," in Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 2019.
- E. J. Behmer et al., "Ontology Population Framework of MAGNETO for Instantiating Heterogeneous Forensic Data Modalities," in IFIP Advances in Information and Communication Technology, 2019.
- X. Zhang, E. Izquierdo, and K. Chandramouli, "Dense and small object detection in UAV vision based on cascade network," in Proceedings - 2019 International Conference on Computer Vision Workshop, ICCVW 2019, 2019.
- K. Wickrama Arachchilage, S.P., Izquierdo, E. Deep-learned faces: a survey. *J Image Video Proc.* 2020, 25 (2020). <https://doi.org/10.1186/s13640-020-00510-w>
- S. W. Arachchilage and E. Izquierdo, "A Framework for Real-Time Face-Recognition," 2019 IEEE Visual Communications and Image Processing (VCIP), Sydney, Australia, 2019, pp. 1-4, doi: 10.1109/VCIP47243.2019.8965805.
- F. Toutounchi and E. Izquierdo, "Enhancing Digital Zoom in Mobile Phone Cameras by Low Complexity Super-Resolution," 2018 IEEE International Conference on Multimedia & Expo Workshops (ICMEW), San Diego, CA, 2018, pp. 01-06. doi: 10.1109/ICMEW.2018.8551540
- Deventer MOV, Dufourd J, Oh S, Lim SY, Lim Y, Chandramouli K, Koenen R (2018). Media Orchestration Between Streams and Devices via New MPEG Timed Metadata. *SMPTE Motion Imaging Journal* Vol. 127, Article 10, 32-38.

List of relevant previous projects or activities, connected to the subject of this proposal

H2020 FCT MAGNETO: Multimedia Analysis and Correlation Engine for Organised Crime Prevention and Investigation (MAGNETO, <http://www.magneto-h2020.eu>), MAGNETO addresses significant needs of law enforcement agencies (LEAs) in their fight against terrorism and organised crime, related to the massive volumes, heterogeneity and fragmentation of the data that officers have to analyse for the prevention, investigation and prosecution of criminal offences. These needs have been identified after consulting with eleven different European LEAs –members of the MAGNETO consortium. In response, MAGNETO empowers LEAs with superior crime analysis, prevention and investigation capabilities, by researching and providing tailored solutions and tools based on sophisticated knowledge representation, advanced semantic reasoning and augmented intelligence, well integrated in a common, modular platform with open interfaces. By using the MAGNETO platform, LEAs will have unparalleled abilities to fuse and analyse multiple massive heterogeneous data sources, uncover hidden relationships among data items, compute trends for the evolution of security incidents, ultimately (and at a faster pace) reaching solid evidence that can be used in Court, gaining also better awareness and understanding of current or past security-related situations. In parallel, MAGNETO will spark an ecosystem of third-party solution providers benefiting from its open, modular and reusable architectural framework and standard interfaces.

H2020 CIP DEFENDER, Defending the European Energy Infrastructures (<http://defender-project.eu>): Critical Energy infrastructures (CEI) protection and security are becoming of utmost importance in our defending the European Energy Infrastructures. DEFENDER will adapt, integrate, upscale, deploy and validate a number of different technologies and operational blueprints with a view to develop a new approach to safeguard existing and future European CEI operation over cyber-physical-social threats, based on a) novel protective concepts for lifecycle assessment, resilience and self-healing offering “security by design” and b) advanced intruder inspection and incident mitigation systems.

EU FP7 SEC LASIE: Large Scale Information Exploitation of Forensic Data, (<http://www.lasie-project.eu/>) Description: The LASIE project aims to design and develop a novel framework to assist forensic analysts in their in-

vestigations. The envisaged framework will be based on automated technology for advanced data processing supported by an important human component in critical decision-making stages, as well as, legal and ethical aspects. The framework will consist of tools to automatically manipulate, analyse and fuse vast amounts of heterogeneous data acquired from different sources including CCTV surveillance content, confiscated desktops and hard disks, mobile devices, Internet, social networks, handwritten and calligraphic documents. The type of data considered includes text, images, video, audio and biometric information in multiple formats. In order to manage the results of the automated processing, a knowledge repository will be built. It will consider explicit analyst-knowledge and critical legacy information from previous cases. Main responsibilities: In LASIE, VMG plays a key role in the media processing part, especially related to CCTV surveillance cameras and analysis of various events. Moreover, VMG plays a significant role in LASIE framework development and integration, performing research in knowledge representation and automatic system recommendations from available data.

EU FP7 SEC ADVISE: ADVISE is a research project co-funded by the FP7-Security Workprogramme of the European Commission, aimed at designing and developing a unification framework for surveillance-footage archive systems. The ADVISE project results will ease the work of law enforcement authorities in their fight against crime and terrorism, through negotiation of all relevant legal, ethical and privacy constraints, and through location based video archive selection and efficient evidence mining of multiple, heterogeneous video archives. In a context where surveillance systems are continuously growing in scale, heterogeneity and capabilities, two major obstacles have to be overcome. On the one hand, the variety of technical components of surveillance systems, producing video repositories with different compression formats, indexing systems, data storage formats sources, has to be addressed.

UK Funded “Towards Big Data Management and Visualisation” (THIRA)

Industry funded “Surveillance centric coding”

Individual exploitation plan

Through the integration of project results with VMG's ongoing R&D activities in collaboration with high-tech industrial partners, VMG will strengthen its strategic value in the highly competitive marketplace. The expertise gained in DECAGON will enable the VMG to enrich the portfolio of its offerings with products and services tailored to the needs of healthcare stakeholders and big-data operators. It will also exploit the existence of large integrators in SATORI consortium to develop data analytics and visualisation modules that can be integrated in the solutions the latter provide to their customers.

Description of significant infrastructure and major items of technical equipment relevant to the project

Media data storage:

- 160TB CyberStore 316S 12GB/s Storage Server

Computing:

- A dedicated workstation Overclocked Intel Core i7-7700k Quad Core (4.8GHz) with GPU 11GB Nvidia GeForce GTX 1080 Ti -
- A TITAN Gladius Overclocked SLI Pro PC Intel Core I5 7600K with Nvidia GPU Asus GeForce GTX 1070

Two Alienware Overclocked AMD Ryzen Threadripper 1950X (16-Core) with GPU Nvidia GeForce GTX 1080 Ti

4.1.18 Massive Dynamics

Partner Name: Massive Dynamics Sweden	 MASSIVE DYNAMIC SWEDEN
Company Website: https://www.massivedynamic.se/	
Type: SME/Industry	

Massive Dynamic is a Swedish SME operating in Sweden since 2016. The company innovates in the immersive technologies and big data analytics fields, offers a competitive immersive development solutions portfolio and combines its offerings with a complete range of professional services in:

- Cloud solutions
- Virtual scenarios training for educational purposes
- Big data manipulation and analysis
- Mobile infrastructure solution through Kurogo Platform
- Operational research models
- Course development and digitalization

Moreover, within information technology and telecommunications industries, MDS offers a multitude of services including contract work in complex projects regarding commercial licensing, technology investments, outsourcing and migration projects. In addition, MDS specializes in advising on compliance with applicable data protection and privacy law, including GDPR readiness, and focusses strongly on IT & cyber security compliance, but also advises on licensing and copyright compliance. MDS has also expertise in exploitation and commercialization process, including impact creation based on the development of relations to potential investors.

MDS have deployed a quick and inexpensive centralized virtual training workplace solution, aiming to avoid the time and resources associated with a large educational development project.

Moreover, MDS, due to its geographical proximity to its scandic customers, in addition to software development, has specialised in offering ‘near-site’ services, including project management of large and complex IT systems and services, as well as requirements gathering and validation, customer relationship management services, application operational support, and communication services. Moreover, MDS offers services in the area of research and innovation policy support, including evaluation, and impact assessment studies which are supported by an established network of external consultants with significant expertise in the area of research and innovation policy formulation and strategy.

CVs of involved key researchers / staff members

Sokratis Nifakos (male) Research and Innovation Manager. Sokratis has a background in computer science with specialization in networks and telecommunications. He received his M.Sc in Medical Informatics from Karolinska Institutet in 2014. Currently, he is a Ph.D. candidate and system developer in Health Informatics Center at Karolinska Institutet and affiliated researcher at Berkman Klein Centre/Assembly a collaborative research centre between Harvard and MIT. He has a strong track record in consultation, system development (e-health systems, mobile applications) as well as in management of H2020 and ERASMUS PLUS projects. His particular areas of technical expertise are in the architecture and software engineering in concept and design for mobile web, iOS, and Android applications. He is finally certified as computer networks professional, Cisco Certified Network Professional (CCNP).

Natalia Stathakarou (female) EU Projects Manager. Natalia has a technical background and holds a B.Sc.degree from National and Kapodistrian University of Athens, department of Informatics and Telecommunications and MSc in medical informatics from Karolinska Institutet. She is acting as project and financial manager for MDS as well as the project manager of several Erasmus+ and H2020 (co)-funded projects related to eLearning.

Role in the project

- **WP1:** MDS will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** MDS will contribute to the participatory process, with focus on EU citizen engagement.
- **WP3:** MDS in collaboration with HB will lead the activity on citizen engagement mobile application.
- **WP8:** MDS will integrate the mobile application within the project platform
- **WP9:** MDS will oversee and provide support for Phase A pilot demonstration on preventive measures promoted to wider public.
- **WP10:** MDS will participate in the dissemination and exploitation activities of the project.

Relevant publications, and/or products, services or other achievements

- Kononowicz AA, Woodham LA, Edelbring S, **Stathakarou N**, Davies D, Saxena N, Tudor Car L, Carlstedt-Duke J, Car J, Zary N. *Virtual Patient Simulations in Health Professions Education: Systematic Review and Meta-Analysis by the Digital Health Education Collaboration*. J Med Internet Res 2019; 21(7):e14676
- **Stathakarou N**, Kononowicz AA, Henningsohn L, McGrath C. Modelling Feedback in Virtual Patients: An Iterative Approach. Studies in health technology and informatics. 2018;247:201-5.
- **Stathakarou N**, Scully ML, Kononowicz AA, Henningsohn L, Zary N, McGrath C. MOOC Learners' Engagement with Two Variants of Virtual Patients: A Randomised Trial. Educ. Sci. 2018; 8, 44.
- Berman AH, Biguet G, **Stathakarou N**, Westin-Hägglöf B, Jeding K, McGrath C, Zary N, Kononowicz AA. Virtual Patients in a Behavioral Medicine Massive Open Online Course (MOOC): A Qualitative and Quantitative Analysis of Participants' Perceptions. Acad Psychiatry. 2017 Apr 7.

- Henningsohn L, Dastaviz N, **Stathakarou N**, & McGrath C. (2017). KIUrologyX: Urology As You Like It—A Massive Open Online Course for Medical Students, Professionals, Patients, and Laypeople Alike. European Urology, 72(3), 321-322.
- Vaitsis C, **Stathakarou N**, Barman L, Zary N, & McGrath C. (2016). Using Competency-Based Digital Open Learning Activities to Facilitate and Promote Health Professions Education (OLAmEd): A Proposal. JMIR research protocols, 5(3).
- Kononowicz AA, Woodham L, Georg C, Edelbring S, **Stathakarou N**, Davies D, Masiello I, Saxena N, Tudor-Car L, Car J, Zary N: Virtual patients simulations for health professional education (Protocol). Cochrane Database of Systematic Reviews 2016; 5:CD012194.
- Kononowicz AA, Berman AH, **Stathakarou N**, McGrath C, Bartynski T, Nowakowski P, Malawski M, Zary N: Virtual Patients in a Behavioral Medicine MOOC: A Case-Based Analysis of Technical Capacity and User Navigation Pathways. JMIR Medical Education 2015; 1(2):e8

List of products/services to be brought into the project as background knowledge. Include references to external resources on the marketing material available (if any)

LifeChamps (H2020): LifeChamps is providing support to middle aged and older (pre-frail and frail) cancer patients, as well as their caregivers and healthcare professionals, with an integrated Big Data-driven solution capable to improve their QOL via a timely and more accurate clinical decision support at the point of care. Its Artificial Intelligence (AI) and analytics engine, running both at the cloud and at the mobile edge, can determine accurately which factors affect the oncological patients' QOL the most, during and after their treatment. Furthermore, complemented by a health recommender system LifeChamps offers personalized healthcare services (i.e., symptom monitoring, treatment and rehabilitation) to these patients and their caregivers. The LifeChamps platform will be validated in four multi-national pilot use case scenarios aimed at demonstrating its applicability and validity for all the requirements of the SC1-DTH01-2019 Call (prediction, care, advice).



Respond-A (H2020): RESPOND-A project aims at developing holistic and easy-to-use solutions for First Responders by bringing together the complementary strengths of its Investigators in 5G wireless communications, Augmented and Virtual Reality, autonomous robot and unmanned aerial vehicle coordination, intelligent wearable sensors and smart monitoring, geovisual analytics and immersive geospatial data analysis, passive and active localisation and tracking, and interactive multi-view 360o video streaming. The synergy of such cutting-edge technological advancements is likely to provide high-end and continuous flows of data, voice and video information to First Responders and their Command & Control Centres for predicting and assessing the various incidents readily and reliably, and saving lives more efficiently and effectively, while maximising the safeguarding of themselves, before, during and after disasters. To this end, RESPOND-A envisions at exercising First Responders for getting familiar with the project technological outcomes, and demonstrating their real-world performance and effectiveness in the classified training facilities of our Responder Partners under hydrometeorological, geophysical and technological disaster scenarios.

AFFINITY is a scenario-based training platform which is based on Interactive virtual scenarios (VS) or simulations (Scenario-Based Learning; SBL) that are recognised by many teaching and learning communities as effective tools for developing reasoning, and for safe training in workplace competency. The platform is used as an online activity modelling system that allows users to build interactive ‘game-informed’ educational activities such as virtual patients, simulations, games, mazes and algorithms. Depending on what decisions you make or paths you navigate through the case, the consequences will be different. The platform is a web application that runs on most modern web browsers. In order to create and edit cases, the user will need to get access to a server running AFFINITY. This runs on Apache and MySQL. The platform’s openness and flexibility is very useful for creating a variety of different activity designs, going way beyond isolated virtual scenario cases.

Some examples are:

- Group work cases · Hybrid simulations with Standardized Patients · Bookending high fidelity simulations · Video Mashups · Resource trade-off scenarios · Multi-case triage · Mini-cases as mobile exemplars · Script Concordance Testing · Bidirectional integration with podcasts and webinars

4.1.19 Fondazione CMCC – Centro Euro-Mediterraneo sui Cambiamenti Climatici

Partner Name: Fondazione CMCC – Centro Euro-Mediterraneo sui Cambiamenti Climatici	
Company website: www.cmcc.it	
Type: Non profit Research Organisation, Foundation	

Partner profile

The Fondazione Centro Euro-Mediterraneo sui Cambiamenti Climatici (Fondazione CMCC) is a non-profit research institution. CMCC’s mission is to investigate and model our climate system and its interactions with society to provide reliable, rigorous, and timely scientific results, which will in turn stimulate sustainable growth, protect the environment, and develop science driven adaptation and mitigation policies in a changing climate. CMCC collaborates with experienced scientists, economists, and technicians, which work together in order to provide full analyses of climate impacts on various systems such as agriculture, ecosystems, coasts, water resources, health, and economics. CMCC also supports policymakers in setting and assessing costs, mitigation, and adaptation policies. CMCC benefits from the extensive applied research experience of its members and institutional partners: Istituto Nazionale di Geofisica e Vulcanologia (INGV); Università del Salento; Centro Italiano di Ricerche Aerospaziali (CIRA S.c.p.a.); Università Ca’ Foscari Venezia; Università di Sassari; Università della Tuscia; Università di Bologna; Politecnico di Milano; Resources for the Future.

CMCC research activities are distributed among nine research divisions that share different knowledge and skills in the field of climate science: Advanced Scientific Computing (ASC) Division; Climate Simulation and Prediction (CSP) Division; Economic analysis of Climate Impacts and Policy (ECIP) Division; Impacts on Agriculture, Forests and Ecosystem Services (IAFES) Division; Ocean modeling and Data Assimilation (ODA) Division; Ocean Predictions and Applications (OPA) Division; Risk Assessment and Adaptation Strategies (RAAS) Division; Regional Models and geo-Hydrological Impacts (REHMI) Division; Sustainable Earth Modeling and Economics (SEME) Division; Information Systems for Climate science and Decision-Making (ISCD); Innovative Platforms for Science Outreach (IPSO).

CMCC acquired portfolio of research projects includes more than 428 primary internationally composed and funded projects: 37 funded projects in FP6 and FP7 (6th and 7th Framework Program of the EU), 81 funded projects in H2020 (Horizon 2020 Programme of the EU) and 310 funded projects under other EU and international research grants. The 2020 annual turnover is equal to 16,4 mil. Euro and 123 permanent staff have been working at CMCC.

CVs of involved key researchers / staff members

MARCO MANCINI (Ph.D. in Computer Science and System Engineering, University of Calabria). He is a Senior Scientist at CMCC leading the activities of the “Production Platforms for Operational Services” (PPOS) research unit with focus on the development of innovative ICT digital platforms to support operational environments and ecosystems in different sectors (agriculture, climate, disaster risk reduction, water management, etc.), also leading

the design, development and deployment of CMCC Data Delivery System (<https://dds.cmcc.it>). His expertise concerns Cloud computing, container orchestration, Internet of Things, advanced data acquisition/management and analytics, high performance computing and he has been involved at CMCC into national and international projects: Highlander, AGREED, TESSA, EUBrazilCC, OFIDIA Interreg, Copernicus Services (SIS on DRR, Demo Case on Soil Erosion Med-MFC), GWP-Med NCWR – Non-Conventional Water Resources Programme. He is the author of several scientific papers in the field of scientific and high-performance computing, Cloud computing, data management and analytics. As for his current engagement in professional services, he is Cloud Technical Evangelist at OpenNebula Systems SL.

- Role in the organisation: Head of “Production Platforms for Operational Services” Research Unit
- Expected contribution to project: Contribution to Project Management, WP4 management, design, development and implementation of data management tools and data analytics algorithms/tools for fire danger prevention

PASQUALE SCHIANO (Master Degree in Mathematics). He is currently CEO and General Manager of CMCC Srl. He is Senior Member of the Strategic Council of Fondazione CMCC. Until the end of 2019 he was the head of ICT Department at CIRA (the Italian Aerospace Research Center.) His research activities are related to the HPC applications in the field of Climate and Weather Prediction models as well as in the Computational Fluid Dynamics sector. He has large experience of participation and coordination of European projects and he leaded, on behalf of the Italian Ministry for Research, the first Italian Position Paper on the European GMES (Global Monitoring for Environment and Security) Program. He has been invited as Invited Speaker at various international conferences on parallel computing, and ICT. He has been invited several times by the UE for the assessment and review of proposals and research projects of the EC R&D workprogramme for High Performance Computing, Networking ICT, Electronics. He is member from 2003 of the European consortium COSMO (Consortium for Small-scale Modelling), aimed to the development of the operational limited area model COSMO LM. He is also a member of the advisory Board of the contract service C3S_430 coordinated by CMCC Foundation supporting the activity with his skill on ICT.

- Role in the organisation: He is Senior Member of the Strategic Council of Fondazione CMCC
- Expected contribution to the project: Contribution to Project Management, Management of WP4

PAOLA MERCOLIANO (Master degree in Physics). She is Senior researcher with more than 16 years of research experience.

She works at CMCC Foundation as head of the Research Division REMHI (Regional Model and geo-Hydrological Impacts). Her main areas of competence include development and use of statistical tools and dynamical model for localization of the weather condition up to local scale, qualitative and quantitative analysis of the soil impact induced by climate change, development of GIS tools for post processing and visualization of observed and simulated atmospherical data.

She is member from 2003 of the European consortium COSMO (Consortium for Small-scale Modelling), aimed to the development of the operational limited area model COSMO LM and from 2008 of the CLM Assembly for the development of the regional climate model COSMO-CLM. She was among the authors of the National Strategy on Adaptation to Climate Change and also Involved in PNACC (National Plan for Adaptation to Climate Change) as CMCC leader for the activities concerning the analysis of the current and future climate conditions and for the chapter on geo-hydrological risk and she also supported the drafting for the chapters related to the risks in urban settings, fires and energy. She is the principal investigator of the Copernicus contract “Sectoral Information System to support Disaster Risk Reduction” (C3S_430) aims at developing a service supporting the risk assessment of extreme events with a special focus on urban areas. Authors of more than 50 scientific publications, she collaborates in various national and international research projects. She has also held the role of operational weather forecaster covering the whole process of forecast production, including development of tailored tool (based on satellite data and NWP models) for optimisation of weather forecast over different areas for different sectors.

- Role in the organisation: Head of the REMHI research division at CMCC Foundation
- Expected contribution to the project: development, implementation and evaluation of the tools on nowcasting and short time range.

FRANCESCO REPOLA (Master degree in Electronic engineering for Automation and Telecommunications). He got a Master degree in Electronic engineering for Automation and Telecommunications at University of Sannio in 2020 with thesis on implementation of a forecast method for synoptic winds using data mining techniques and satellite data. Currently he is researcher at CMCC working on configuration and verifications of NWP models working on short time range. He got knowledge of statistics, weather data analysis and visualization and machine learning techniques. Moreover he has experience on use and analysis of EUMETSAT data and products.

- Role in the organisation: Junior research associate at Fondazione CMCC
- Expected contribution to the project: implementation, software engineer and data analyst for the tools developed on nowcasting and short time range

GIULIANA BARBATO (Master degree in Electronic Engineering for Automation and Telecommunication) Since 2016 she has been working for Fondazione CMCC-REMHI division. Product engineer of the DATACLIME platform (www.dataclime.com). Expert on developing post-processing tools for the analysis of climate data of different types (simulated, in situ and satellite). Good knowledge of satellite data analysis, useful for supporting hazard monitoring and assessment, through the use of software to manage data provided by different platforms and sensors. Her activity is also focused on the co-design and then on implementation of climate indicators tailored to user needs. Involved in the drafting of the climate analysis performed for the PNACC (National Adaptation Plan on Climate Change). Involved in many national and international projects and consultancy providing climate analysis also for impact assessment from the local up to the continental scale

- Role in the organisation: Junior research associate at Fondazione CMCC
- Expected contribution to the project: implementation, software engineer and data analyst for the tools developed on nowcasting and short time range

SILVIO GUALDI (PhD in Geophysics (University of Hamburg). He is Senior Scientist at the Euro-Mediterranean Centre on Climate Change (CMCC), where he heads the “Climate Simulations and Predictions” division. For over twenty-five years he has been dealing with numerical climate modelling, climate simulations and forecasts. During this period, he participated in numerous international research programs and projects. He has been coordinator of an ERA4CS project on climate prediction based services in the Mediterranean basin, and of two Copernicus tenders, leading the CMCC contribution to the C3S multi-model seasonal forecasting system. It also coordinated the CMCC contribution to the simulations of the CMIP3, CMIP5 and CMIP6 programs, for the production of climate change scenarios. He is the author of over 90 scientific publications in international journals (H-index = 31), member of the Editorial Board of the Oxford Research Encyclopedia of Climate Science and current president of the Italian Society for Climate Sciences (SISC).

- Role in the organisation: Head of “Climate Simulations and Prediction” Division.
- Expected contribution to the project: probabilistic forecasts of fire danger indexes at seasonal time scales

RICCARDO HENIN (Master degree in Physics of the Earth System). He got a Master degree in Physics of the Earth System at the University of Bologna in 2015 with a thesis on the computation of atmospheric water balances and air-sea fluxes over the Adriatic Sea during Bora wind events. He is a PhD candidate at Instituto Dom Luiz, Faculty of Sciences of the University of Lisbon, close to discuss the thesis on precipitation and wind extremes associated with extra-tropical cyclones in Western Europe. Currently, he is a researcher at CMCC, involved in a consultancy project with Generali Italia (Insurance). His expertise includes numerical modelling (BOLAM-MOLOCH models by ISAC-CNR and WRF model), weather extremes, compound events, extreme data analysis, statistics, and he is currently developing new skills in machine learning techniques. His publications look at precipitation and precipitation extremes (assessment of several precipitation data, association of precipitation to atmospheric fronts, ranking of precipitation events).

- Role in the organisation: Collaborator/Researcher at Fondazione CMCC

- Expected contribution to the project: weather data analysis and application of ML techniques for the predictive algorithms and tools developed for fire danger prevention.

CARLO TROTTA (PhD in Forest Ecology). He holds a master's degree in Forestry Sciences and a PhD in Forest Ecology at University of Tuscia. Since years, he has been deeply involved in the application of physically based forest ecosystem modelling under climate change and alternative management, including model Bayesian calibration and validation. Thank to these activities he gained skills in programming languages as R, python, matlab and also in conducting analyses based on statistical to more complex algorithms to be applied to process (e.g., filling gap) time series of data to be used for model evaluation.

- Role in the Organisation: Researcher at Fondazione CMCC
- Expected Contribution to the Project: forest models' ensemble application.

MIRKO STOJILJKOVIC (male) graduated in 2005 with honors and in 2015 he obtained the Ph.D. degree in Mechanical Engineering at the University of Nis. Since 2005, he has been working at the University of Nis, Faculty of Mechanical Engineering. At CMCC, he is Scientific Software Developer with the main activities related to the development of Python workflows for the analysis of CDS climate data, Python APIs for accessing and analyzing CMCC products, and web services. He has been involved in Copernicus Services (SIS on DRR, Demo Case on Soil Erosion) and he contributed to the development of the CMCC Data Delivery System (<https://dds.cmcc.it>).

He is an expert in scientific computing, mathematical modeling, optimization, and data science. He is versatile in several programming languages including Python and its scientific, numerical, and data-science libraries like NumPy, SciPy, Pandas, Xarray, Scikit-learn, StatsModels, CVXOPT, GLPK, PuLP, etc. Most of his late research is dedicated to the application of data mining, data science, and machine learning methods to support hybrid optimization and decision-making in the energy sector. He is the author of over 50 scientific papers, reviewer for several leading scientific journals, and contributor to RealPython.

- Role in the Organisation: Researcher at Fondazione CMCC
- Expected Contribution to the Project: development and implementation of data analytics algorithms/tools for fire danger prevention

JAKUB WALCZAK (male) is a PhD candidate in Computer Science at the Lodz University of Technology (LUT). He specializes in various aspects of point cloud processing and analysis. His interests involve general data science as well. He graduated from LUT in 2017 with a Bachelor thesis entitled: "Application of computer vision for gender recognition based on facial image" and a Master thesis entitled: "Computer vision estimation of geometrical objects position and orientation by means of their 3D fiducial points". During his course of studies, he spent one semester at the Universitat Politècnica de Catalunya working on the project for the Hospital San Juan de Deu. At CMCC, he is Scientific Software Developer with the main activities related to the development of Python workflows for the analysis of CDS climate data, Python APIs for accessing and analyzing CMCC products, and web services. He has been involved in Copernicus Services (SIS on DRR, Demo Case on Soil Erosion) and he contributed to the development of the CMCC Data Delivery System (<https://dds.cmcc.it>). He is the author of a few academic papers in the field of point cloud processing.

- Role in the Organisation: Researcher at Fondazione CMCC
- Expected Contribution to the Project: development and implementation of data management tools and data analytics algorithms for fire danger prevention

LAURA CONTE (female) Ph.D., is a Senior Scientific Manager at the Advanced Scientific Computing (ASC) Division of the Euro-Mediterranean Center on Climate Change (CMCC Foundation). She graduated cum laude in "Biological Sciences" in 2003 and received a Ph.D. degree in "Biology and Biotechnologies" in 2007 at the University of Salento; she currently works as Division Manager at the ASC Division, supporting the Director in the coordination of the scientific staff. In addition, she is involved as project manager in the scientific and administrative management of several national and international projects.

- Role in the Organisation: Division Manager at Fondazione CMCC
- Expected Contribution to the Project: Contribution to Project Management

Expertise relevant to the project

Climate Driven Forest Model: CMCC will conduct multi-model experiments under ensemble of climate forcing and forest ecosystem models, also including management options, so to derive information on those conditions that, combined with probability of fire occurrence, will allow estimating not only likely impact of climate on forests through fires, but also effects of forest fires on climate due to GHG emissions from burned vegetation.

Weather Data: In the SILVANUS Project CMCC will provide high quality and reliable different atmospherical data and products to support analysis for fire prediction in the nowcasting (0-3 hours) and short term (up to 72 hours). Data will be provided using EUMETSAT products but also adopting data coming different type of NWP models, characterized by different forecast range and horizontal resolution, depending from the features of the test pilot.

Additionally, probabilistic forecasts of fire danger indexes at seasonal time scales, using ensemble seasonal forecasts produced by the C3S operational multimodel prediction system will be provided. The use of consolidated techniques will be strengthened and complemented by the design and development of novel, additional sub-sampling techniques, based upon physics-informed ML/AI methods. The possibility of using observed data to verify the very early part of the seasonal forecast (first 10 to 15 days) will be used to diagnose the initial forecast trajectory of each ensemble member and, again by using ML techniques trained on the C3S reforecast database, algorithms will be produced to eliminate from the ensemble those trajectories which are heading toward "wrong" sectors of the real world climate attractor.

Data analytics platform for fire danger prevention: Fondazione CMCC will contribute to the development, integration and deployment of a data analytics platform for fire danger prevention providing:

- predictive algorithms based on fire danger indexes that use weather and seasonal forecast data
- tools to seamlessly access weather/climate data, fire danger indexes allowing time-series extraction, sub-region subsetting, resampling/rolling and regridding,
- tools for real-time monitoring and visualization

The platform will provide also a Rest API to access and analyse data that can be easily integrated in other components/modules developed in the project

Role in the project

- WP1: CMCC will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- WP2: CMCC will lead the activity on climate sensitive forest models
- WP4: CMCC will coordinate the work package activities and will lead the development of predictive climate conditions and process weather data obtained from EO repository
- WP5: CMCC will contribute to the big-data framework, semantic information fusion and realtime response coordination.
- WP8: CMCC will actively participate in the integration activities of the project resulting from WP2, WP4 and WP5.
- WP9: CMCC will collaborate with Italian pilots organized by ASSET and PNRT in demonstrating Phase A, B and C scenarios.
- WP10: CMCC will actively exploit the project outcomes in strengthening their internal knowledge competencies.

Relevant publications, and/or products, services or other achievements

- **List of papers related to the technology recently published**
 - M. Mirto, A. Mariello, A. Nuzzo, M. MANCINI, A. Raolil, O. Marra, S. Fiore, C. Sirca, M. Salis, V. Bacciu,[^], D. Spano, G. Aloisio, (2015) "The OFIDIA Fire Danger Rating System" Proceedings of 10th International Conference on P2P, PARALLEL, GRID, CLOUD and INTERNET COMPUTING, November 4-6, 2015, Krakow, Poland

- M. Mirto, M. MANCINI, A. Mariello, A. Raolil, O. Marra, C. Sirca, M. Salis, D. Spano, A. Baratzokas, S. Anastasiadis, S. Fiore, G. Aloisio (2015). "The OFIDIA Project: an operational fire danger prevention platform". Second International Conference on Fire Behaviour and Risk, Alghero, Sardinia, May 26-29, 2015.
- Manzi M.P., Zollo A.L., MERCOGLIANO P. and Galdi C. (2015) "Aviation weather awareness: development of algorithms for the detection of weather hazard through the use of EUMETSAT products" - Proceedings of 2nd IEEE International Workshop on Metrology for Aerospace, Benevento, Italy, June 3-5 2015, pp 466-471, IEEE Catalogue Number: CFP1532W-ART , ISBN: 978-1-4799-7569-3 DOI: 10.1109/MetroAeroSpace.2015.7180702
- Zollo A.L., Manzi M.P., MERCOGLIANO P. and Galdi C. (2015) "Precipitation nowcasting using the satellite product Multi-Sensor Precipitation Estimate"- Proceedings of 2nd IEEE International Workshop on Metrology for Aerospace, Benevento, Italy, June 3-5 2015, pp 460-465, IEEE Catalogue Number: CFP1532W-ART , ISBN: 978-1-4799-7569-3 DOI: 10.1109/MetroAeroSpace.2015.7180701
- Collalti, A., TROTTA, C., Keenan, T. F., Ibrom, A., Bond-Lamberty, B., Grote, R., et al. (2018). "Thinning can reduce losses in carbon use efficiency and carbon stocks in managed forests under warmer climate". Journal of Advances in Modeling Earth Systems, 10.<https://doi.org/10.1002/2018MS001275>

- **List of products/services to be brought into the project as background knowledge. Include references to external resources on the marketing material available (if any)**

- CMCC Data Delivery System (DDS) (<https://dds.cmcc.it>) provides a unique access point for data produced and used by CMCC. The DDS consists of two main components: 1) a web portal that allows users to browse the Catalog and to build dataset queries 2) a Python client that provides a simple API to programmatically query, access and analyse data (<https://pypi.org/project/ddsapi>, <https://anaconda.org/Fondazione-CMCC/ddsapi>).
- DATACLIME value-driven climate service developed in a GIS environment, with the main goal to manage climate data, link climate and impact studies and assist a wide users' range.
www.dataclime.com

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
OFIDIA Interreg Italy-Greece - http://www.ofidia.eu/	OFIDIA main objective is to build a cross-border operational fire danger prevention infrastructure that advances the ability of regional stakeholders across Apulia and Ioannina Regions to detect and fight forest wildfires through more effective patrolling, environmental monitoring, weather modelling, fire danger forecasting and automated access to related historical data.	<ul style="list-style-type: none"> - fire danger prevention, analysis, and modelling - data analytics platform for fire danger prevention - integration of short-medium weather forecast - fire risk maps visualization and real-time monitoring
CRESCENDO – Coordinated Research in Earth Systems and Climate: Experiments, kNowledge, Dissemination and Outreach https://www.crescendoproject.eu/	CRESCENDO project brings together 7 European Earth System Modelling (ESM) teams and 3 European Integrated Assessment Modelling groups to improve the process realism and future climate projection reliability of ESMs, to investigate the changes in the fully coupled system	<ul style="list-style-type: none"> - forest model validation conducted under CRESCENDO will allow starting from robust parameterization for model application to different ecosystems (e.g. deciduous, evergreen).

	considering both past and future development pathways of anthropogenic greenhouse gas emissions and land use change. A significant effort has been put also in the improvement of physical and biochemical processes (including forests) to develop the next generation ESMs and the necessary tools to evaluate their performance quality and projections reliability.	
CLIMATE KIC-Wat-ener-cast (https://www.climate-kic.org/projects/wat-ener-cast/)	Wat-Ener-Cast (WEC), develops activities to avoid penalties and leverage opportunity to water and energy actors through the use of high-quality weather forecasts tailored to their operational needs. Wat-Ener-Cast could represent a real concrete value in terms of optimization of their operation and reduction of risks. Wat-Ener-Cast will fill this gap by providing these actors with easy access to high quality forecasts (predictions and scenarios) suited in risk assessment dashboards for operational decisions.	<ul style="list-style-type: none"> - Furniture of high-quality data for weather forecast in short time range. - Development of post processing tool for the optimization of NWP data over the geographical area of interest
Copernicus C3S_430 - Copernicus Sectoral Information System for Disaster Risk Reduction Pluvial Flood Risk Assessment in Urban Areas https://climate.copernicus.eu/pluvial-flood-risk-assessment-urban-areas	CMCC has been contracted by ECMWF to develop a climate change service to support Disaster Risk Reduction (DRR) in Europe. The service exploits Copernicus C3S data and generates knowledge required for assessing risks from extreme weather and climate related events.	<ul style="list-style-type: none"> - Development of datasets and applications (available through the Copernicus Data Store [CDS]), to address requests from users and practitioners
ARTACLIM 2 (Funded by Politecnico Torino)	The aim of the project was to provide to local authorities the appropriate tools to introduce adaptation measures and actions in the planning processes in order to increase the resilience of their territories	

Individual exploitation plan

Fondazione CMCC will exploit the output of the SILVANUS project for improving its competencies and offered services in the field of weather and climate data for environmental emergencies like wildfires, enlarging the portfolio of the companies helping to increase the revenues of the company. The participation to an EC project, with large number of participants, will allow to the Fondazione CMCC employees to enlarge its cooperation at European level positioning itself as a reliable partner for future R&D projects in the area of weather and climate services applied to several sectors that are crucial for the well-being of people and the environment such as energy, food, agriculture, tourism, blue economy, health, education, real-estate, and many others.

Communication strategy for promoting project outcomes

CMCC will exploit the results of SILVANUS project in its research network and in the research conferences related to the climate change sector. The SILVANUS project represents for CMCC a good opportunity to apply for further national and international grants. CMCC has been involved in several activities focused on research services and consultancy studies addressing the challenges introduced by climate change to improve activities of public administration, small and large enterprises by taking opportunities towards a resilient and sustainable development. The activities performed by CMCC within SILVANUS project will be appropriately promoted in the CMCC marketing plan helping to enlarge its portfolio of activities. The SILVANUS results will be largely advertised over the social media (Company web site, Instagram, Twitter, etc.), that CMCC use to promote its research services.

Description of significant infrastructure and major items of technical equipment relevant to the project

Since 2008, CMCC operates its own Supercomputing Centre (SCC) located within the University of Salento Campus in Lecce. The CMCC Supercomputing Center is the only computational facility in Italy specializing in Climate Change research (<https://www.cmcc.it/super-computing-center-scc>).

Zeus, the supercomputer currently in operation, is based on 348 Lenovo SD530 biprocessor nodes (for a total of 12.528 cores) all interconnected by means of an Infiniband EDR network. The HPC system has a computing power (theoretical peak performance) of 1.202 TFlops.

During 2021, CMCC will build its new supercomputing center at the new CMCC headquarters in Lecce. This new project also includes the upgrading of the computing and storage facilities. In particular, CMCC plans to have its new HPC facility (named Juno) in production starting from the end of the first quarter of 2022. The new supercomputer Juno will have a computing power (theoretical peak performance) of about 1.134 TFlops and will be based on the new Intel processors generation just announced this month (3rd Generation Intel Xeon Scalable codenamed "Ice Lake") and also on the latest generation of NVIDIA GPU (NVIDIA Ampere architecture).

In order to manage and preserve for medium/long term the huge quantity of climate data produced by the research and operational activities at CMCC, in 2019 a new archiving system has been deployed. The hardware components of this new system are: IBM TS4500 tape library with nr 6 LTO8 drives and 2 accessors, 5PBytes of capacity; Nr 2 servers Lenovo ThinkSystem SR630; Nr 1 IBM DS2200 FC storage system; 16Gbps FC SAN implemented with nr 2 Lenovo FC switches B6505.

IBM Spectrum Archive Enterprise Edition is the software that manages the tape library operations and stores the data on the tape tier in the Linear Tape File System (LTFS) format. At the beginning of 2022, the CMCC archiving system will be moved to the new CMCC data center and will also be upgraded in order to extend both its capacity (to 40 PetaBytes) and its I/O throughput by adding 8 more LTO8 drives.

Within the SUILVANUS Project the HPC resources will be used to run meteo and climate models and to manage the large amount of data produced by these models and from observed and in-situ data base.

4.1.20 EXUS SOFTWARE SINGLE LIMITED LIABILITY COMPANY

Partner Name: EXUS SOFTWARE SINGLE LIMITED LIABILITY COMPANY (short name: EXUS)	
Company website: https://www.exusinnovation.co.uk/	
Type: SME	

Partner profile

EXUS Software Single Member Limited Liability Company (EXUS) was founded with the vision to transform the costly and complex enterprise software industry – making it simple, accessible and exciting. Our purpose is to improve the business of those we serve, simplifying complexity to enable intelligent action.

EXUS designs, creates and markets software solutions and services in several business and application areas such as business, e-health, e-learning, business process management, collection, wireless applications. Currently, EXUS employs highly skilled professionals in areas such as software engineering & web development, project and product management, account management and research. The company aims at leveraging the successful track record of

EXUS in view of delivering cutting edge innovation to its customers. Both products and bespoke solutions built by EXUS, serve demanding and critical business applications and domains, covering all types of diverse sectors. From consumer banking applications, smartphones-based payment and transaction systems, augmented-reality mobile applications, large-scale and complex portals, extranets, Electronic Data Interchanges to secure cloud services, serious games and gamification mechanisms, data management and analytics, EXUS covers a wide spread of activities by leveraging the expertise of its 130+ people strong technical divisions that are led by expert project managers and senior consultants. EXUS has been awarded with the EFQM “Recognised for Excellence” award. EXUS is certified with ISO: 9001 for quality assurance. The project managers are certified according to the Project Management Institute as Project Management Professionals. Finally, EXUS is a Gold Microsoft and Oracle Partner for development and Integration works.

Our vision is to transform research to successful market products. Products enhanced with intelligent services built upon novel data analytics algorithms, mechanisms and tools that are reusable and scalable across multiple application domains. EXUS actively contributes to the definition of new research and innovative opportunities harnessing the potential of Data.

Our approach includes the following important aspects:

- The successful transformation of primitive research ideas into large-scale innovation projects.
- Its strategic management, quality control and efficient coordination of multinational projects.
- Work closely with key industry and government stakeholders to provide real-world applications and drive impact.
- Privacy by design, federated access control in heterogeneous environments (e.g. finance, energy, security, health).
- Deal with different data quality: raw, processed, annotated, metadata.

Finally, the company operates its internal Innovation department which manages the strategic research and development portfolio of the company. EXUS AI Labs manages a portfolio of initiatives that aim to pave the way for the introduction and take up of emerging technologies. Leveraging the results of strategic research activities allows us to harness untapped niches in our market sectors of interest. We excel in driving innovation in software engineering, data management and machine learning to foster advances in key sectors such as: security, health, creativity and lifelong learning.

CVs of involved key researchers / staff members

Dr. Eva Jaho (Female) is a Senior Research Consultant at EXUS. She received the PhD and MSc in Net-working from the Department of Informatics and Telecommunications of the National & Kapodistrian University of Athens, Greece, in 2011 and 2007 respectively. She received the Diploma degree from the same university department in 2005. She has participated in several European research projects in the areas of media convergence, social media and artificial intelligence, including SocialSensor, RE-VEAL, FuturePulse, BLOOMEN and FotoInMotion. She has been the Quality Assurance Manager in big consortia, like INGENIOUS and Dissemination/Exploitation Manager of CROSSOVER, HEADS, REVEAL and FuturePulse. Currently she is coordinating CONNECT and STAMINA H2020 projects. She has co-organised numerous workshops in the field of networking and social media and has authored numerous publications for international journals and conferences. Her main research interests lie on the analysis of content networks and data dissemination, as well as artificial intelligence applications.

Role in FORTORI Project: Project manager

Dr. Aristides Bonanos (Male) is a Mechanical Engineer graduating in 2002 from the University of Virginia (Charlottesville, Va, USA). In 2005, he received his PhD from the Aerospace Engineering Department at Virginia Tech (Blacksburg, Va, USA), where he studied flow mixing and combustion phenomena in super-sonic turbulent flows. He continued along this line of research during his postdoctoral fellowship at the California Institute of Technology (Pasadena, Ca, USA) until 2008. Subsequently, from 2009-2020, he was a researcher at the Cyprus Institute (Nicosia, Cyprus), studying heat transfer phenomena in concentrating solar thermal power and thermal desalination applications. He is the author or co-author of over 30 publications in peer reviewed journals and conference proceedings. In September 2020 he joined EXUS as a Research Consultant.

Role in FORTORI Project: Member of the management Team, Leader of the technical tasks

Dr. Pantelis Z. Lappas (Male) is an Artificial Intelligence (AI) Solutions Architect at EXUS AI Labs. His educational background includes a PhD in Operations Research, MSc degrees in Statistics with specialisation in quantitative statistical methods applied in decision making and in Information Systems with specialisation in Business Information Systems from Athens University of Economics and Business. He has 10 years of professional/academic experience in applying machine learning and optimisation techniques in finance and business, whereas he has been

involved in numerous applied qualitative and quantitative research projects with respect to credit default risk management. His interests are rooted in Operations Research, Statistics and AI and within these fields Risk Management, Bioinformatics, Optimisation, Decision Making, Machine Learning and Evolutionary Learning. He has published in scientific journals and conferences as well as book chapters related to risk management and evolutionary optimisation in Supply Chain Management and Credit Risk Management.

Role in FORTORI Project: Leading Data Scientist Expert for EXUS developments

Mrs. Theodora Galani (Female) joined EXUS in June 2017 as a Software Engineer. She holds a Diploma in Electrical and Computer Engineering from the National Technical University of Athens (NTUA). Also, she is a PhD candidate in the School of Electrical and Computer Engineering of NTUA in the field of data management. She specializes in full stack web application design and development, using Java / Spring Framework and React. In EXUS, she has participated in several EU funded projects (SECUREGAS, CRISS, EMO-TIVE, MAGELLAN FTI) and in one national project (METEORA), both as developer and technical lead (CRISS, METEORA)

Role in FORTORI Project: Leading software engineer for EXUS developments

Role in the project

- **WP1:** EXUS will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** EXUS will contribute to the review of historical case studies on the past wildfire events. The economic impact of wildfires on infrastructures and other associated man-made and natural objects will be reviewed.
- **WP3:** EXUS will collaborate with SIMAVI on the curation of AR/VR content.
- **WP4:** EXUS will contribute to the aggregation of data from EO repository
- **WP5:** EXUS will actively contribute to the activities of this workpackage, with the support on setting big-data framework, development of data driven services and real-time monitoring of response coordination.
- **WP8:** EXUS will contribute to the project integration activities
- **WP9:** EXUS will take part in Phase A and B pilot demonstration organized in Greece.
- **WP10:** EXUS will disseminate the project outcomes to financial services sector. The stakeholder engagement will be further extended to facilitate financial protection of man-made structures such as buildings.

Relevant publications, and/or products, services or other achievements

EXUS Analytics Framework (EAF)

EXUS Analytics Framework is built upon a distributed, multi-node Hadoop cluster backed by the Hadoop Distributed File System (HDFS), running on Ubuntu Linux 14.04 LTS. More precisely, the Cloudera Distribution Hadoop (CDH) cluster that resides on Azure cloud platform is deployed.

Cloudera provides a data-management platform designed specifically to address the opportunities and challenges of big data. By uniting flexible storage and processing under a single management framework and set of system resources, Cloudera delivers the versatility and agility required for modern data management. EXUS Analytics Framework is a generic analytics platform that can be adapted to the needs of the scenario under investigation and the data provided to the platform.

The driving idea behind the design and development of EAF is the seamless facilitation of analytics functions for both batch and streaming data (including “Big Data”) by different types of business users, without imposing strong requirements on expertise and specialisation. To achieve that, EAF employs a codeless approach in the sense that the end-to-end platform is integrated in such a way, so that the end users can interact with it, without requiring extra effort.

EAF enables data scientists and application developers to design, implement and deploy novel applications that seamlessly process offline and online big data without having to cross disruptive boundaries between distinct processing systems or paradigms. Through a unified offline and online model, EAF increases the productivity of data scientists and enables new application use cases in a cost-efficient fashion. For this, EAF includes advanced predictive, interactive and visual analytics capabilities. Analytics applications on EAF execute on an underlying infrastructure that can exploit heterogeneous cluster compute resources for data-parallel processing of high volume and velocity data. EAF leverages existing and mature big data technologies, including Spark, Hadoop and Storm, where appropriate, and uses them to provide a comprehensive integration of offline and online processing models. EAF’s focus on privacy-preserving processing allows the platform to act as a building block for cross-border adoption by

European stakeholders, such as public authorities, private organisations and research institutions that hold and work with sensitive data.

EFS Financial Suite

The EFS Financial Suite is based on the outcomes of previous innovative research work conveyed by EXUS in the framework of EC co-funded projects. In specific, EFS uses best of breed technologies in the field of scalable data analytics, pattern recognition and analysis, machine learning for continuous adaptation and state of the art visualisation techniques. EFS provides the necessary tools for supporting all the steps of the Risk scoring and management, Loan Origination, Debt Collection and Recovery process for financial institutions or other organisations that deal with transaction-heavy processes in real-time applications (e.g. Telcos, Brokers, Insurance Companies etc.). EFS product enables non-IT expert users (collection managers) to develop detailed collection strategies and to define rules for implementing the strategies, visually through intuitive web tools. So based on the requirements of each customer, every step of the strategy can be set-up using the most suitable paradigm. The representation is translated to specific business processes that are understandable and editable by the collection managers. The EFS enables on the fly changes, as well as the automated production of self-adapting strategies taking into account the whole cycle of the collection process from pre-collections (e.g. SMS notifications for high risk customers before the delinquency date) to early, restructuring, pre-legal, legal, write off and portfolio sale. To that effect, the EFS core engine aggregates disparate data sources both internal and external. Therefore, large historic data sets within the organisation are fully exploited for pattern identification and extraction while social media and other real-time consumer behavioural attributes are leveraged to yield a complete picture. EXUS is an expert in enabling intelligent action in enterprise systems through effective and value-adding real-time information management. In 2016, EFS was ranked “Best in Class in the world” from the CEB Tower group. <http://collections.exus.co.uk/loan-collections-systems-technology-analysis>

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
H2020 IN-PREP (2017 - 2020), "An INtegrated next generation PREParedness programme for improving effective inter-organisational response capacity in complex environments of disasters and causes of crises", https://www.in-prep.eu/	EXUS leads the development of the decision support system and the work-flow engine, and is involved in all technical work packages including integration and help with commercialization.	Experience with tools powered by decision-tree logic and other artificial intelligence technologies.
H2020 CURSOR (2019-2022) "Coordinated Use of miniaturized Robotic equipment and advanced Sensors for search and rescue Operations" https://cordis.europa.eu/project/rcn/222585/factsheet/en	Exus is responsible for development of multiple-source Data Fusion Engine (MDFE) and the Expert Reasoning and machine learning based Data Exploitation tasks, development of back-end services	Data fusion and machine learning expertise applied in SILVANUS
H2020 INGENIOUS (2019-2022) "The First Responder (FR) of the Future: a Next Generation Integrated Toolkit (NGIT) for Collaborative Response, increasing protection and augmenting operational capacity " https://ingenious-first-responders.eu/	Exus leads the development of smart algorithms for low and high level fusion; ruled based mechanisms, such as Complex Event Processors (CEPs) to translate raw sensor's data into boosted intelligence; and publish-subscribe middleware to support the transmission of messages between distributed systems	Complex event processor and information fusion expertise will be exploited within SILVANUS
H2020 STAMINA (2020-2022), "Demonstration of intelligent decision support for pandemic crisis prediction and management within and across European borders"	EXUS will contribute to the technical developments regarding the decision support tool and the interfaces for data exchange	Experience with the decision support tool will be exploited in the training and real time response coordination activities of SILVANUS

Individual exploitation plan

EXUS plans to exploit the SILVANUS outcomes by improving its research and development in data analytics, machine learning, computational intelligence and artificial intelligence applications, with the objective of improving its technical offering and expanding its network of contacts. The role of EXUS in SILVANUS will further increase the team's know-how and establish the company as a reliable partner for future EU-funded research endeavours under Horizon Europe, ensuring a sustainable long-term plan for the AI Labs division of the company.

Communication strategy for promoting project outcomes

EXUS will contribute towards the project's dissemination activities by delivering tailored messages to identified target audiences. The first target involves the general public, who will be engaged at a high level through posting of project activities on our social media accounts; a second target is current and potential collaborators where the project will be showcased on our website with more in-depth information regarding our offerings; while the third target consists of participation in industry- and scientific-relevant events such as international conferences and workshops.

Description of significant infrastructure and major items of technical equipment relevant to the project

EXUS has implemented an architecture and services for intelligent data query, indexing, retrieval and storage based on models of NoSQL and hybrid SQL, coupling the approaches of Big Data, Big Analytics and Cloud Computing. In this architecture, EXUS has integrated an open source portal to automate the provisioning of a full suite of services on Windows servers that also supports provisioning of Windows and Linux Virtual Machines. We use an Orchestrator for aligning workflows suitable for provision with commercial and open-source software. The Orchestrator uses methodologies for a data centric and homogeneous representation of the various technical components for maximum independence from proprietary solutions and is significantly used in the development of application processing chains based on open platforms with end user involvement.

Moreover, EXUS has available the following infrastructure for the development, technical testing and integration of the project: five dedicated Servers allowing for the quick and reliable testing of the prototypes developed in the context of the project and two dedicated workstations.

4.1.21 RINIGARD DOO ZA USLUGE

Partner Name: RiniGARD	 RiniGARD <small>Smart technology</small>
Company website: www.rinigard.com	
Type: SME	

Partner profile

RiniGARD (RINI) is a Zagreb based SME, specialized in providing Counter-UAV, communications security, ICT, smart health solutions for critical infrastructure and security applications. Established in 2019, the company benefits from the vast expertise and experience of its founding members and works closely with several global technology providers.

In the security market segment, RINI works closely with Sensofusion (FI), Secureone (NL), Rinicom (UK), ST Engineering (Singapore), Saher EU (EE), MSAN (HR), Fleksbit (HR) and KING ICT (HR), providing technical support, upgrade and customisation of products for LEAs and first responders in HR.

In the emergency medicine and smart healthcare market, the company works in close cooperation with local first responders and several hospitals, implementing novel state of the art technologies and supporting them with local certification and regulatory approvals.

RINI aims to become the leading-edge technology company in Croatia and Europe and as such, pays particular attention to innovations and R&D development. The company actively participates in Collaborative European Research Programs expanding its market reach and research capabilities.

Among its staff and founders, RINI has a number of retired senior police officers with experience in operational and strategic policing and international law enforcement cooperation, leading scientific officers with over 1000 publications, including 4 textbooks, 42 international patents and great number of papers in leading scientific journals, as well as a few well experienced project managers. This expertise and experience are utilised to ensure that all the products and technologies developed and supplied by RINI meet specific requirements of the end user. These new

products and services will be developed according to the internal Research and Product Development roadmap which will be funded by the proceeds from sales, internal resources and participation in various R&D Programmes, including H2020 programme.

CVs of involved key researchers / staff members

RINI has all the required operational capacity to complete the assigned tasks. More specifically, RINI staff are well qualified and have significant experience in developing technical specifications for the desired systems, in integrating RINI solutions with third party systems and in conducting marketing and brand awareness activities. Furthermore, RINI possesses adequate R&D facilities which will enable RINI engineers to develop, implement and test the SILVANUS deliverables. As a subsidiary company of a UK-based company Rinicom Ltd (<https://rinicom.com>), RINI has unlimited access to the existing IPR and will be using this as a foundation for further improvements to ensure smooth integration into the SILVANUS architecture.

Key Personnel

Prof. Garik Markarian (M), Chief Scientific Officer, is one of the founding members of RiniGARD. He recently gained the status of Emeritus professor and moved to Croatia, where his expertise and experience is in great demand. Prof. Markarian co-authored over 1000 publications, including 4 textbooks, 42 international patents and a great number of papers in leading scientific journals. His main expertise is in the field of Secure Communications, Artificial Intelligence, Video Analytics, Telemedicine, just to name a few.

Jelena Levak (F), Head of EU Projects, is a former Chief Police Inspector with vast knowledge in policing, security and data protection. She was a member of various police teams and is a former leader of CSI teams. During her diplomatic service as a JHA counsellor in Brussels she was covering all strategic matters in the work of a whole series of Working Groups of the Council of the EU and drafting of legislative and non-legislative acts, including: DAPIX (Protection, Exchange, Retention), Interoperability of EU IT systems, Standing Committee on Operational Cooperation on Internal Security (COSI), PROCIV, CATS, encryption, e-Evidence, eu-LISA, Convention 108, e-Privacy, EUROPOL, Horizontal Working Party on Cyber Issues. During that time, she participated in drafting the next EU Policy Cycle for organised and serious international crime 2018-2021. She holds the certificate for project management and a certificate for the Data Protection Officer. Currently finishing postgraduate studies in Criminal Law at the Faculty of Law at the University of Zagreb.

Denis Kolev (M) is the lead Algorithm expert and Research Advisor at Rinicom. He is specialised in mathematics, machine learning and system optimization methods. He is involved in several R&D projects. He holds a MSc in Data mining and machine learning by the Department of Computational Mathematical Methods for Forecasting, Faculty of Computational Mathematics and Cybernetics, Moscow State University. He is also currently a second year PhD student in University of Glasgow, School of Computer Science. Regular publications in AI and Machine Learning conferences like Fusion, SSCI, IJCNN.

Natasha McCrone (F) is a versatile, analytical and hard-working Business Improvement Project Manager with a practical approach to strategic analysis. Over the last 12 years, she has successfully managed (on schedule, scope and budget) a variety of internal and grant funded projects nationally and throughout Europe. She is responsible for presenting project outcomes to customers and funding bodies and liaising with the engineering teams to ensure proper understanding of commitments. Natasha is also responsible for managing operations to ensure the engineering work is delivered to a high-quality standard and that all projects are aligned with the company's strategy to promote commercial prospects following the project's completion.

James Barnes (M), senior software engineer. He has experience in a wide range of software related fields, including web technologies and development, software engineering, testing design and methodologies, distributed systems, networking, neural networks, algorithm optimisation and design, machine learning and wireless communications. James has worked on a number of projects that focus on delivering unparalleled communications devices using proprietary technology.

Dominik Gustin (M), Senior software engineer, experienced in a wide range of software related fields, including web technologies and development, software engineering, testing design and methodologies, distributed systems, and wireless communications. He is working on several projects that focus on delivering unparalleled communication devices by using proprietary technology.

Matea Novosel (F), Sales Executive, is former PR and HR Manager with experience in sale in International Health Company. Her role in sales was developing commercialization strategy. She was responsible for helping build up business by identifying new business prospects and selling product to them, maintaining relationships with current clients and building and maintaining relationships with new clients, research and analyze sales options, stay current with trends and competitors to identify improvements or recommend new products, meet with potential clients to determine their needs. She was Project Advisor at Rudjer Boskovic Institute on the five-year project of the World Bank, the Ministry of Education, Science and Sports and the Rudjer Boskovic Institute. She worked in Innovations and Technology Transfer department with scientists in Croatia and abroad. Core business was commercialization of innovations.

Expertise relevant to the project

- Phase B [Detection and Response] – Objectives: in PB2: Onboard computation of high-speed multi-spectral imaging using neural network compression RINI will setup the wireless communication infrastructure for design and development of advanced visual computational units based on the development of neural network compression applied for the multi-spectral imaging sequences. To enable efficient and fast onboard computation of high-speed multi-spectral imaging using neural network compression, RINI will develop, implement and test a dedicated FPGA based visual computational processor, which will enable real- time processing of multi-spectral images while ensuring compliance with payload constraints on weight, size and power consumption.
- Phase B [Detection and Response] – Objectives: in Wireless sensor network mesh for aggregating distributed sensor data (from aerial and ground vehicles) the wireless communication sensor network developed by RINI will be extended for the pilot demonstration activities. RINI will be conducting internal research activity on the development, testing and optimisation of Software Defined Radio (SDR) communication network enabling interoperability between the UAVs and UGVs. Special emphases will be placed on ensuring backward compatibility with the legacy communication systems.

Role in the project

- WP1: RINI will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- WP2: RINI will engage with stakeholders to formulate the challenges in establishing communication between the mobile command centre and the frontline fire fighters.
- WP4: RINI will contribute to the aggregation of information from in-situ sensors. The communication infrastructure developed in WP5 will be used to transmit high-bandwidth information stream from the fixed and dynamic sensors including UAVs, UGVs.
- WP5: RINI in collaboration with WUT will lead the activity on Software Defined Radio (SDR) for establishing on-demand wireless communication. The highly flexible and configurable infrastructure will be demonstrated across Croatia pilot.
- WP8: RINI will contribute to the overall integration activities carried out in the project
- WP9: RINI will closely collaborate with the stakeholders in Croatia and facilitate pilot demonstration for Phase A and B. The detection and response coordination will be carried out in collaboration with UGSV and HZV.
- WP10: RINI will exploit the results of the project outcome through stakeholder engagement and strengthening the market share in SDR wireless communication.

Relevant publications, and/or products, services or other achievements

- D. Kangin, D. G. Kolev, G. Markarian, "Multiple video object tracking using variational inference," in Sensor Data Fusion: Trends, Solutions, Applications (SDF 2015). IEEE p. 47-52. 6 p., 6/10/2015. [http://www.research.lancs.ac.uk/portal/en/publications/-\(f833683d-8c42-4347-8079-b12b7c977c83\).html](http://www.research.lancs.ac.uk/portal/en/publications/-(f833683d-8c42-4347-8079-b12b7c977c83).html)
- D. G. Kolev, G. Markarian, D. Kangin, "Data fusion for unsupervised video object detection, tracking and geo-positioning," in Information Fusion (Fusion), 18th International Conference on. IEEE p. 142-149, 4/07/2015. [http://www.research.lancs.ac.uk/portal/en/publications/-\(325ab46f-bd8f-4fee-9d22-f8bfa8119e37\).html](http://www.research.lancs.ac.uk/portal/en/publications/-(325ab46f-bd8f-4fee-9d22-f8bfa8119e37).html)
- Isupova, O, Mihaylova, LS, Kuzin, D, Markarian, G & Septier, F 2015, An expectation maximisation algorithm for behaviour analysis in video, in *Information Fusion (Fusion), 2015 18th International Conference on*. IEEE, pp. 126-133, International Conference on Information Fusion'2015, Washington DC USA, United States, 4/07/15.
- Kolev, D, Suvorov, M, Morozov, E, Markarian, G & Angelov, P 2015, Incremental anomaly identification in flight data analysis by adapted one-class SVM method, in P Koprinkova-Hristova, V Mladenov & NK Kasabov (eds), *Artificial neural networks: methods and applications in bio-/neuroinformatics*. Springer Series in Bio-/Neuroinformatics, vol. 4, Springer, pp. 373-391.
- Angelov, PP, Kolev, DG & Markarian, G Oct. 01 2015, SYSTEM STATE CLASSIFIER: United States Patent Application 20150278711, Patent No. 14/677269, IPC No. G06N99/00; G06N7/00.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
TIVA - Advanced UAV Thermal Imaging and Video Analytics for Search and Rescue Missions (NATEP: Birmingham City Council/Finance Birmingham): developing a new, innovative technology in the form of an all-encompassing autonomous system to detect the thermal signature of a potential missing person/ body.	RINI provided their expertise in the aerospace industry as well as contributed technically through the provision of a light-weight small imaging system for use on UAVs.	Ability and know-how to develop and implement on-board thermal image processing neural network algorithms.
NO-FEAR – Network of Practitioners for Emergency Medical Systems and Critical Care (H2020-SEC-2016-2017-2): The emergency medical care in the EU is a fragmented chain including population, emergency medical services, volunteers, hospitals and cooperation with fire services, police and authorities. It needs to prepare to respond to new threats and assist casualties after security incidents. [http://no-fearproject.eu]	RINI provides its expertise, know how and contact base in the field of remote patient monitoring utilising various sensors.	Ability to build, integrate and secure remote monitoring systems interoperable between the various stakeholder systems.
NEXES - Next Generation Emergency Services: was a 36-month project funded by the EU Horizon 2020 from May 2015 to April 2018. The project involved 17 European partners from local government agencies, ambulance services, and IT companies. The NEXES project developed a number of IP-based communication technologies for the next generation emergency services to empower first responders, ambulance service providers, and patients through a 'total conversion' approach with special focus on the inclusion of people with disabilities and special needs such as deaf and blind people.	RINI coordinate the project and lead the activities associated with the development, implementation and demonstration of the emergency communication system suitable for people with disabilities, such as deaf and blind people.	Ability to build, integrate, test and demonstrate modern emergency communication systems compatible with different user requirements.

Individual exploitation plan

- RINI will use the results of SILVANUS project in its further research work, by extending its know-how and specialization in information collection, security and modern communication technologies. RINI will also use SILVANUS to apply for further research grants: national, to spread the results in the local scientific community, and international, to continue with further research and development based on SILVANUS outcomes.
- RINI has been involved in various projects related to development and implementation of rapidly deployable secure wireless communication infrastructure and is strongly committed to transfer gained knowledge and expand its portfolio in this area beyond the state-of -art to new market segments.

Communication strategy for promoting project outcomes

To maximize the expected impact, RINI will follow a carefully defined innovation and commercialisation strategy to ensure visibility, uptake, and follow-up. RINI will carry out communication and dissemination activities during the whole time of the project and beyond, to support the project objectives. The dissemination plan will be consisted of actions that should raise awareness at all levels. It will mainly be done through social networks (project participation in public events, joint cooperation with other projects, achievements, publications etc.) such as company's Twitter, Facebook or LinkedIn page. Additionally, RINI will issue newsletters and participate in specific workshops, seminars, forums, innovation events, exhibitions and conferences relevant to the project, where the projects results will be presented. Industry events will play an important role in the marketing strategy because they will enable us to demonstrate and showcase our technology, build stronger relationships, increase brand awareness, and create high-quality leads. We will promote SILVANUS at industry events and events enabling commercialization outside of this sector (e.g. for critical infrastructure – we will promote SILVANUS in a dedicated workshop in the Cyber Security of Critical Infrastructure Conference, which is a bi-annual conference dedicated to cyber security and protection of critical infrastructure, organized by RINI in Croatia).

Description of significant infrastructure and major items of technical equipment relevant to the project

RINI will bring to the projects its technical KNOW-HOW and commercial expertise (including distribution network and existing customer base) in the following areas:

- **Wireless communication using SDR:** long-standing expertise in the development of wireless communication infrastructure. The technology is based on the recent popularity of using software defined radio (SDR) systems, which enables dynamic configuration of the system operation with the ability to control the frequency spectrum upon which the radio infrastructure should operate. Thus, building on their current expertise, the activities within SILVANUS will further enhance the robustness of the system to be operational beyond line of sight upon being deployed on UAVs. The outcome of the activity will result in autoconfiguration among swarm of drones to establish an on-demand wireless communication network, which will facilitate coordination among ground personnel and extend the service to public in the absence of commercial communication infrastructure due to wildfire. The technology, currently demonstrated in a relevant industrial environment, will be further enhanced to become complete and qualified. [Target TRL: 8]
- **MESH-IN-THE-SKY** – today there is no solution on the market for small, medium and large UAVs, operating at high speed and over long distances. Current solutions utilise standard MANET routing protocol which was developed for WiFi-based ground applications and is not suitable for rapidly changing formations flying at high speed. Offering this feature as part of the SILVANUS SDR data link will allow achieve the desired long range beyond the line-of-sight communication for UAVs flying in formation without dramatic increase of transmit power and payloads.
- **Dynamic Modulation Selection** – current competing products offer only one type of modulation COFDM for wideband data link for distance up to 75km and GMSK modulation for narrow band transmissions for distances in excess of 100km. The proposed SILVANUS SDR data link will be able to automatically change modulation format during the flight, operating COFDM for short or medium ranges and switching to GMSK (or other types of power efficient modulation) for longer ranges.
- **Single SDR platform** – will be the foundation for manufacturing cost reduction as it will eliminate the need to manufacture various platforms for various customers. The reduced manufacturing cost will lead to reduced end user prices without loss of profit margins.

4.1.22 Micro Digital d.o.o

Partner Name: Micro Digital d.o.o.	 Micro Digital
Company website: www.microdigital.eu	
Type: SME	

Partner profile

Micro Digital (MD) is highly specialized ICT oriented small enterprise, focused on making the existing critical infrastructures and processes go digital and sustainable, while at the same time increasing their operational capability without compromising the security and privacy of its users. Micro Digital strongly focuses on lifecycle impacts and shifting towards sustainable operation and is particularly well-versed in retrofitting the digital technologies and novel digital practices in the established industries and increasing their environmental sustainability as well as reducing their carbon footprints. Micro Digital does so by primarily focusing on transforming the existing processes with a strict goal-oriented vision. It is also experienced in securing the critical infrastructure and collaborates closely with several key industry partners in Croatia. MD has successfully executed pilot projects resulting in creation of new products and successful makeovers and upgrades of existing practices. MD experts helped in ensuring one of key industry players in Croatia unlock their innovative research potential through participation in H2020 projects. MD's experts' decades of experience span environment, energy, banking, international trade and logistics sectors, as well as stakeholder and community management.

CVs of involved key researchers / staff members

Lovorko Marić

- Education: Two master's degrees from the Karl-Franzens University in Graz in Environmental System Sciences and Sustainability-oriented Management
- Career profile/Experience: His main field of expertise consists of socio-economic and environmental analyses of international energy projects (renewable energy, energy efficiency, overhead transmission lines, coal mining operation, power plants), through environmental and social impact assessments in compliance with World Bank/IFI standards and guidelines across all continents. He is experienced in drafting climate change mitigation plans including life-cycle assessment, and renewable energy feasibility studies with an emphasis on GIS-based detailed spatial analyses, assessment of socio-economic impacts and financial modelling. He is an experienced H2020 project manager and has worked as panel leader at the European Council for an Energy Efficient Economy. He is fluent in Croatian, English, and German. He has excellent communication skills and exceptional presentation skills acquired through dissemination and presentation of project results to policymakers and target groups on projects across the world, most recently in Bangladesh and Kosovo.
- Role in the organisation: Socio-economic and Environmental Expert / Project Manager
- Expected contribution to the project: Climate-driven forest models, Socio-economic analysis of affected regions, Stakeholder engagement, community establishment, dissemination and communication.

Igor Kršić

- Education: Master of Science and Master of Engineering degree in electrical engineering from the University of Zagreb
- Career profile/Experience: In his career, he started in the academic sector and has worked in banking, insurance and energy sectors. Mr. Kršić has lead development and support teams with thousands of employees, establishing agile and responsive practices: his track record includes a successful digital makeover of two large-scale Croatian banks. Mr. Kršić is also experienced in successful detection and mitigation of security threats and in streamlining the internal company and distributed teams' processes. Through entrepreneurship initiatives, Mr. Kršić has a very successful track record in the creation and spinning-off of several successful initiatives based on internal innovative projects and converting them into self-sustainable businesses.
- Role in the organisation: CEO, Program management and consulting expert

- Expected contribution to the project: Business model development for stakeholders, market trends assessment, SILVANUS results replication strategy.

Anita Jukić

- Education: Master's degree in management from University of Zagreb
- Career profile/Experience: After a successful career at highest echelons in top-tier international companies, she is currently an organizational and administrative expert in Micro Digital. Her role is currently instrumental in enabling key industry players and public municipal companies in unlocking their R&D potential through collaboration on Horizon 2020 and other research and innovation projects. Her contribution has been crucial player in enabling several large-scale Croatian companies to reach considerable levels of funding from European level R&D funds.
- Ms. Jukić is highly experienced in Horizon 2020 project technical execution and administration. She has a considerable experience as a community manager.
- Role in the organisation: Administrative expert
- Expected contribution to the project: Project administration, dissemination, community management.

Role in the project

- **WP1:** MD will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** MD will contribute to the development of forest resilience models
- **WP3:** MD will contribute to the development of training methodology.
- **WP10:** MD will coordinate the project dissemination and exploitation activities. MD will responsible for registering and setting up the operations for Center for Adaptation Strategies and Development (CASD) as outlined in WP10/T10.1

Relevant publications, and/or products, services, or other achievements

- Environmental and social impact assessment of a coal mine Dighipara in northwestern Bangladesh - The main assignment was to establish whether the construction of a coal mine is acceptable according to social and environmental standards, especially since the construction would include involuntary resettlement of local population. Activities performed: (1) Assessment of positive and negative socio-economic impacts according to the World Bank standards and guidelines, with particular emphasis on employment, health, infrastructure, involuntary settlement, the position of minorities and indigenous peoples (2) Organisation and implementation of focus group discussions and key informant interviews with community stakeholders (3) Dissemination of project results and established impacts to the local population (4) Resettlement action plan with the assessment of costs
- Amendment of an environmental and social impact assessment for the new lignite-powered plant in Obiliq, Kosovo (450 MW) - focus on the effects the future power plant will have on the local population in terms of social, environmental and economic impacts, regarding employment (relationship to the closing of the old coal-fired power plant which should coincide with the opening of the new one), resettlement, water security, infrastructure, status of ethnic minorities etc.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
FLEXCoop – Horizon 2020, call H2020-LCE-2016-2017, Competitive Low-Carbon Energy, RIA	Micro Digital experts have indirectly contributed to community building, business development plans and stakeholder engagement and have been engaged in administrative actions;	Innovative practices dissemination, preparation of material palatable to a wide range of stakeholders, engaging energy cooperatives and similar entities in the dissemination activities

action, October 2017-January 2021, GA number 773909	Micro Digital experts have been engaged by a consortium partner.	
HOLISDER – Horizon 2020, call H2020-EE-2016-2017, Energy Efficiency Call 2016-2017, IA – Innovation Action, October 2017-March 2021, GA number 768614.	Micro Digital experts have been engaged in project administration and dissemination tasks by a project commercial (industry) partner.	Experience in project administration and publication of project results

Individual exploitation plan

Micro Digital mission is digital transformation and making the established industry practices sustainable, and the SILVANUS project fits perfectly in line with this effort. The existing strong dissemination and stakeholder engagement expertise of Micro Digital experts is expected to have an impact on the sustainability of the SILVANUS results well beyond the project end. By participating in this project, the key experts of Micro Digital will also expand their skills into the sustainable forest fire management practices. As the importance of sustainable forest management is expected to increase and digital services utilized in such management are expected to be sought for, Micro Digital expects this will strongly support their digital transformation expert portfolio and possibly result in full-time engagement of additional two consultant senior experts in this field.

Communication strategy for promoting project outcomes

The Micro Digital experts' team is well-versed in the dissemination and presentation skills across diverse areas. Their existing connection network spans international trade, logistics, banking sector, consultancies, policy makers and local communities, and reaches across all continents. Through their participation in the digital transformation projects, Micro Digital is quite well directly connected into regional industry and academia. MD's communication strategy will take advantage of this strong established network of contacts, and over the course of the project development, these connections are going to be strengthened with other identified stakeholders.

The proposed communication channels will extend beyond direct contacts and will include social media. As Mr. Marić, MD's key environmental expert is experienced in creation of very popular live streamed and video blog YouTube videos with hundreds of thousands of views, this will also be one of principal outreach means to the wider community. This is expected to result in raised awareness and increased demand for SILVANUS-derived exploitable assets and services and will be a direct MD contribution to the SILVANUS business exploitation plans.

Description of significant infrastructure and major items of technical equipment relevant to the project

N/A

4.1.23 WARSAW UNIVERSITY OF TECHNOLOGY

Partner Name: Politechnika Warszawska		POLITECHNIKA WARSZAWSKA
Company website: www.pw.edu.pl		
Type: Academia		

Partner profile

Warsaw University of Technology is one of the leading institutes of technology in Poland, and one of the largest in Central Europe. It employs 2,453 teaching faculty, with 357 professors (including 145 titular professors). The student body numbers 36,156 (as of 2011), mostly full-time. There are 19 faculties covering almost all fields of science and technology.

The Institute of Computer Science is one of the six Institutes within the Faculty of Electronics and Information Technology, Warsaw University of Technology. The Institute's main research areas include cybersecurity, computer graphics, computer systems' architectures, software engineering, artificial intelligence and information systems. These research and teaching areas have influenced the organisation of the Institute: its staff is subdivided into four Divisions. To each of divisions belongs a specialised laboratory unit for carrying out the research and also for students preparing their major projects and diploma theses. Besides these three specialised laboratories, the Institute runs a large Computing Laboratory (more than 100 PCs and workstations) where students do most of their practical work. The Institute of Computer Science is one of a few academic institutions in Poland with the longest tradition in computer research & development and education. The teaching in the field of computing and computers was started early, so that the first few MSc degrees in Computer Science were granted in 1962. From then on, the regular curricula in the field have been proposed with up to 80 students graduating each year. So, over last several decades more than 2500 computer professionals have been graduated from the Institute. Currently, there are 75 people employed in the Institute of Computer Science, including 61 members of academic staff (9 professors, 1 associate professors, 28 assistant professors with a PhD degree, 8 assistants, 15 senior lecturers). The remaining employees are the engineering, laboratory and administrative staff.

Computer Systems Security Group at Institute of Computer Science has had over 15 years of experience in working collaboratively on developing research proposals and successfully deliver and demonstrate research projects. The proposals are mostly related to the communications technologies and their security.

CVs of involved key researchers / staff members

Wojciech Mazurczyk (M) is University Professor at the Institute of Computer Science, Division of Soft-ware Engineering and Computer Architecture, Faculty of Electronics and Information Technology, Warsaw University of Technology (WUT), Poland where he is a head of the Computer Systems Security Group (CSSG). Till September 2019 he was an Associate Professor at the Cybersecurity Division, Institute of Tele-communications (IT) at WUT where he co-founded Cybersecurity Division and was a head of the Bio-inspired Security Research Group (BSRG). Researcher at the Parallelism and VLSI Group at Faculty of Mathematics and Computer Science at FernUniversitaet, Germany. Holds B.Sc. (2003), M.Sc. (2004), Ph.D. (2009, with honours) and D.Sc. (habilitation, 2014) all in Tele-communications from WUT. Author or co-author of 2 books, over 150 papers, 2 patent applications and over 35 invited talks. Involved in many international and domestic research projects as a principal investigator or as a senior researcher. A guest editor of many special issues devoted to network security (among others: IEEE TDSC, IEEE S&P, IEEE Commag). Serving as Technical Program Committee Member of (among others): RAID, IEEE GLOBECOM, IEEE ICC, IEEE LCN, IEEE CNS, ACSAC, ARES and ACM IH&MMSec. From 2016 Editor-in-Chief of an open access Journal of Cyber Security and Mobility. From 2018 Associate Editor of the IEEE Transactions on Information Forensics and Security and Mobile Communications and Networks Series Edi-tor for the IEEE Communications Magazine. From 2016 an Accredited Cybercrime Expert, Trainer, and a member of the Academic Advisory Network for Europol EC3 (European Cybercrime Center). A founder and a coordinator of the Criminal Use of Infor-mation Hiding (CUIng) Initiative launched in cooperation with Europol EC3. A founding member of EURASIP "Biometrics, Data Forensics and Security" (B.For.Sec) Special Area Team. IEEE Senior Mem-ber (2013-) and EURASIP member (2015-). Certified PRINCE2 Foundation / PRINCE2 Practitioner project manager. For over 10 years has been serving as the independent consultant in the fields of network security and tele-communications. Between 2003 and 2007 he was also a deployments specialist for the telecom company Suntech. His research was covered by worldwide media numerous times including in "IEEE Spectrum", "New Scientist", "MIT Technology Review", "The Economist", "Der Spiegel", etc.

Krzysztof Cabaj (M) holds M.Sc (2004), Ph.D. (2009) and D.Sc. (2019) in computer science from Faculty of Electronics and Information Technology, Warsaw University of Technology (WUT). Currently, University Professor at WUT. Former instructor of Cisco certificated Academy courses: CCNA Routing & Switching, CCNA Security and CCNP at International Telecommunication Union Internet Training Centre (ITU-ITC). His re-search interests in-clude: network security, honeypots, dynamic malware analysis, data-mining techniques, IoT and Industrial Control Systems security. He is the author or the co-author of over 60 publications, and supervisor of more than twenty five M.Sc. and Eng. degree theses in the field of information security. He took part in over a dozen research projects, among others for EU, ESA, Samsung, US Army and US Air Force. Co-leader of Computer Systems Security Group at Institute of Computer Science.

Role in the project

- **WP1:** WUT will contribute to the overall project management and will participate in the general assembly meetings organized by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** WUT will contribute to the participatory process
- **WP4:** WUT will contribute to data collection and aggregation and pre-processing of in-situ devices (i.e., IoT equipment).
- **WP5:** WUT in collaboration with RINI, will contribute to the development of SDR, focusing especially on the security of the developed setup.
- **WP8:** WUT will contribute to the integration of the project outcomes into platform.
- **WP9:** WUT will oversee the pilot demonstration activities of Phase B.
- **WP10:** WUT will disseminate the results of the project through scientific publications, co-located workshops, special sessions.

Relevant publications, and/or products, services or other achievements

- S. Nowaczewski, W. Mazurczyk - Improving Security of Future Networks Using Enhanced Customer Edge Switching and Risk-Based Analysis, Electronics, MDPI, 10(9), 1107; <https://doi.org/10.3390/electronics10091107>, 2021
- M. Skowron, A. Janicki, W. Mazurczyk - Traffic Fingerprinting Attacks on the Internet of Things using Machine Learning, IEEE Access, 2020, DOI: 10.1109/ACCESS.2020.2969015
- W. Mazurczyk, L. Caviglione - Cyber Reconnaissance Techniques: Evolution and Countermeasures - Communications of the ACM, March 2021
- K. Cabaj, M. Gregorczyk, W. Mazurczyk, P. Nowakowski, P. Zorawski - Network threats mitigation using Software-Defined Networking for the 5G Internet of Radio Light system, Security and Communication Networks, John Wiley & Sons, 2019, Vol. 2019, Article ID 4930908, 22 pages, DOI: 10.1155/2019/4930908
- K. Cabaj, W. Mazurczyk - Using Software-Defined Networking for Ransomware Mitigation: the Case of CryptoWall, IEEE Network, November/December 2016, DOI: 10.1109/MNET.2016.1600110NM, pp. 14-20
- A. EL-Latif, B. Abd-El-Attya, W. Mazurczyk, C. Fung, S. Venegas-Andraca - Secure data encryption based on quantum walks for 5G Internet of Things scenario, IEEE Transactions on Network and Service Management, DOI: 10.1109/TNSM.2020.2969863, Vol. 17, Iss.: 1, March 2020, pp. 118-131
- S. Nowaczewski, W. Mazurczyk - Securing Future Internet and 5G using Customer Edge Switching us-ing DNSCrypt and DNSSEC - Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications (JoWUA), September 2020, DOI: DOI:10.22667/JOWUA.2020.09.30.087
- A. El-Latif, B. Abd-El-Atty, S. Venegas-Andraca, H. Elwahsh, MD. Jalil Piran, A. K. Bashir, O. Song, W. Ma-zurczyk - Providing End-to-End Security Using Quantum Walks in IoT Networks, IEEE Access, Vol. 8, 2020, pp. 92687-92696, DOI: 10.1109/ACCESS.2020.2992820
- A. Velinov, A. Mileva, S. Wendzel, W. Mazurczyk - Covert Channels in MQTT-based Internet of Things, IEEE Access, 2019, DOI: 10.1109/ACCESS.2019.2951425
- J. Cosmas, M. Gregorczyk, W. Mazurczyk, K. Cabaj, et al. - Network and Application Layer Services for High Performance Communications in Buildings, IEEE International Symposium on Broadband Multimedia Systems and Broadcasting (IEEE BMSB 2020), Paris, France, June 2-5 2020

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
IoRL: Internet of Radio Light (2017-2020) - H2020 programme project funded by EC	Design, implementation, and experimental evaluation of the dedicated security framework for the IoRL system in 5G networks and its integration	Ability to build, integrate, and secure modern ICT systems
SIMARGL: Secure Intelligent Methods for Advanced RecoGnition of malware and stegomal-ware (2019-2022) - H2020	Design, implementation, and experimental evaluation of the new innovative malware detection methods	Ability to build, integrate, and secure modern ICT systems

programme project funded by EC		
CoCoDe: Covert Communication Detection - R&D project funded by US Air Force Office of Scientific Research (2017-2020) - Contract No. FA9550-17-1-0254	Design, implementation, and experimental evaluation of the new innovative methods for distributed network covert channels detection	Ability to build, integrate, and secure modern ICT systems
microMole: Sewage Monitoring System for Tracking Synthetic Drug Laboratories (2015-2018) - H2020 programme project funded by EU	Design, implementation, and integration of the security protocols for the sewage monitoring robot.	Ability to build, integrate, and secure modern ICT systems
MobiTraff: Cooperative Way to Mobility and Traffic Efficiency (01.2013-06.2015) - funded by National Centre for Research and Development (Poland) and Fonds National de la Recherche (Luxembourg) - POLLUX programme	Design, implementation, and evaluation of the effective security framework for Vehicular Ad-hoc Networks	Ability to build, integrate, and secure modern ICT systems

Individual exploitation plan

- WUT will use the results of SILVANUS project in its further research work, by extending its know-how and specialization in information collection, security and modern communication technologies. WUT will also use SILVANUS to apply for further research grants: national, to spread the results in the local scientific community, and international, to continue with further research and development based on SILVANUS outcomes.
- WUT has been involved in various projects related to cybersecurity, and is strongly involved in teaching activities at various levels, starting from bachelor degree studies, through master, ending up with doctorate (3rd level) studies. Work complete within SILVANUS will help attract new PhD students for WUT post-graduate program. WUT will extend the curriculum for BSc and MSc students with the courses on “Cybersecurity”.

Communication strategy for promoting project outcomes

- WUT staff will publish the results of the SILVANUS project in prestigious academic journals and present them on scientific conferences and workshops, as it has been doing in all past projects.

Description of significant infrastructure and major items of technical equipment relevant to the project

- Several powerful servers to conduct SILVANUS-related calculations.

4.1.24 University of Borås

Partner Name: University of Borås	 UNIVERSITY OF BORÅS
Company website: https://www.hb.se/en/	
Type: Research	

Partner profile

The University of Borås / Högskolan i Borås (HB) (www.hb.se), has approximately 13 000 students and 750 employees. In collaboration with the public and private sectors, the university conducts education and research of high international quality with societal relevance. The nationally and internationally renowned Swedish School of Library and Information Science (SSLIS), Swedish School of Textiles, and Swedish Centre for Resource Recovery are parts of the University of Borås, which also conducts research and teaching in healthcare, education, business and IT.

HB's strategy is to carry out research and teaching at a high scientific level and in close relationship with industry and the public and cultural sectors. HB has a well-developed department for administrative and economical routines for EU projects through its Grants and Innovation Office that serves researchers during participation in Horizon 2020 projects in the pre-project phase as well as during and after an EU project. The support structure includes research, finance, specialised IP, and legal advice. So far, HB has won 11 Horizon 2020 grants of which 2 as coordinator (e.g., [SUITCEYES](#)). This is in addition to multiple other EU-funded projects in earlier programmes (e.g., FP7) such as SHAMAN and [PERICLES](#). HB also coordinates two large ERDF projects: [CircularHub](#) and [Ways2Taste](#). Both of them are focusing on realization of circular economy, within the textile & furniture industries and the food industries respectively. Part of HB is also a [Science Park](#) focusing on developing and implementing circular business models. At the core of the Science Park is a [Do-tank](#) where SMEs can take part in good practice and knowledge from existing R&D projects, access to test- and demo facilities as well as support in business model development.

As part of HB, [SSLIS](#) is one of the leading institutes of its type in terms of size and contribution to its field, both nationally and internationally. Although evaluation and ranking measures are not common in the area, in an evaluation by the government agency for higher education in Sweden the School was ranked as No. 1 in Sweden. SSLIS is a member of the [iSchools](#) group and has organized many conferences (e.g., [iConference 2020](#)) and hosts The Centre for Cultural Policy Research ([KPC](#)) and Centre for Welfare Studies ([CVS](#)). It is also the publisher of a number of national, Nordic and international journals including Information Research ([IR](#)), which is indexed in many core databases including Web of Science, Scopus, ACM Digital Library, Google Scholar, INSPEC, LIS&T Abstracts, and LISA.

CVs of involved key researchers / staff members

Nasrine Olson (Female) has a background in computer science (Waikato University, NZ) and has obtained her PhD degree in Library and Information Science from the University of Gothenburg Sweden. Her career path has included positions such as software analyst and system manager, and teaching positions at bachelor, masters and PhD levels since 1995 during which time she has been involved with course development and delivery, co-leadership of a Master program and a research program (Social Media Studies), and supervision of students at Masters and PhD levels. She has also been the coordinator of innovation and research utility for her faculty as part of which she has served at the University's Innovation Board which is an advisory board for the Vice Chancellor. She has also been a member of the University's Research and Education Board and has initiated, participated in, and led multiple competitive research projects funded by regional, national and international agencies. She was a work package leader in a large EU-funded project called [PERICLES](#) and is currently the coordinator of a Horizon (RIA) project called [SUITCEYES](#) that aims at developing wearable haptic communication technologies, utilising smart textiles. The specific use-case in that project is people with deafblindness, however the technologies developed are scalable to other areas (e.g., in firefighting where visibility due to smoke is poor and other modes of communication may not be as convenient). User-centred participatory methodologies and engagement with the users and other stakeholders (including national agencies, interest groups, policy makers, technologists and researchers) has been at the core of that project and will be brought in, contributing to the methodology of participatory process in SILVANUS. Nasrine's extended experience of project management and timely delivery of quality results will also be useful in conducting her work where she will contribute mainly to the citizen engagement programme but also to reviews, case studies, methodology for participatory process and the assessment framework.

Thomas Bebis' (male) work experience spans 10+ years in Higher Education, both as a researcher as well as a consultant and manager. He has worked at Yale University as a Physics Research Fellow (2003), interned in the Permanent Delegation of the European Union to the United Nations (Geneva, 2011) and worked during the past decade in senior management positions in Greek Higher Education (Athens University of Economics & Business - AUEB, International Hellenic University - IHU, University of Athens - UoA) and in Swedish Higher Education (University of Borås - HB). He has extensive expertise with managing academic and research projects, presently acting as Project Manager on behalf of HB for SUITCEYES - a H2020 2.4m EUR EU funded project. He holds graduate degrees on Public Management and Governance from the London School of Economics, and Nanoscience from TU Delft.

Prof. Emer. Sándor Darányi (male) earned his university degrees -- in agriculture vs. library and information science, with a PhD in computational ethnography -- in Hungary. Until his retirement, he worked 25 years in higher education, 5 years in science diplomacy, and altogether 40 years in the information business. He has research interests

in advanced access to digital libraries, digital preservation, narrative genomics for the study of intangible cultural heritage, quantum interaction, and evolving semantics. In the latter area, his recent interest has been social mechanics, i.e., the influence of community context on conceptual dynamics. He was involved in several national and international research projects, with publications on e.g., the integration of simulations in formal models of digital libraries; physics as a metaphor to model language change; and formalization of folk narratives for the extraction of test collections from unstructured big data. During his tenure at HB (2003-2018), he was responsible for setting up the Strategic Research Program for Data Science. He worked in science diplomacy during FP6, initiated and contributed to several national and international RTD projects during FP7 both in his native Hungary and in Sweden, among them [SHAMAN](#) and [PERICLES](#). He was co-founder of the [SQUALAR](#) (Scalable Quantum Approaches in Language Representations) initiative, served on the Editorial Board of *Journal of Documentation* and *Journal of Information Science*, and was Member of the Academic Board of the Graduate School of Language Technology at Göteborg University (Sweden). He will contribute to advanced knowledge formalization and the modelling of language-independent conceptual dynamics by working on T3.1 Formalisation of sustainable and resilient forest management knowledge models, T4.5 Social media sensing and concept extraction, and T5.3 Semantic framework for information fusion.

Prof. Elena Maceviciute (female) has graduated in library and information science programme at Vilnius University (Lithuania) and defended a doctoral dissertation at Moscow Institute of Culture and Arts in international and comparative information science. She worked at Vilnius University teaching courses in information and communication science and doing research until in 2000 she moved to Swedish School of Library and Information Science. She has been responsible for creating and leading the Master's programme in Digital Library and Information Services and teaching of information management courses. She has been involved in different national and international educational and research projects in Sweden and Lithuania. Among others, the projects financed by FP7 [SHAMAN](#) and [PERICLES](#); by structural funds of the EU LiBiTOP (Feasibility study of the optimisation of Lithuanian library network); by Swedish Research Council E-book in small language culture and others. At present she further works at the Swedish School of Library and Information studies, carries out research in the [SUITCEYES](#) (Improving the quality of life for people with deafblindness through intelligent haptic technologies) and leads the Department of Digital Cultures and Communication at Vilnius University. Her main research interest lies in the area of human and organisational information behaviour. She has conducted several projects involving their subjects into participatory design and her main contribution to SILVANUS will be to the methodology of participatory research and information sharing behaviour between the organisations and communities in different stages of fire prevention and post-fire rehabilitation.

Expertise relevant to the project

- Review of sustainable forest management services
- Forest resilience from historical case studies
- Systematic methodology for participatory process
- Assessment framework
- Citizen engagement programme for preventing wildfires
- Mobile application for citizen engagement
- Social media sensing and concept extraction
- Semantic framework for information fusion
- Platform integration
- Dissemination and communication across global communities
- Standards and compliance for interoperability of SILVANUS platform

Role in the project

The HB team members come from information science and have strong competences in several different areas, such as users' communication and information behaviour, information management, knowledge organisation, semantic relations and machine learning as well as in information systems. Team members have worked with developers of digital preservation systems, assistive technologies and different applications on evaluation of users' needs and transformation of those to system requirements, used participative design technologies and conducted analytical reviews of previous research in different related areas. Thus, the HB team will provide expertise in the area of citizen engagement and information use by citizens during the stage of fire prevention and monitoring of the environment, including the development of the methodology for the participatory process. They will be involved in the development of the

mobile application and its adoption by citizens as well as to the review of the sustainable forest management services and their relevance to the local population.

HB's support extends to various tasks spread over Phases A-C from the efforts towards conducting initial studies, building the knowledge base, engagement activities, development of methodologies and models and contributing to various. More specifically the contribution of HB to the SILVANUS project will be the following:

WP 1. HB will participate in general project management activities (T1.1).

WP 2. The HB representatives will bring to the tasks in this work package (T2.1-2.6) the understanding of information management, information distribution and use, as well as the participatory methodologies. HB will participate in reviewing forest management services, and development of models for treat assessment; will contribute to the development of methodologies for participatory methodologies and the assessment framework; and will also analyze the terminology of historical case studies to identify those core terms which, in dialogue with field experts, must be included in the ontology.

WP 3. The HB team will contribute significantly in application of participatory methodologies and information behaviour research findings to the development of the citizen engagement program for wildfire prevention (T3.5) and development usage of an app for this purpose (T3.6), as well as identify possible input of this knowledge in other phases of the forest management.

WP 4. To contrast with a more stable ontology structure, in T.4.5, HB will contribute to the management of dynamically changing concepts in social media and their ingest in semantic information fusion.

WP 5. By building on previous work conducted by HB (i.e., addressing the dynamics of knowledge organization, combined with graph layout visualization), in T5.3 dynamically changing incoming data will be tagged by ontology concepts in real time for decision support.

WP 8. HB will contribute with the knowledge of the assessment and evaluation of information systems and technologies with the end users (T.8.6).

WP10: The HB team will enact dissemination and exploitation activities as described in the proposal. It will also take part in the stakeholders 'community building and will contribute to standards and compliance for interoperability of the platform.

Relevant publications

Berström, A., Höglund, L., **Maceviciute**, E. Et al. (2017). Books on screens: Players in the Swedish e-book market. Gothenburg: Nordicom.

Darányi, S., **Olson**, N., Riga, M., Kontopoulos, E., & Kompatsiaris, I. (2019). *Static and Dynamic Haptograms to Communicate Semantic Content: Towards Enabling Face-to-Face Communication for People with Deaf-blindness*. Paper presented at the SEMAPRO 2019, The Thirteenth International Conference on Advances in Semantic Processing, Porto, September 22-26, 2019., Porto, Portugal. [Best paper award]

Darányi, S., Wittek, P. (2013) Demonstrating Conceptual Dynamics in an Evolving Text Collection. Journal of the Association for Information Science and Technology, ISSN 2330-1635, E-ISSN 2330-1643, Vol. 64, no 12, p. 2564-2572. At [diva2:869675](#)

Darányi, S., Wittek, P., Konstantinidis, K., Papadopoulos, S., Kontopoulos, E. (2016) A Physical Metaphor to Study Semantic Drift. Proceedings of SuCCESS-16, 1st International Workshop on Semantic Change & Evolving Semantics, 2016, Vol. 1695. At [diva2:1062332](#)

Kontopoulos, E., **Darányi**, S., Wittek, P., Konstantinidis, K., Riga, M., Mitzias, P., Stavropoulos, T., Andreadis, S., Maronidis, A., Karakostas, A., Tachos, S., Kaltsa, V., Tsagiopoulou, M., Avgerinakis, K. (2016) Deliverable 4.5: Context-aware Content Interpretation. PERICLES project. At [diva2:1063758](#)

Kontopoulos, E., Riga, M., Mitzias, P., Andreadis, S., Stavropoulos, T., Konstantinidis, K., Maronidis, A., Karakostas, A., Tachos, S., Kaltsa, V., Tsagiopoulos, M., **Darányi**, S., Wittek, P., Gill, A., Tonkin, E. (2016) Deliverable 4.4: Modelling Contextualised Semantics. PERICLES project. At [diva2:1063744](#)

Lindell E., Theil A., Guo L., **Olson** N., Korn O., Persson NK. (2021) Physical Add-Ons for Haptic Human-Surrounding Interaction and Sensorial Augmentation. In: Ahram T., Taiar R., Langlois K., Choplal A. (eds) *Human Interaction, Emerging Technologies and Future Applications III. IHET 2020. Advances in Intelligent Systems and Computing*, vol 1253. Springer, Cham. https://doi.org/10.1007/978-3-030-55307-4_28

- Manzuch, Z. and **Maceviciute**, E. (2020). Digital comics reading program for reducing the digital exclusion of people with hearing impairments. In: iConference: International Conference on Information: Sustainable Digital Communities: 15th International Conference, iConference 2020, Boras, Sweden, March 23–26, 2020, Proceedings / [ed] Anneli Sundqvist, Gerd Berget, Jan Nolin, Kjell Ivar Skjerdingstad, (p. 456-469). Cham: Springer.
- Nolin, J., Nelhans, G., & **Olson**, N. (2019). The Naming of the Beast: Scrutinizing Concepts of Technology Rich Futures. In A. G. M. M. I. S.-S. Andreas Lösch (Ed.), *Socio-Technical Futures Shaping the Present: Empirical Examples and Analytical Challenges* (pp. 231-254). Wiesbaden, Germany: Springer.
- Nolin, J., **Olson**, N. (2016). The Internet of Things and Convenience. *Internet Research*, 26 (2). [Available at: <http://www.emeraldinsight.com/toc/intr/26/2>]
- Olson**, N. & **Maceviciute**, E. (2020). Information worlds of people with deafblindness. In *Proceedings of ISIC, Pretoria, South Africa, 28-30 September, 2020*. *Information Research*, 25(4), paper isic2012. Retrieved from <http://InformationR.net/ir/25-4/isic2020/isic2012.html> (Archived by the Internet Archive at <https://bit.ly/3qNWKD7>) <https://doi.org/10.47989/irisic2012> [best paper award]
- Olson**, N., & Bae, J. (2019). Biosensors – Publication Trends and Knowledge Domain Visualization. *Sensors*, 19 (11, 2615), 31.
- Olson**, N., Urbański, J., Persson, N.-K., Starosta-Sztuczka, J., & Fuentes, M. (2019a). Sensor Technology, Gamification, Haptic Interfaces in an Assistive Wearable. *Journal on Technology and Persons with Disabilities*, 7(16), 79-87.
- Wittek, P., **Darányi**, S., Kontopoulos, E., Moysiadis, T., Kompatsiaris, I. (2015) Monitoring Term Drift Based on SemanticConsistency in an Evolving Vector Field. Proceedings of IJCNN-15. At [diva2:894316](#)

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
SUITCEYES	The SUITCEYES project aims to improve communication and life experiences of people with deafblindness by developing a smart, haptic interface that (a) extends the environmental perception and spatial orientation of the user, (b) extends the communication modalities and exchanges of semantic contents, and (c) enhances learning and user-engagement through gamification and mediated social interaction.	There are various elements of the SUITCEYES project that could inform SILVANUS, including: elaborate user-centred participatory methodologies; computer vision and sensing technologies; haptic communication; and semantic aspect of communication between the system and users.
PERICLES	PERICLES addresses the challenge of ensuring that digital content remains accessible in an environment that is subject to continual change in technology as well as in semantics, academic or professional practice, or society itself, which can affect the attitudes and interests of the stakeholders interacting with the content. PERICLES takes a ‘preservation by design’ approach that involves modelling, capturing and maintaining detailed and complex information about digital content, the environment in which it exists, and the processes and policies to which it is subject.	SILVANUS will capitalize from work in PERICLES related to contextualized semantics, both from an ontology vs. a high dimensional vector space perspective, developing ideas toward vector field semantics to address and formalize the inherent dynamics of knowledge organization. This ‘dynamics’ was found to be typical for expanding information universes, and the concept is underlying ideas in SILVANUS WP5, T5.3.
SHAMAN	The SHAMAN Integrated Project aimed at developing a new framework for long-term digital preservation (more than one century) by exploring the potential of recent developments in the areas of GRID computing, federated digital library architectures, multivalent emulation and semantic representation and annotation. It developed and tested a digital preservation frame-	The Digital Preservation approaches developed within SHAMAN can contribute to the design of ICT systems to automatically act on high volumes and dynamic and volatile digital content, keeping track of its evolving semantics and usage context and safeguarding its

	work including tools for analysing, ingesting, managing, accessing and reusing information objects and data.	integrity, authenticity and long-term accessibility over time.
PET – INCITE - TACIT	These are a number of collaborative projects funded regionally that all dealt with various issues of automated data and text analysis, including topic modelling and novel visualizations.	The insights gained and approaches developed within those projects can be utilized in SILVANUS in the analysis and representation of the results in for example data collected in interactions with the citizens.

Individual exploitation plan

The team at HB are researchers working at an academic institution, hence conducting research and pursuit of knowledge are core ambitions and will enhance the competency areas of the researchers involved. Project results are expected to inform relevant educational programs leading to the development of new generations of researchers. A central principle adopted by HB and well-recognized nationally is *sustainability* and therefore the ambitions of SILVANUS are well in line with the goals of the University. HB has close ties with the surrounding community and both public and private sectors and will therefore extend the utility of the results by networking and effectively disseminating the findings to relevant authorities and stakeholders including decision makers, the public and other interest groups (both independently and in collaboration with the Science Park).

Communication strategy for promoting project outcomes

The HB team will actively promote and disseminate project outcomes in multiple ways at local, regional, national and international levels. The activities will include production of scholarly publications, attending relevant conferences, holding workshops, press releases and engaging the press, production of popular scientific papers, engaging with stakeholders at all levels from the general public and firefighters to authorities and decision makers.

Description of significant infrastructure and major items of technical equipment relevant to the project

As a University, HB provides a suitable environment for the work that is intended to be conducted by this team. As well as a supportive and nurturing environment and provision of the general ICT tools and services, the University hosts an excellent library that provides extensive services in support of its users.

4.1.25 Agriculture university of athens

Partner Name: Agricultural University of Athens Company website: https://www.aua.gr Type: University	
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Partner profile

The **Informatics Laboratory of the Agricultural University of Athens (AUA Infolab)** was established in 1989. It is part of the Agricultural Economics and Rural Development Department which belongs to the School of Applied Economics and Social Sciences. Its mission is to support the research and educational needs of all faculties of the University. Its main activity is the education of students on topics of Information and Communication Technologies (ICT), so that the graduates of AUA can effectively use ICT in their everyday jobs. Moreover, its activities include research in topics of Agricultural Informatics and the application of ICT in Agriculture, Food and the Environment. Infolab's expertise focuses on the design and implementation of Web-based and mobile applications and tools for e-services (e-business, e-learning, e-government). In more detail, Infolab specializes in web technology, mobile

technology, information systems, e-business, e-learning, e-government, databases, big data analytics, artificial intelligence, neural networks, blockchain, and Internet of Things. Infolab has established collaborations with universities, research institutions, public agencies and businesses in national and European research projects. Infolab also engages in research outreach and dissemination through conferences, workshops, lectures, and seminars. The Department of Agricultural Economics and Rural Development has a faculty of 50 members (Professors, post-doc researchers and PhD candidates) and over 1,000 students.

CVs of involved key researchers / staff members

Prof. Constantina Costopoulou (F) is a professor at the Informatics Laboratory of the Agricultural Economics & Rural Development Dept. of the Agricultural University of Athens. She holds a BSc in mathematics from the National and Kapodistrian University of Athens, Greece, an MSc in software engineering from Cranfield University (former Cranfield Institute of Technology) and a PhD from the National Technical University of Athens, Greece. Her research interests include rural area networks, Web services, e-commerce, e-government, e-learning, and e-services for the agricultural sector. She has published more than 120 papers in scientific journals, edited volumes, and refereed conferences. She has also served as the scientific responsible or member of the working group of several funded projects in the above research areas.

Prof. Stavroula Galanopoulou (F) is a professor at the Department of Science of the Agricultural University of Athens, teaching Geology – Mineralogy – Petrography, Environmental Chemistry and Environmental Pollution. She has a Bachelor's degree from the Department of Geology of University of Patras, a M.Sc. degree from University of Aix – Marseille III (France) on Geosciences of the Environment and a Ph.D. from National Technical University of Athens (Greece) on mineralogy and environmental geochemistry. She has taught several classes on Geology – Mineralogy – Petrography, Environmental Pollution and Soil Science (undergraduate). She has been involved in national and international projects funded by European Union.

Prof. Spyridon Kaloudis (M) is a professor at the Department of Science of the Agricultural University of Athens. He was graduated of the Department of Forestry and Natural Environment, School of Geotechnical Sciences of the Aristotle University of Thessaloniki, Greece. He holds an MSc degree in Environmental Physics of the School of Sciences, Department of Physics of the National and Kapodistrian University of Athens. He got a PhD degree from the Agricultural University Athens, Informatics Laboratory, on Decision Support System for Forest Ecosystem Management Based on Geographic Information Systems and Knowledge Systems aiming at reducing wildfire damages. His research interests include intelligent decision support systems for forest management and wildfire risk assessment, wildfire indices, geographic information systems for forest management planning. He has also taken part as a member of the working group of several funded projects relevant to his research interests.

Prof. Maria Ntaliani (F) is a professor at the Informatics Laboratory of the Agricultural University of Athens (AUA). She is a graduate of the Department of Agricultural Economics and Rural Development and received her PhD in Informatics from AUA. Her scientific research work has been published in refereed journals, conferences and books. From 2005, she has been working in national and European research and development projects. Her research interests include e-government, e-business, e-commerce, e-learning and social networking focusing on the agricultural sector.

Dr. Konstantinos Demestichas (M) received his Diploma (2005), as well as his Ph.D. degree in Telecommunications (2009), from the School of Electrical and Computer Engineering of the National Technical University of Athens (NTUA). He also holds an MBA degree (2012) in Techno-Economic Systems through the joint postgraduates' programme of NTUA and University of Piraeus, as well as a Master's degree in Quality Assurance (2015) from the Hellenic Open University. His primary research interests include machine learning, software design and development, user preferences inference, and mobile applications. Since 2005, he has been actively involved in several European and national research projects in the aforementioned fields. He was also the concept initiator and primary proposal author of the EU funded projects EcoGem and EMERALD, where he has also assumed the role of scientific coordinator, focusing on machine learning techniques and data analytics. He served as the Project Coordinator of the H2020 INLIFE project and he is currently serving as the Project Coordinator of the H2020 MAGNETO project and

the H2020 PREVISION project. He has participated in the Technical Program Committees of international conferences and has assisted as a reviewer and editor in top ranked scientific journals. He has authored over 100 publications in the aforementioned fields and has also served as a technical expert for the European Commission.

Role in the project

- **WP1:** AUA will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** AUA will contribute to the development of forest landscape models, fire risk index evaluation in the context of agricultural burning, impact analysis of wildfire on farming.
- **WP6:** AUA will actively contribute to the development of ecological resilience programme carried out within Phase C trials.
- **WP7:** AUA will coordinate the activities of the workpackage and will promote policy recommendations for establishing EU forest governance. The industrial representation from farming and agriculture sector will be focused within the recommendation.
- **WP9:** AUA will participate in Phase C trials organized in Greece.
- **WP10:** AUA will promote the project outcomes through stakeholder engagement and engaging with the industrial vendors on environmental sensors.

Relevant publications, and/or products, services or other achievements

1. Kaloudis, Spiridon & Pantera, A & Papadopoulos, A & Galanopoulou, S. & Damianidis, Christos. (2019). Impact of human and environmental factors on land cover changes of an oak silvopastoral system. *Agroforestry Systems*. 10.1007/s10457-019-00437-w.
2. Petr, M., Vacchiano, G., Thom, D., Mairota, P., Kautz, M., Goncalves, L. M. S., ...Reyer, C. P. O. (2019). Inconsistent recognition of uncertainty in studies of climate change impacts on forests. *Environmental Research Letters*, 14(11), 113003. doi: 10.1088/1748-9326/ab4670
3. Kaloudis, Spiridon & Yialouris, Constantine & Lorentzos, Nikos & Karteris, Michael & Sideridis, Alexander. (2010). Forest management planning expert system for wildfire damage reduction. *Computers and Electronics in Agriculture*. 70. 285-291. 10.1016/j.compag.2009.07.020.
4. C. Costopoulou, S. Karetso, M. Ntaliani (2020). Investigating Educational Mobile Apps for Agriculture, *International Journal of Sustainable Agricultural Management and Informatics* (to be published).
5. Demestichas K, Peppes N, Alexakis T. Survey on Security Threats in Agricultural IoT and Smart Farming. *Sensors*. 2020; 20(22):6458.
6. Demestichas K, Daskalakis E. Information and Communication Technology Solutions for the Circular Economy. *Sustainability*. 2020; 12(18):7272.

List of relevant previous projects or activities, connected to the subject of this proposal

What follows is a selection of Infolab's recent projects:

1. “**Organic.Edunet**: A Multilingual Federation of Learning Repositories with Quality Content for the Awareness and Education of European Youth about Organic Agriculture and Agroecology” (2007-2010). Funded by the eContentplus Programme, <http://www.organic-edunet.eu/>
2. “**Rural inclusion**: e-Government Lowering Administrative Burdens for Rural Businesses” (2009-2012). Funded by the Competitiveness and Innovation Framework Programme (CIP), Policy Support Programme (PSP), <http://www.rural-inclusion.eu/>
3. “**Metaschool**: Enhancing Teachers Skills and Competencies on the use of Metadata, Learning Resources, and Learning Repositories” (2008-2010). Funded by Lifelong Learning Programme, Comenius, <http://www.ea.gr/ep/metaschool/>
4. “**Rural-eGov**: Training SMEs from Rural Areas in using e-Government Services” (2006-2008). Funded by Lifelong Learning Programme, Leonardo Da Vinci Programme (LdV), Transfer of Innovation, <http://rural-egov.eu>.
5. “**Bio@gro**: Demonstration of an online Multilingual Biological Agriculture eServices System for Organic Farmers, Traders, Institutions and Citizens” (2005-2007). Funded by the eContent Programme, <http://bioagro.hua.gr>

Individual exploitation plan

Thanks to its engagement in the project, AUA will strengthen its know-how in forest management and forest fire risk assessment using cutting-edge computing, sensing and data analysis technologies. The courses and term papers at AUA will be enriched with practical case studies from the subject matter of the project. Novel research activities will be launched by PhD candidates in the domain of innovative forest management. In addition, AUA will have the opportunity to exploit the knowledge and tangible results of the project for expanding its advisory and consultation role at national level as an institution for environmental protection in Greece. In close collaboration with the Region of Central Greece, as well as other regions, municipalities and forestry departments throughout Greece, AUA will explore more case studies for the deployment of the project's platform and services, for enhancing the resilience of forest regions in the country.

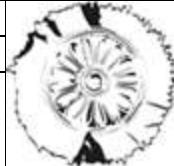
Communication strategy for promoting project outcomes

AUA will communicate the activities and results of the project inside the large community of the university (counting more than 7700 undergraduate students, 900 postgraduate students, and hundreds of faculty members) as well as other university and research networks in Greece. AUA will also disseminate project results in scientific journals (Agroforestry Systems, Agronomy, Computers and Electronics in Agriculture, Environmental Research Letters, Sustainability, etc.), conferences (such as the International Conference on Sustainable Forest Management, the International Conference on Forestry Science and Forest Management, the International Conference on Protection and Restoration of the Environment, etc.) and other events. AUA also organizes a large scientific conference on Geographic Information Systems on an annual basis. Moreover, AUA will reach out through its extensive network of contacts to local stakeholders in the agricultural industry, communities of farmers, environmental organizations, and policy makers. Last but not least, AUA is also active in social media for reaching out to the general public, especially for raising environmental awareness.

Description of significant infrastructure and major items of technical equipment relevant to the project

AUA owns the necessary computing infrastructure (servers, workstations) and S/W frameworks (Big data analytics, geographic information systems, social media analytics, and others) for carrying out research activities in the field of information and communication technologies applied in agriculture and for the environment. AUA also owns the necessary facilities for hosting conferences and workshops for stakeholder engagement and the dissemination of project results.

4.1.26 Centre for Research and Technology Hellas

Partner Name: Centre for Research & Technology Hellas	 CERTH CENTRE FOR RESEARCH & TECHNOLOGY HELLAS
Company website: https://www.certh.gr/root.en.aspx	
Type: Research	

Partner profile

The **Centre for Research and Technology-Hellas (CERTH)**, founded in 2000, is the only research centre in Northern Greece and one of the largest in the country. CERTH has important scientific and technological achievements in many areas including: Energy, Environment, Industry, Mechatronics, Information & Communication, Transportation & Sustainable Mobility, Health, Agro-biotechnology, Smart farming, Safety & Security, as well as several cross-disciplinary scientific areas. Today CERTH includes the following five institutes: (a) Chemical Process & Energy Resources Institute (CPERI), (b) Information Technologies Institute (ITI), (c) Hellenic Institute of Transport (HIT), (d) Institute of Applied Biosciences (INAB), (e) Bio-economy and Agro-technology Institute (IBO). Out of those, CERTH participates in SILVANUS through ITI. CERTH is essentially a self-supported Research Centre generating an average annual turnover of ~€ 45 Million coming from: (a) >30% from bilateral industrial research contracts, (b) >60% from competitive research projects, (c) <10% as government institutional funding. More than 900 people work at CERTH with the majority being scientists. CERTH has received numerous awards and distinctions, such as the European Descartes Prize, the European Research Council (ERC) Advanced Grant, the Microsoft International Contest Prize, the Trading Agents Competition Award, and many more, and is also listed among the Top-20 of the EU's Research Centres with the highest participation in FP7, as well as in H2020 competitive research grants. CERTH has participated successfully in more than 1.000 competitive research projects (with a total budget exceeding 423 M€ and involving more than 1.100 international partner organisations) financed by the European

Union (EU), leading industries from USA, Japan, and Europe, and the Greek Government via the General Secretariat of Research and Technology (GSRT).



The **Information Technologies Institute (ITI)** of the Centre for Research and Technology Hellas (CERTH) was founded in 1998 as a non-profit organisation under the auspices of the General Secretariat of Research and Technology of Greece (GSRT), with its head office located in Thessaloniki, Greece. Since 2000 it has been a founding member of the GSRT supervised CERTH. CERTH's related areas of R&D activities include: semantic multimedia analysis, indexing and retrieval, multimedia and the Semantic Web, knowledge structures, ontology construction, reasoning and personalisation for multimedia applications, distributed environments and Grid technology. The participating team of CERTH-ITI in SILVANUS will be the **Multimodal Data Fusion and Analytics Group (M4D)** of the **Multimedia Knowledge and Social Media Analytics Lab (MKLab)**.

MKLab, part of ITI, has authored over 180 publications in scientific journals, over 60 books and book chapters and over 580 presentations to international conferences. Additionally, the team has significant experience and scientific expertise on Social Media Monitoring and Social Network Analysis, Web Multimedia Mining, Image and Video Analysis, Multimedia Understanding, Interactive Multimedia Search and Knowledge Retrieval, Virtual and Augmented Reality, Artificial Intelligence (including Machine Learning and Deep Learning), Forensics, Semantic Technologies and Integration of heterogeneous resources, Knowledge Representation, Reasoning and Management, Computer Vision, Visual analytics, Big Data Analytics as well as Crisis and Security Management. The aforementioned experience was gained through its leading role in over 100 relevant projects, many of them in the security domain. Specifically in the Disaster Resilient Societies (DRS) sector, M4D/MKLab/ITI-CERTH has coordinated H2020 SEC-DRS **beAWARE** (which was considered and evaluated as a success story from the EU) and H2020 SU-DRS **aqua3S** and participated with a leading role in H2020 SU-DRS **INGENIOUS**. Additionally, M4D/MKLab/ITI-CERTH has coordinated H2020 SEC-FCT **CONNEXIONs**, H2020 SEC-BES **ROBORDER**, H2020 ICT **MindSpaces**, and H2020 ICT **V4Design**. Moreover, the team has been the Technical Manager in H2020 SU-FCT **INFINITY**, DT-MIGRATION **MiiCT**, DT-MIGRATION **WELCOME** and H2020 EO RIA **EOPEN**, and the Scientific Manager in H2020 SU-FCT **CREST**. Moreover, it has participated with leading roles in H2020 SU-ICT **ECHO**, H2020 SU-BES **ARESIBO**, H2020 DT-ICT **DIH^2**, H2020 SC6-MIGRATION **SO-CLOSE**, H2020 SU-FCT **PREVISION**, H2020 SU-DS **FORESIGHT**, H2020 SEC-FCT **PROPHETS**, H2020 SEC-FCT **TENSOR**. **M4D** has also participated in the COST Action MultiForesee and in FP7 SEC **HOMER**. The complete list of MKLab projects is available online: <http://mklab.iti.gr/projects>. The results of aforementioned European projects are also exploited through the lab's spin-off companies Infalia (www.infalia.com) and Carelia (<http://www.carelia.gr>).

CVs of involved key researchers / staff members

Dr. Ioannis (Yiannis) Kompatsiaris (male) is a Senior Researcher (Researcher A') with CERTH-ITI and head of the Multimedia Knowledge and Social Media Analytics lab (MKLab). His research interests include semantic multimedia analysis, indexing and retrieval, social media and big data analysis, knowledge structures, reasoning and personalization for multimedia applications, eHealth and environmental applications. He is the co-author of 144 papers in refereed journals, 51 book chapters, 10 patents and more than 490 papers in international conferences. He has participated in more than 30 EC funded projects, in 8 as the co-ordinator and he has been the co-organizer of various international conferences and workshops and has served as a regular reviewer for a number of journals and conferences. He is a Senior Member of IEEE and member of ACM.

Dr. Stefanos Vrochidis (male) received the Diploma degree in electrical engineering from Aristotle University of Thessaloniki, the MSc degree in radio frequency communication systems from University of Southampton, and the PhD degree in electronic engineering from Queen Mary, University of London. He is a Researcher with CERTH-ITI. His research interests include semantic multimedia analysis, indexing and retrieval, semantic search, multimedia search engines and human interaction, as well as security applications, including fight crime and terrorism, border surveillance, crisis management and cybersecurity. Stefanos Vrochidis has participated in more than 35 European and National projects, in 3 as Project Coordinator, 2 as Deputy project Coordinator and in 5 as Scientific or Technical Manager, dealing with analysis and retrieval of multimedia information. Stefanos Vrochidis has a long experience in security projects also due to the leading role he has in several H2020 security related projects (H2020 SEC-BES **ROBORDER**, H2020 SEC-DRS **beAWARE**, H2020 SU-DRS **aqua3S**, H2020 SEC-FCT **CONNEXIONs**, H2020

SU-FCT CREST, etc.). Stefanos Vrochidis has been among the organizers of several workshops, conferences and journal special issues and he has authored more than 180 related scientific journal, conference, and book chapter publications.

Dr. Ilias Gialampoukidis (male) received the Bachelor degree in Mathematics and the M.Sc. in Statistics and Modelling from the Aristotle University of Thessaloniki, where he also received a PhD degree in Mathematics, with a special interest in applied mathematics, time series analysis, stochastic modelling, and network analytics. He has been awarded the “Aristeia” Postdoctoral Fellowship 2016 from the Aristotle University of Thessaloniki, Greece. At the moment, Dr. Ilias Gialampoukidis is an interdisciplinary postdoctoral researcher at CERTH-ITI and he serves as a Work Package leader in H2020-EOPEN (<http://eopen-project.eu/>) and H2020-aqua3S (<https://aqua3s.eu/>). He has served both as a reviewer and as rapporteur of the COST Association evaluations. His research interests involve information retrieval, Big Data analytics, change detection, multimodal fusion, supervised (deep) and unsupervised learning, and social media network analytics. He has co-authored more than 35 publications in international journals conferences such as IEEE Intelligent Systems, International Journal of Critical Infrastructure Protection, Water MDPI, Sensors MDPI, Resources MDPI, IEEE Access, IEEE Transactions on Multimedia, Journal of Visual Communication and Image Representation, ISPRS Journal of Photogrammetry and Remote Sensing, EURASIP Journal on Image and Video processing, Signal Processing - Image Communication, IET Image Processing, Multimedia Tools and Applications, and conferences: ACM MM, CIKM, ECIR, ICIP, ICMR, ICME, ACM CoCo, SMAP, ACM SAC, COINS.

Stelios Andreadis (male) received his Bachelor degree in Computer Science in 2011 and received his MSc. Degree in Information Systems in 2014 from the same department. Since 2015, he has been working as a research assistant at the Information Technologies Institute of CERTH. He has a leading role in H2020 EO EOPEN (<http://eopen-project.eu/>) and also participates in H2020 DRS aquas3S (<https://aqua3s.eu/>). His research interests include Information Retrieval, Social Media Analytics, Web-based Applications and Semantic Web. He is the co-author of 5 journal and circa 30 conference publications.

Anastasia Mountzidou (female) received her diploma degree in Electrical and Computer Engineering in 2006, her first MSc degree dealing Advanced Systems of Computers and Communications in 2009, and her second MSc degree dealing with Informatics and Management in 2011, all from the Aristotle University of Thessaloniki. Since 2007, she has been working as a research associate in CERTH-ITI and her research interests include software engineering for database systems and web-based applications, semantic multimedia analysis and image indexing and retrieval, and artificial intelligence techniques related to visual analysis. She participated in the development of the interactive video retrieval engine VERGE (<http://mklab.itи.gr/verge/>) that has been used to compete in the related TRECVID competitions in years 2007-2019. She has participated in several European projects (e.g. PATExpert, hackAIR, MULTISENSOR, EOPEN, acqua3S) dealing with advanced patent document processing techniques, orchestration of personalized environmental services, and development of artificial intelligence techniques for identifying the content of EO and non-EO images. She is the co-author of 9 journal, 3 book chapter and 59 conference publications.

Role in the project

- WP1: CERTH will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- WP2: CERTH will contribute to the participatory process.
- WP3: CERTH will contribute to the development of knowledge representation
- WP4: CERTH will lead the activity on social sensing and concept extraction
- WP5: CERTH will contribute to information fusion framework
- WP8: CERTH will participate in the platform integration
- WP9: CERTH will participate in Phase A trial organized in Greece, by HRT
- WP10: CERTH will disseminate and exploit the relevant results from the project.

Expertise relevant to the project

The contribution of CERTH to the SILVANUS project will be to support the detection phase with the development of a social media monitoring module that will focus on citizen observations about potential fire events and the analysis of the collected textual and visual information, in order to detect location-related concepts in the text and fire-related concepts in the images. CERTH will bring its expertise and experience from other EU-funded research projects, i.e. H2020-beAWARE, H2020-EOPEN, and H2020- INGENIOUS

Relevant publications, and/or products, services or other achievements

- **D. Mantsis, M. Bakratsas, S. Andreadis, P. Karsisto, A. Mountzidou, I. Gialampoukidis, A. Karppinen, S. Vrochidis, and I. Kompatsiaris**, “*Multimodal Fusion of Sentinel-1 images and Social media Data for Snow Depth estimation*”, IEEE Geoscience and Remote Sensing Letters, 2020.
- W. Yao, **A. Mountzidou**, C. O. Dumitru, **S. Andreadis, I. Gialampoukidis, S. Vrochidis**, M. Datcu, and **I. Kompatsiaris**, “*Early and Late Fusion of Multiple Modalities in Sentinel Imagery and Social Media Retrieval*”, 11th IAPR International Workshop on Pattern Recognition in Remote Sensing (PRRS 2020/2021), in conjunction with the International Conference on Pattern Recognition (ICPR 2020), January 2021.
- **I. Gialampoukidis, A. Mountzidou**, M. G. Scarpino, G. Palumbo, **S. Vrochidis, I. Kompatsiaris**, F. Zaffanella, D. Norbiato, M. Ferri, and G. Vingione, “*Earth Observation and Social Multimedia Data Fusion for Natural Hazards and Water Management: The H2020 EOPEN Project Paradigm*”, 2nd International Conference Citizen Observatories for natural hazards and Water Management (COWM 2018), Venice, 27-30 November 2018.
- **Mountzidou A., Andreadis S., Gialampoukidis I., Karakostas A., Vrochidis S. and Kompatsiaris I.**, “*Flood relevance estimation from visual and textual content in social media streams*”, In Companion Proceedings of the The Web Conference 2018 (pp. 1621-1627), 2018.
- **Andreadis S., Gialampoukidis I.**, Fiorin R., Lombardo F., Norbiato D., **Karakostas A.**, Ferri M., **Vrochidis S. and Kompatsiaris I.**, “*Social Media Observations for Flood Event Monitoring in Italy over a One-Year Period*”, 2nd International Conference Citizen Observatories for natural hazards and Water Management (COWM 2018), 27-30 November 2018, Venezia, Italy

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SIL-VANUS
BeAWARE Enhancing decision support and management services in extreme weather climate events H2020-DRS-2015 http://beaware-project.eu/	Apart from the project’s coordination, CERTH was responsible for tasks about social media collection and analysis, image and video analysis, and semantic technologies for crisis management and disaster resilience.	<ul style="list-style-type: none"> • Social media crawler for fire incidents • Training dataset created by human annotation (relevant/irrelevant posts)
EOPEN Open interoperable platform for unified access and analysis of Earth Observation data H2020-EO-2017 https://eopen-project.eu	CERTH was involved mainly in research activities in the domain of knowledge discovery and knowledge representation. The tasks leaded by CERTH concerned social media crawling, change detection, concept and event detection, similarity fusion, the creation of an ontology for semantic reasoning, and the Web presence of the project.	<ul style="list-style-type: none"> • Social media crawlers • Concept detection on Twitter images • Localization based on locations mentioned in Twitter text
INGENIOUS The First Responder (FR) of the Future: a Next Generation Integrated Toolkit (NGIT) for Collaborative Response, increasing protection and augmenting operational capacity H2020-SU-SEC-2018 https://cordis.europa.eu/project/id/833435	CERTH contributes with the development and integration of an ontology-based framework for representing information about resources, entities and relations pertinent to the application domain of INGENIOUS. In addition, CERTH contributes with the collection and analysis of social media data to assist first responders with additional contextual information.	<ul style="list-style-type: none"> • Social media crawler for fire incidents • Heatmap of affected areas based on tweets

Individual exploitation plan

CERTH is interested in commercialising the developed modules through its spinoff company Infalia or licensing the developed services to interested clients. CERTH is already active in providing research services and results to the local and European industry through direct research contracts and licensing agreements. Part of the CERTH's business plan is to participate in a number of new spin-off commercial companies capable of exploiting its research when new market needs and solutions are identified.

Communication strategy for promoting project outcomes

Publication in journals and conferences; presentations in relevant workshops and conferences; liaison with and contribution to standardisation efforts, organisation of local and regional networking and communication workshops, summer schools to train trainers for end users of CALLISTO products and Copernicus services, training seminars and demonstration forums.

Description of significant infrastructure and major items of technical equipment relevant to the project

Through its involvement in the aforementioned projects, MKLab has built an infrastructure of considerable computational capacity (100+ cores, 600+ GB RAM, 40+ TB storage) and developed a sophisticated distributed architecture for data collection and indexing, as well as a variety of cutting edge data mining and retrieval algorithms. The team is therefore in excellent position to support a wide range of data collection, mining and indexing needs within research and innovation projects.

4.1.27 University of Thessaly

Partner Full Name	University of Thessaly - Panepistimio Thessalias	Logo	 UNIVERSITY OF THESSALY creative years
Short Name	UTH	Country	EL
Status	Research	Website	www.cs.uth.gr

Description

The University of Thessaly was founded in 1984 and its administrative and academic centre is in the city of Volos. In order to serve the needs of the region of Thessaly, its first Departments were based on agricultural, educational and technological sciences. Since 1984 and onwards the University of Thessaly has been gradually growing with new Departments in Greek cities Volos, Larissa, Trikala, Karditsa and Lamia. Today, University of Thessaly, with 37 Departments and 8 schools, is the third biggest University in Greece, with its own identity and with a prominent position in the Greek National educational system. University of Thessaly provides 105 undergraduate and postgraduate programs, and extra-curricular modules in specific research and business fields. It has more than 42.000 undergraduate students, about 4300 postgraduate students and about 1500 PhD students. It also has 1000 members of teaching and research staff and 450 members of administrative personnel. UTH will participate in the project with the Department of Informatics and Telecommunications.

The Department of Informatics and Telecommunications is located in the city of Lamia. It was created to cover important research areas like security, data management, augmented reality and computational intelligence. With a continuous development of the curriculum, the Department of Informatics and Telecommunications is always connected with the academy and industry offering to its students up-to-date knowledge on the critical areas of Computer Science. UTH will participate in the project with the Intelligent Pervasive Systems (iPRISM – www.iprism.eu) research group specializing in the applied distributed intelligence at multiple domains like data management, edge computing, internet of things and cloud computing.

Key Personnel

Dr Kostas Kolomvatsos (Male) received his Ph.D. from the Department of Informatics and Telecommunications at the National and Kapodistrian University of Athens (NKUA) in 2005 and in the beginning of 2013, respectively. He

serves as an Assistant Professor in the Department of Informatics and Telecommunications, University of Thessaly. He is the founder of the Intelligent Pervasive Systems (iPRISM – <http://www.iprism.eu>) research group in the Department of Informatics and Telecommunications. He has an experience of 16 years and participated in several projects realized in the context of EU Programs (FP6, FP7, H2020) as well as National Initiatives. He was a Marie Skłodowska-Curie Research Fellow (Individual Grant) in the MSCA-2016 call. He served as the Project Manager of the ENFORCE (H2020) project and serves as the Project Manager of the SaveWoodenBoats (National Initiative) project in the Department of Informatics and Telecommunications, University of Thessaly. His research interests are in the definition of Intelligent Systems and techniques adopting Machine Learning, Computational Intelligence and Soft Computing for Pervasive Computing, Distributed Systems, Big Data and Cloud Computing. In the aforementioned areas he has published over 100 papers.

Dr. Oikonomou Panagiotis (Male) received his Diploma degree (2008) and M.Sc. degree (2010) from the Dept. of Electrical and Computer Engineering, University of Thessaly, Greece. Since 2017 he holds a PhD in Temporospatial Organization of Circuits and Tasks over the Cloud from the same Dept. Currently he is a scientific scholarship holder and a postdoc researcher in Scheduling and Orchestration of Tasks in the Cloud at the Dept. of Computer Science, University of Thessaly, Greece. His research interests include CAD algorithms, Optimization algorithms, Cloud Computing and Soft Computational Methods. He is a member of groups developing open source platforms and member of Technical Chamber of Greece.

Dr George Floros (male) is a Postdoctoral Researcher and an Academic Instructor at the Department of Electrical and Computer Engineering at the University of Thessaly. He received his Engineering Diploma, M.Sc. and PhD degrees from the same department in 2013, 2015, and 2019 respectively. His research interests lie primarily in the areas of mathematical modeling and simulation of electronic circuits, model order reduction as well as embedded systems techniques.

Role in the Project

The participation of UTH in the project will be on the following subjects: the definition and preparation of the climate models, the implementation of data collection interfaces to earth observatory repository, the definition and development of forecasting models for assessing the fire threat risk, the implementation of intelligent algorithms for realizing an improved situation awareness and the management of large scale data upon which intelligent analytics will be delivered. Finally, UTH will participate in the integration, testing and validation activities of the project.

Experience

In recent years, UTH has been heavily involved in several National and European projects with focus on the application of intelligent algorithms (machine learning, artificial intelligence, optimization) in various domains. Additionally, the research team involved in the project exhibits significant experience in domain specific languages and the creation of abstractions of low level functionalities for hiding the complexity of the underlying processes. A number of tools have been designed and implemented to support intelligent analytics on top of streams derived by sensors. Multiple recent publications reveal the applied research performed by the Department of Informatics and Telecommunications while presenting the strengths of the proposed solutions. The main contributions involve: applied machine learning algorithms; distributed intelligence; proactive decision making; applied soft computing; spatio-temporal predictive models; optimization techniques; streams processing; semantic annotation and reasoning; intelligent analytics.

Role in the project

- **WP1:** UTH will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** UTH will engage in the participatory process to evaluate the health condition of frontline fire fighters.
- **WP5:** In collaboration with DELL, UTH will develop algorithms to evaluate the health status of fire fighters and incorporate the decision within the decision support system, responsible for response coordination.
- **WP8:** UTH will participate in the platform integration activity interfacing the algorithm in resource deployment.
- **WP9:** UTH will participate in Phase B of the trial organized in Greece by KEMEA.
- **WP10:** UTH will disseminate the project results through scientific publications.

Relevant Publications

- Kolomvatsos, K., 'Proactive Tasks Management for Pervasive Computing Applications', Journal of Network and Computer Applications (JNCA), Elsevier, 2021.
- Kolomvatsos, K., Anagnostopoulos, C., 'A Deep Learning Model for Demand-driven, Proactive Tasks Management in Pervasive Computing', IoT, MDPI, 2020.
- Kolomvatsos, K., Anagnostopoulos, C., Koziri, M., Loukopoulos, T., 'Proactive & Time-Optimized Data Synopsis Management at the Edge', IEEE Transactions on Knowledge and Data Engineering (IEEE TKDE), 2020.
- Kolomvatsos, K., Anagnostopoulos, C., 'An Intelligent Edge-Centric Queries Allocation Scheme based on Ensemble Models', ACM Transactions on Internet Technology, 2020.
- Savva, F., Anagnostopoulos, C., Triantafillou, P., Kolomvatsos, K., 'Large-scale Data Exploration using Explanatory Regression Functions', ACM Transactions on Knowledge Discovery from Data, 2020.
- Yiannis Kathidjiotis, Kostas Kolomvatsos, Christos Anagnostopoulos, 'Predictive Intelligence of Reliable Analytics in Distributed Computing Environments', Springer Applied Intelligence, 2020.
- K. Kolomvatsos, C. Anagnostopoulos, 'A Probabilistic Model for Assigning Queries at the Edge', Computing, Springer, 2020.
- Karanika. P. Oikonomou, K. Kolomvatsos, C. Anagnostopoulos, 'An Ensemble Interpretable Machine Learning Scheme for Securing Data Quality at the Edge', in International IFIP Cross Domain (CD) Conference for Machine Learning & Knowledge Extraction (MAKE) - CD-MAKE 2020, August 25-28, 2020.
- P. Fountas, K. Kolomvatsos, 'A Continuous Data Imputation Mechanism based on Streams Correlation', in 10th Workshop on Management of Cloud and Smart City Systems, in conjunction with IEEE Symposium on Computers and Communications (ISCC), 2020.
- Anagnostopoulos, K. Kolomvatsos, 'An Intelligent, Time-Optimized Monitoring Scheme for Edge Nodes', Journal of Network and Computer Applications, Elsevier, vol. 148, 2019.
- K. Kolomvatsos, 'An Efficient Scheme for Applying Software Updates in Pervasive Computing Applications', Journal of Parallel and Distributed Computing, Elsevier, vol. 128, 2019, pp. 1-14.
- K. Kolomvatsos, 'A Distributed, Proactive Intelligent Scheme for Securing Quality in Large Scale Data Processing', accepted for publication in Springer Computing, 2019.
- K. Kolomvatsos, C. Anagnostopoulos, 'Intelligent Applications over Large-Scale Data Streams', The Scottish Informatics & Computer Science Alliance (SICSA), DemoFest, Edinburgh, Scotland, Nov. 6th, 2018.
- K. Kolomvatsos, C. Anagnostopoulos, 'In-Network Edge Intelligence for Optimal Task Allocation', 30th International Conference on Tools with Artificial Intelligence, Nov. 5-7, Volos, Greece, 2018.
- K. Kolomvatsos, 'An Intelligent Scheme for Assigning Queries', Springer Applied Intelligence, <https://doi.org/10.1007/s10489-017-1099-5>, 2018.
- K. Kolomvatsos, P. Oikonomou, M. Koziri, T. Loukopoulos, 'A Distributed Data Allocation Scheme for Autonomous Nodes', IEEE International Conference on Scalable Computing and Communications, Guangzhou, China, Oct. 8-12, 2018.
- K. Kolomvatsos, P. Papadopoulou, S. Hadjiefthymiades, 'Data Storage in Internet of Things: A Proposed Distributed model', 12th Mediterranean Conference on Information Systems, Corfu, Greece, Sept. 28-30, 2018.
- K. Kolomvatsos, S. Hadjiefthymiades, 'Predictive Intelligence in Analytics Aggregation of Partially Ordered Subsets', IEEE Transactions on Systems, Man and Cybernetics: Systems, 2017.
- K. Kolomvatsos, 'An Intelligent, Uncertainty Driven Aggregation Scheme for Streams of Ordered Sets', Springer Applied Intelligence (APIN), doi 10.1007/s10489-016-0789-8, pp. 1-23, 2016.
- K. Kolomvatsos, C. Anagnostopoulos, S. Hadjiefthymiades, 'Distributed Localized Contextual Event Reasoning under Uncertainty', IEEE Internet of Things Journal, vol. 4(1), 2017, pp. 183-191.
- K. Kolomvatsos, C. Anagnostopoulos, S. Hadjiefthymiades, 'Data Fusion & Type-2 Fuzzy Inference in Contextual Data Stream Monitoring', IEEE Transactions on Systems, Man and Cybernetics: Systems, vol. PP, Issue 99, pp. 1-15, 2016.
- Anagnostopoulos, K. Kolomvatsos, 'A Delay-Resilient and Quality-aware Mechanism over Incomplete Contextual Data Streams', Elsevier Information Sciences Journal (INS), vol. 355-356, pp. 90-109, 2016.

Relevant Projects

- UTH participated the National Research Project **SWeFS** that focuses on the prevalence of forest fires in URIs zones through the adoption of innovative ideas in the areas of sensor networks, distributed vision systems, remote sensing, geographical information systems (GIS), data stream fusion, space-time predictive modeling and control systems.

- The **ECOSYSTEM** project concerns an intelligent platform for scheduling and administrating smart buildings. It involves tools and mechanisms that deal with the automatic management of building services. It also incorporates a learning mechanism and an adaptation scheme on the needs of the building in terms of the automatic management of the provided services. An abstraction layer is provided and the necessary hardware (sensors, actuators) accompanied by a portal for the design of the information flow.
- **NANOTRIM** is a tool for the continuous transistor sizing adopted in sensors systems. The project offers a toolset for nanoscale IC optimization. It aims to make significant advances in Electronic Design Automation (EDA) technology, to develop key enablers for the performance optimization of integrated circuits (ICs). This is targeted by means of innovative methods and algorithms, which are pioneered by the participating partners. The proposed activity is building on the learnings from both academic and industrial attempts to tackle a difficult yet attractive design problem. The approach taken is to perform continuous sizing optimization but in a constrained mode, in order to arrive at solutions that are reliably implemented, and easily integrated into mainstream design flows.
- **ENFORCE** provides solutions for the virtualization of Set-top Boxes (STBs - vSTBs) and iTV services chains while covering the programmability aspect of a fully virtualized infrastructure that is based on Software Defined Networking (SDN) and Network Functions Virtualization (NFV). ENFORCE proposes and evaluates monitoring mechanisms that are able to detect when QoS is violated, thus, re-configuration actions should be fired. The final aim is to meet a pre-defined set of QoS requirements for each interactive application.
- **SaveWoodenBoats** provides a platform for the management of digitized information of wooden boats to expose it in an Augmented Reality (AR) application. The aim is to have users diving in a boat exhibit remotely through their personal devices.
- The **GeoMake-It** project aims at providing an online platform where users with little or no programming background can design and launch their own Geo-Game. In other terms, the goals and expected market exploits of the GeoMake-It project don't concern with launching a successful Geo-Game (although demo games will be implemented for evaluation purposes). Rather than that, the project target is to provide the means in order to enable people with little relevant background, become Geo-Game authors. The vision is to provide suitable graphical interfaces, so that even users belonging to the age group 10-14 years can author simple Geo-Games for fun with friends or profit.

Infrastructure

The infrastructure available includes a number of PCs, high speed networks and the appropriate software.

4.1.28 Association of Instituto Superior Técnico for Research and Development

Partner Name: Instituto Superior Técnico	 Associação do Instituto Superior Técnico para a Investigação e Desenvolvimento
Company website: http://tecnico.ulisboa.pt	
Type: University	

Partner profile

Instituto Superior Técnico (IST) is the largest engineering school in Portugal. The University of Lisbon (UL) to which IST belongs was recently ranked as second in the research productivity based Ibero-American ranking. IST hosts several research units being MARETEC (Marine, Environment and Technology Research Centre) the research unit participating in the project. This research unit has a large experience in applying multidisciplinary and innovative approaches to study the complexity of environmental systems in the context of sustainability and policy-making. This project fits in MARETEC strategic lines of Sustainability Assessment and Grazing for Sustainability. MARETEC's team is engaged in the development of sustainable industry 4.0 solutions for pastures and grazing animals. Overall, the aim is to mitigate the impacts of livestock production and enhance the environmental and social benefits through better land cover and grazing management, while maintaining farming economic viability.

CVs of involved key researchers / staff members

Vânia Proença, PhD in Ecology, is an Assistant Researcher at MARETEC - Centro de Ciência e Tecnologia do Ambiente e do Mar, Instituto Superior Técnico, University of Lisbon. Her research activity focus on biodiversity patterns and processes, and the use of biodiversity data, indicators and models to assess biodiversity change and its effects on ecosystem functions and services, from local to global scales. She has more than 40 scientific publications and has participated in 15 projects, mainly on biodiversity and ecosystem services from local to global scales. She

was part of the scientific team of the Portugal Millennium Ecosystem Assessment and a co-editor of the final report, was a lead author of a report on biodiversity scenarios for the 21st century for the Global Biodiversity Outlook 3, a contributor to the GEO BON Terrestrial species working group, served as a Lead Author and Contributing Author in four IPBES reports, and was nominated for the Technical Advisory Group on Biodiversity and Ecosystem Services of the Livestock Environmental Assessment and Performance Partnership (hosted by FAO). She will be part of the Portuguese cluster contributing with biodiversity monitoring and assessment to evaluate the effectiveness of nature-based fire prevention and restoration approaches.

Expertise relevant to the project

IST-ID will be engaged in the activities implemented in the Portuguese demonstrator, namely on biodiversity and ecosystem assessment, test and development of monitoring indicators, integrating multiple data sources (in-situ, local sensors, drone, satellite). IST-ID will also contribute to WP9 and WP2 in the development of tools for sustainable forest and landscape management and restoration.

Role in the project

- **WP1:** IST will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** IST will aggregate feedback from landowners on the biodiversity resilience and ecological balance to be maintained.
- **WP6:** IST will contribute to the ecological governance framework developed in collaboration with other partners.
- **WP9:** IST will participate in Phase A and C of the pilot demonstration in Portugal.
- **WP10:** IST will disseminate the project outcomes through stakeholder engagement from energy distribution network

Relevant publications, and/or products, services or other achievements

- FAO. 2020. *Biodiversity and the livestock sector – Guidelines for quantitative assessment – Version 1*. Rome. <https://doi.org/10.4060/ca9295en> [V.Proença was part of the Technical Advisory Group that produced the report]
- Proença, Vânia; Teixeira, Carlos M. G. L. 2019. "Beyond meat: Ecological functions of livestock". *Science* 366 (6468): 962-962. <http://dx.doi.org/10.1126/science.aaz7084>
- Ribeiro, Inês; Proença, Vânia; Serra, Pere; Palma, Jorge; Domingo-Marimon,Cristina; Pons, Xavier; Domingos, Tiago. 2019. "Remotely sensed indicators and open-access biodiversity data to assess bird diversity patterns in Mediterranean rural landscapes". *Scientific Reports* 9 (1). <http://dx.doi.org/10.1038/s41598-019-43330-3>
- Navarro, Laetitia M; Marques, Alexandra; Proença, Vânia; Ceausu, Silvia; Gonçalves, Bárbara; Capinha, César; Fernandez, Miguel; Geldmann, Jonas; Pereira, Henrique M. 2017. "Restoring degraded land: contributing to Aichi Targets 14, 15, and beyond". *Current Opinion in Environmental Sustainability* 29: 207-214. <http://dx.doi.org/10.1016/j.cosust.2018.03.014.10.1016/>
- Proença, Vânia; Martin, Laura Jane; Pereira, Henrique Miguel; Fernandez,Miguel; McRae, Louise; Belnap, Jayne; Böhm, Monika; et al. 2017. "Global biodiversity monitoring: From data sources to Essential Biodiversity Variables". *Biological Conservation* 213: 256-263. <http://dx.doi.org/10.1016/j.biocon.2016.07.014.10.1016/>
- Proença, Vânia; Pereira, Henrique M.; Vicente, Luís. 2010. "Resistance to wildfire and early regeneration in natural broadleaved forest and pine plantation". *Acta Oecologica* 36 (6): 626-633. <http://dx.doi.org/10.1016/j.actao.2010.09.008.10.1016/>

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FOR-TORI
ECOPOTENTIAL: IMPROVING FUTURE ECOSYSTEM BENEFITS THROUGH EARTH OBSERVATIONS (H2020, EC)	Use of satellite driven indicators for biodiversity and ecosystem services monitoring	Remote sensing approaches for biodiversity monitoring

SILVPAST - Cost-efficient implementation of silvo-pastoral mosaics of Quercus pyrenaica (PDR2020/IFAP,Portugal)	Biodiversity indicators to monitor grazing approaches for fire prevention and ecosystem restoration	Optimization of extensive grazing as a nature-based solution and tool for fire prevention and forest ecosystems management and restoration.
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Individual exploitation plan

- Optimization of biodiversity survey approaches and data processing
- Development of remote-sensing based approaches and tools for biodiversity monitoring from local to landscape scales
- Development of algorithms for the integration of biodiversity data from multiple sources (in-situ, local sensors, drone, satellite) in ecological assessment and predictive models.

Communication strategy for promoting project outcomes

- Publication of scientific papers in national and international journals, and participation in scientific conferences.
- Dissemination of project results in MARETEC and IST social networks

Description of significant infrastructure and major items of technical equipment relevant to the project

- Computers, servers and data hosting

4.1.29 VELEUCILISTE VELIKA GORICA

Partner Name: University of Applied Sciences
Velika Gorica

Veleučilište Velika Gorica

Company website: www.vvg.hr

Type: International collaborator



Partner profile

The University of Applied Sciences Velika Gorica is a Croatian higher education institution founded in 2003 with a mission to develop, modernize and implement specialized undergraduate and graduate professional study programmes in the areas of crisis management, optometry, information technologies, motor vehicle maintenance and aircraft engineering. The University is located in Velika Gorica near the capital city of Croatia, Zagreb.

By providing Crisis Management undergraduate and graduate study programmes, as well as short specialized courses, the University became a proud national and regional centre of higher and lifelong education and Centre of Excellence in the field of Crisis/Disaster Management.

The quality of the study programmes is guaranteed by the continuous cooperation of the University with Croatian institutions such as Ministry of the Interior, Croatian Mountain Rescue Service, Centre 112, Emergency Medical Service, Croatian Red Cross and Croatian Firefighting Association, which is the member of the project consortium. The cooperation with the Croatian Firefighting Association is especially productive, given that the Association is also a project partner on the ESF project „Crisis Management, Optometry, Aircraft and Vehicle Maintenance – Qualifications Framework“.

The University is currently an active participant in 5 projects funded by the European Union and has successfully concluded participation in 2 major projects, one of which was Horizon2020. The total budget of the University in these 7 projects is approximately 1.165.000,00 €. The University actively promotes student and staff mobility in order to increase expert competencies and facilitate the exchange of knowledge and experience of the crisis management professionals. As a result of staff mobility, the University has become a proud member of CONRIS Network (Cooperation Network for Risk, Safety & Security Studies), a network of universities with accredited degree programs in risk, safety and security management, which aims at increasing safety and security in Europe through collaboration in education and research. The University has established especially constructive cooperation with the Faculty of Criminalistics, Criminology and Security Studies of the University of Sarajevo. We strongly believe that the Faculty shall recognize the importance and benefits of this project and that the cooperation of two universities shall enable for the Firefighting Association of Bosnia and Herzegovina to become the potential end-user of the project.

CVs of involved key researchers / staff members

Ivan Toth, PhD, graduated in 1981 at the Faculty of political sciences in Zagreb where he obtained a master's degree in 2001 in the area of National security. He holds a PhD in the area of International law. His professional career includes working as Head of Security in "Končar" and Senior Consultant for operational planning and Head of the Civil Protectorate Headquarters of the Republic of Croatia withing the Ministry of Defense. Since 2004 he holds the position of Dean at the University of Applied Sciences Velika Gorica where he lectures courses on civil protection and crisis management. He also lectures at the College of Occupational Safety and Health in Zagreb. Apart from his participation and organization of numerous congresses and conferences both in Croatia and abroad, he has founded the Croatian Crisis Management Association in 2004. He published 8 books and over 50 professional and scientific papers. He has received some of the most prestigious Croatian awards, including 4 awards by the President of Croatia, and Annual award by the Ministry of Interior. He will be responsible for coordination of UASVG activities and personnel in order to ensure results relevant for the Croatian pilot within the SILVANUS project. Apart from ensuring that these results are disseminated and exploited, he will especially be engaged in the activities of pilot outcome assessment and replicability studies. The participation in these activities will contribute to the quality testing and validation of platform whose aim is to enhance combating wildfire.

Ivan Nad, PhD, Assoc. Prof., graduated from the High School for Internal Affairs in Zagreb, as well as the Zagreb University Faculty of Kinesiology. In 2011 he received a master's degree in Criminalistics by completing the Zagreb Police College postgraduate professional study programme in Criminalistics. In 2009 he received a Master of Science degree in the field of Criminal Law from the "St. Cyril and Methodius" University, Law School "Justinian the First", by completing a postgraduate study programme in Criminal Law and Criminology. In 2011 he completed a doctoral study programme in Criminal Law at the same university and obtained a scientific degree as a Doctor of Law.

Since 1 October 2012 he has been employed as a lecturer at the University of Applied Sciences Velika Gorica in Velika Gorica, and since 2015 he has held the position of a Vice-Dean of Teaching Activities and performed professorial duties for several courses on the professional study programme in Crisis Management, specifically the courses in Data Protection, Critical Infrastructure and Protection of Persons and Property; as well as teaching a course in Critical Infrastructure Management at the specialist graduate study programme in Crisis Management. He has authored and co-authored 11 books and 47 scientific and professional papers in the fields of Police Law, Criminalistics, Private Protection, and papers dealing with the quality management system. As Assistant Coordinator of UASVG activities, he shall contribute in the areas of project and innovation management, as well as dissemination and exploitation of the project.

Sanja Kalambura, PhD, Prof. Sanja Kalambura holds a PhD in eco engineering at the University of Zagreb, Zagreb, Croatia, and she has more than 20 years of experience in ecology, waste management sector with an emphasis on strategic planning, nature remediation, education and communication. She holds the position of a Vice-dean of Science and Quality at the University of Applied Science Velika Gorica. In the last 18 years of teaching, she has taught Waste management, Ecology, Chemistry, Waste management in Agriculture, Strategies and planning in waste management sector at the University of Applied Science Velika Gorica, the University of Applied Health Science and the Agriculture Faculty of the University of Zagreb.

She has been a researcher at Agricultural Faculty, University of Zagreb in waste management with focus on bio waste processing and bio gas. With a research background, she has contributed in more than 150 peer review scientific papers and numerous proceedings at international conferences. She is author and coauthor of 12 scientific books in ecology and waste management sector. She has several international experiences including a stay at SWECO company, Sweden, guest professor at University of Padova, Italy, guest professor at University of Coimbra, Portugal.

Her experience includes strategic environmental protection aspects as well as daily management. She has experience from sustainable waste management planning, integrating with other parts of city planning. Prof. Kalambura has extended experience as project leader including education and public awareness campaign for two large Counties in Croatia. She is a leader of waste management group in Croatian Academy of Science for last 8 years, member of International waste working group, a member of the board for International waste management conference in Zagreb, Crisis management days and review for Waste management and research.

In 2020 she was given The Croatian National Science Award. Her expertise in the area of ecology will significantly contribute to the projects activities that deal with environmental threat level models, evaluation of damage assessment

and ecological impact, as well as models of biodiversity. All these activities are a part of establishing environmentally sustainable, resilient forest models and assessment framework, as well as culture of risk aversion against wildfire for sustainable forest management.

Igor Milić has been working in the area of civil protection since 2000. He is currently employed by the Ministry of Interior of the Republic of Croatia where he holds the position of Head of Preparedness and Coordination Sector in the Civil Protection Directorate. His main responsibilities include operational coordination of the civil protection forces, organization of training and exercises, drafting civil protection sub laws and development of international projects. He has been involved in numerous operations related to floods, refugee's crisis, COVID-19 pandemic and earthquake in Zagreb (March 2020) in Croatia, as well as in providing international assistance to foreign countries. He is trained within Union Civil Protection Mechanism, UNDAC and IFRC Regional Disaster Response Team. His activities are currently oriented towards training and lecturing in international courses and exercises. Special focus of his activities is put on raising preparedness of civil protection teams and organization of tabletop and field exercises in the area of civil protection, both on national and international level. He graduated in the field of Crisis Management at the University of Applied Science of Velika Gorica where he is currently a lecturer of Disaster Assessment and Disaster Management in the European Union. He is also associate lecturer of Logistics and Security, Crisis Management on Government Level and Designing Crisis Response Exercises. He holds a master's degree from the Faculty of Criminalistics, Criminology and Security Studies of the University Sarajevo on the topic of Crisis Management in Security Sector where he is now on doctoral studies on security issues. He published 15 expert papers on wide area of topics related to Crisis Management. He has extensive experience in EU funded project in the civil protection area (IPA 1 and IPA 2 for southeast Europe, IPA FLOODS for SEE, MURA 2015, ADRIATIC 2017, EU for Civil Protection in Bosnia and Herzegovina – ongoing, Heavy USAR Module – INSARAG certification – ongoing, Helicopters support for civil protection operations - ongoing) where he had different positions (team leader, key-expert, non-key expert). As an expert in civil protection with necessary experience relevant to the SILVANUS project, his scientific approach will contribute to the monitoring and assessing the outcome of the Croatian pilot. He will also be engaged in the activities of establishing environmentally sustainable, resilient forest models and assessment framework, as well as culture of risk aversion against wildfire for sustainable forest management. Alongside Project Coordinator of the UASVG activities within the Croatian pilot, he will be engaged in the activities of platform integration, testing and validation.

Martina Mihalinčić, PhD, obtained a Master of Science degree in 2003 and a PhD in Comparative Politics in 2020 at the Faculty of Political Science, University of Zagreb. In 2010 she began to work at the University of Applied Sciences Velika Gorica and currently holds the position of Senior Lecturer. She is a lecturer of Communicology and Public Relations and has published numerous papers on the topics of communication within the area of Crisis management. She has published scientific and professional papers, as well as participated in numerous national and international conferences. Her role in the project would be essential in the development of citizen engagement programme for prevention of wildfires within the area of risk prevention culture. As an expert in the field of communication, she will also be of great importance in dissemination of project results.

Expertise relevant to the project.

- Ivan Toth, PhD – Coordinator of the UASVG activities within the Croatian pilot who will be responsible for project management and innovation management, as well as dissemination and exploitation activities. He will also be engaged in the activities of platform design specification, integration, testing and validation and large-scale demonstration activities of project outcomes.
- Ivan Nad, PhD – Assistant Coordinator of UASVG activities will contribute to the successful completion of activities within the project coordination and dissemination and exploitation.
- Sanja Kalambura, PhD – Environmental scientist whose expertise will be implemented in the activities that deal with establishing environmentally sustainable, resilient forest models and assessment framework, as well as the culture of risk aversion against wildfire for sustainable forest management.
- Igor Milić - Crisis management expert who will be involved in activities of the environmentally sustainable, resilient forest models and assessment framework, culture of risk aversion against wildfire for sustainable forest management and large-scale demonstration activities of project outcomes. He will also contribute to the integration of the platform, as well as its testing and validation.
- Martina Mihalinčić, PhD – As an expert in the field of communication, her role will be significant within dissemination and exploitation activities of the project, as well as culture of risk aversion against wildfire for sustainable forest management.

Role in the project

- **WP1:** UASVG will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** UASVG will collaborate with TUZVO in the development of the participatory process.
- **WP3:** UASVG will contribute to knowledge representation model, forest fire ignition models and citizen engagement programme.
- **WP9:** UASVG will contribute to the Phase A pilot demonstration in Croatia.
- **WP10:** UASVG will disseminate the project through conferences, knowledge transfer programs and other established communication channels.

Relevant publications, and/or products, services or other achievements

Apart from active participation in projects, the University also publishes the international scientific journal Annals of Disaster Risk Sciences (ADRS), which is the result of successful organization of international scientific conference Crisis Management Days. The University organized the last conference May 27-29, 2019 in Šibenik, Croatia, under the Patronage of the President of the Republic of Croatia Kolinda Grabar-Kitarović. The Conference gathered leading experts and scientists in the field of crisis management in order to explore all scientific fields that deal with various aspects of crises. Unfortunately, the 2020 edition of the Conference edition of the conference was cancelled due to the outbreak of COVID-19 pandemic.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
ECHO/SUB/2014/696006 RECIPE - Resilience of Critical Infrastructure Protection in Europe; DG – ECHO: EU Civil Protection Mechanism https://ec.europa.eu/echo/funding-evaluations/financing-civil-protection-europe/selected-projects/resilience-critical-en	The aim of the project was to strengthen the resilience of critical infrastructure protection systems both at national and European level by filling the gaps in the management and protection of critical infrastructure. UASVG was one of the project beneficiaries and the amount awarded during the project was app. 50.000,00 €.	Dean Ivan Toth was the Scientific coordinator of the project and understands the operational as well as scientific nature of EU funded projects in the area of Crisis Management. Ivan Nad and Martina Mihalinčić were project assistants on the same project. It was the first project that gave UASVG experience with EU funding.
H2020-DRS-201-GA No. 653824 EU-CIRCLE – A panEuropean framework for strengthening Critical Infrastructure Resilience to Climate Change; Horizon 2020; www.eu-circle.eu	The aim of the project was to derive an innovative framework for supporting the interconnected European Infrastructure's resilience to climate pressures. That was achieved by the development of a validated Climate Infrastructure Resilience Platform. UASVG was one of the project beneficiaries and was awarded app. 214.000,00 € during the project.	EU-Circle was HORIZON2020 project, which gave the University more experience in participating within international consortiums in EU funded projects. The topic regarding Infrastructure resilience to climate pressure falls under the scientific area of Crisis management. Dean Ivan Toth participated in most activities, which gave him relevant experience for participating in the SILVANUS project.
ISFP-AG952825 DroneWISE Internal Security Fund for Police ISFP-2019-AG-PROTECT www.dronewise-project.eu	DroneWISE will develop a Counter-UAV Command, Control and Coordination Strategy for first responders, supported by Counter-UAV Command Training for all first-responder agencies, including tactical options and decision-making frameworks, underpinned by a Counter-UAV Command Training Handbook, all being made readily accessible via a Counter-UAV Online Training Portal.	One of the project members within the DroneWISE consortium is Rignard d.o.o.. UASVG has established a fruitful cooperation within the project and we are certain that the cooperation will be continued on SILVANUS project.

UP.03.1.1.03.0068. Crisis Management, Optometry, Aircraft and Vehicle Maintenance – Qualifications Framework ; European Social Fund (ESF) - Operational Programme Efficient Human Resources https://esf-kozmok.vvg.hr/	<p>The main goal is to develop 5 occupational standards in accordance with the Croatian Qualifications Framework: Engineer of Management in Crisis Situations, Engineer of Crisis Management, Engineer of Air-Craft Engineering, Engineer of Motor Vehicle Maintenance and Engineer of Optometry. For all these occupational standards, the expert groups will also develop standards of qualifications that are relevant for these occupations and implement them together on the study programmes at the University. The project is consisted of another two elements which aim to increase the quality of study programmes and student experience, including various workshops, conceptual models to facilitate student traineeships and reduce administration and procurement of equipment for the laboratory for optometry. UASVG is awarded by app. 535.000,00 €.</p> <p>This project is conducted in partnership with the Croatian Association, which is one of the members of the consortium of the SILVANUS project. Since the partnership on this project has been successful and constructive, we believe that this partnership shall continue to grow within the SILVANUS project. Given the fact that we plan on working to these occupations and implement them together on the activity of pilot: Accidents and incidents caused by human error – The project is consisted of another two elements which aim to increase the quality of the two institutions is of crucial importance.</p>
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Individual exploitation plan

UASVG is an institution determined to develop the field of crisis management by implementing new practices, knowledge and skills. Given that the SILVANUS project deals with wildfire prevention, which is an important part of crisis management, this project shall significantly increase institutional, as well as staff competency of UASVG.

Communication strategy for promoting project outcomes

Since this project proposal deals with fighting forest fires, an important subject within Crisis Management, members of the project consortium have a unique opportunity to disseminate project results at the scientific international conference Crisis Management Days organized by the UASVG. The University has its own internet website (<https://vvg.hr/>) where all activities of the University are recorded, including major breakthroughs on EU projects. There is also a special part of the website that is dedicated to UASVG projects where the visibility of this project would be guaranteed. Alongside UASVG website, the University continuously updates its social media presence through Facebook and LinkedIn channels.

Description of significant infrastructure and major items of technical equipment relevant to the project

UASVG University campus consists of two modern buildings with 19 lecture rooms and 15 offices for teachers, including 851 seating places, 220 computers and a fully equipped laboratory of optometry. Its modern infrastructure and equipment, as well as professionals with expert knowledge and experience, provide excellent pre-conditions for successful and quality research relevant for this project.

4.1.30 INSTITUTE OF INFORMATICS OF THE SLOVAK ACADEMY OF SCIENCES (Ústav informatiky Slovenskej akadémie vied)

Partner Name: Institute of Informatics of the Slovak Academy of Sciences (Ústav informatiky Slovenskej akadémie vied v Bratislave) Company website: https://www.ui.sav.sk/ Type: International collaborator (Research)	 INSTITUTE OF INFORMATICS SLOVAK ACADEMY OF SCIENCES
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Partner profile

Institute of Informatics of the Slovak Academy of Sciences (UISAV¹) is one of more than 50 scientific and research institutes of the Slovak Academy of Sciences in Bratislava, Slovakia. UISAV, established in 1956, is a leading research institute in informatics and information technology in Slovakia. The Institute employs around 70 researchers; almost half of them are women. The scope of research and development activities includes informatics, information technology, robotics, control theory and artificial intelligence. The Institute is very active in EU-wide and national research projects, mainly in the areas of distributed computing, grid and cloud computing, knowledge management, information security and data processing. It is structured into eight departments covering a wide range of technologies: Parallel and Distributed Information Processing, Design and Diagnostics of Digital Systems, Numerical Methods and Algorithms, Speech Analysis and Synthesis, Discrete Process Modelling and Control, Sensor Systems, PCB Design and Production and Electron Beam Lithography.

The principal department leading the participation of UISAV in the SILVANUS project is the:

- **Department of Parallel and Distributed Information Processing** (PDC) with an excellent track record in participating in EU and national research projects and in cooperating with IT industry. The department started to be engaged in European research in the 4th Framework Programme, and since it has participated in over 60 research projects, steadily moving from distributed and HP computing, through Grid to Cloud Computing as well as Big Data and Artificial Intelligence research. UISAV has strong experience in both research and commercial applications in the Information retrieval and processing field. UISAV has cooperated with different types of business sectors e.g.: advertising (Magnetic Media – US-based company), social media (Connectik – Switzerland-based company) and media monitoring (SCS – Switzerland-based company) as well as security field of mobile device and Big Data transfer and preparation for automated data privacy tools (IBM Slovakia). In the research area of security and large data aggregation and processing UISAV participated in SECRICOM and REDIRNET project. The strong technological expertise of UISAV, based on Big Data management, knowledge management and modelling using machine learning and deep learning techniques, semantic based communication processing and metadata for accessing document repositories make the excellent starting point for the SILVANUS project.

There other department to be involved in the SILVANUS project is the:

- **Department of Modelling and Control of Discrete Processes** - the department since long has been orienting on research of complex systems with emphasis on discrete and event systems. Distinguished results were achieved in the domain of agents and multi-agents technology. The research is oriented on coordination and cooperation of mobile agents, application of artificial intelligence methods, distributed intelligence and distributed control. The goal is to research and evolve methods of collective intelligence and apply the results in the area of swarm robotics, social systems, economic and political systems.

UISAV is also publishing an academic Current Content journal, Computing and Informatics² (CAI). The journal is published under a delayed open access model (all publications are available in golden open access status six months after the publication).

CVs of involved key researchers / staff members

The following persons will be the key members of the consortium from the UISAV side responsible for the management and fulfilment of tasks in the SILVANUS project:

- **Assoc. Prof. Ladislav Hluchý, PhD. (M)** is the head of the Department of Parallel and Distributed Information Processing. He has been the director of the Institute of Informatics, Slovak Academy of Sciences (UISAV) for more than 20 years. He received his MSc and PhD degrees both in Computer Science. He has rich experience as a R&D project manager, work-package leader and coordinator in projects of the 4th, 5th, 6th, 7th Framework Programmes and H2020 program; e.g. PROCESS (PROviding Computing solutions for ExaScale ChallengeS), DEEP - Hybrid Data Cloud (Designing and Enabling E-infrastructures for intensive Processing in a Hybrid DataCloud), EOSC-hub (Integrating and managing services for the European Open Science Cloud), EUSAS (European Urban Simulation for Asymmetric Scenarios EDA A-0938-RT-GC), VENIS (Virtual Enterprises by Networked Interoperability Services FP7-284984), ADMIRE (Advanced Data Mining and Integration Research for Europe FP7-215024), REDIRNET (Emergency Responder Data Interoperability Network FP7-607768), Pellucid (A Platform for Organisationally Mobile Public Employees IST-2001-34519), ANFAS (Data Fusion for Flood Analysis and Decision Support IST-1999-11676), as well as multiple Slovak national R&D projects. He is a member of IEEE, e-IRG, EGI Council, the Editor-in-chief of the CC journal Computing and Informatics. He is also (co-)author of scientific books and numer-

ous scientific papers (more than 570), contributions and invited lectures at international scientific conferences and workshops. He is a supervisor and consultant for PhD study at the Slovak University of Technology in Bratislava.

- **Zoltán Balogh, PhD. (M)** is a senior computer scientist and researcher at the Department of Parallel and Distributed Information Processing at UISAV. He received his MSc. in quantitative management and informatics in 1999. He defended his PhD dissertation dealing with knowledge-based estimation of service performances in 2007 from the Faculty of Informatics and Information Technology at the Slovak Technical University in Bratislava. He is an author and co-author of many scientific publications. He participated in numerous national and EU projects where he gained rich experiences as a project and WP leader. He is a co-author of the Secure Agent Infrastructure, developed in scope of a large FP6 IP project called SECRICOM (Seamless Communication for Crisis Management) which was evaluated as a success story among many FP6 Secure societies projects. In the FP7 ReDIRNET project he was the WP leader and the main author of the information polling and aggregation service (PMAS). He participated in the past also in other EU projects such as Pellucid, K-Wf Grid, EGEE, Commius or VENIS. He was a leader of a national APVV project OptiMAT and has participated in many other national projects under SPVV - State Program of Research and Development (project NAZOU), APVV - Agency for R&D (projects U-COMP, CLAN, AIIA, SEMCO-WS), EU Structural Funds (projects Recler, CRISIS, RP-KOM) and many VEGA projects. Recently he is a principal investigator in an ERA-NET project called SOON – Social Network of Machines where a unique communication infrastructure system is being developed for management of machines, users and IoT devices in the manufacturing domain. He was a member of the Scientific Council at UISAV and a member of the VEGA5 reviewers' groups for Automation, Robotics, Telecommunications and Informatics at the Ministry of Education and Research of the Slovak Republic for 8 years (max allowed time). He is currently a member of an expert group for electronic elections in the SR at the Ministry of Interior of the Slovak Republic. He is a reviewer of papers for many conferences and journals. He was a member of many commissions for IT-related Master and PhD defenses. He acts also as a commercial consultant in the domains of information security and safety, big data, artificial intelligence, cloud and hosted solutions.
- **Emil Gatial, PhD. (M)** is a senior researcher at UISAV since 2003. He received his MSc. in information and management systems. He defended his dissertation dealing with coordinating distributed execution of agents for trusted information collection in 2010. He is an author and co-author of many scientific papers. He participated in many national and EU projects. Main related projects to the proposal are A Platform for Organisationally Mobile Public Employees (2002-04) IST-2001-34519 (Pellucid), Slovak national project RAPORT (2005-2007), Seamless Communication for Crisis Management (2008-2011) FP7-218123 (Secricom) and REDIRNET (Emergency Responder Data Interoperability Network FP7-607768). He is an author of the SAI agent platform which was scientifically validated by in his PhD thesis and verified within the scope of the Secricom EU IP project.

Role in the project

- The core UISAV team comes from the **Department of Parallel and Distributed Computing⁴⁷** (PDC) whose strong competences lie in cloud computing, HPC, Big Data information processing, analytical models and tools, deep learning techniques and real-time stream processing and aggregation. PDC staff will therefore provide its experience in Big Data information processing such as information extraction and retrieval, statistics, machine learning and natural language processing. The strong technological expertise based on big-data management, knowledge management and modelling using machine learning and deep learning techniques, ontologies and semantic modelling, metadata for accessing document repositories and large streamed data and communication processing makes PDC UISAV an excellent and relevant team for the SILVANUS project.
- **Department of Discrete Processes Modelling and Control⁴⁸** (DPMC) will bring into the project their approach for robots (UAVs or UGVs) coordination. The software being developed is a multi-robotics swarm system, which can work properly with adding and removing robots during the mission. Most important characteristic of the system is to continue achieving the objectives without the need to replace tasks for the new swarm configuration. The system was implemented in a way that the goals can be achieved also with a single robot in finite time. The approach gives an effective solution without the need for complex negotiations

⁴⁷ <http://pdc.ui.sav.sk/> and <http://ikt.ui.sav.sk/>

⁴⁸ <https://www.ui.sav.sk/pp/des/>

between robots. Our robotic system was created to solve coverage problems. The problem of multi-robot coverage is a basic problem in mobile robotic systems. Multi-robot coverage can be easily transformed into the problem of the exploration of an unknown environment or can be used as a searching algorithm.

- The specific contribution of UISAV to the project is the following:
 - **WP1: Task 1.1** – UISAV will participate in general project management activities.
 - **WP2: Task 2.5** – UISAV will contribute to the systematic methodology for participation processes which will be inspired by the Poll, Template and Channel concepts in the EmerPoll system. In **Task 2.3** UISAV will contribute to micro-predictive analytics for modelling granular changes to weather patterns. UISAV will contribute with expertise and connection to HPC and supercomputer infrastructures (Objectives: PB4).
 - **WP3: Task 3.5 and 3.6** – UISAV will leverage its crowd-sourcing EmerPoll platform as a part of the campaign and citizen engagement toolkit to distribute, collect and aggregate data from stakeholders based on semi-structured data polls as well as provide situational awareness and a context-based information distribution (Objectives: PA4, PA5).
 - **WP4: Task 4.4. - 4.6** – UISAV will support and contribute to UAVs for fire risk assessment and payload capacity for early response and robotic ground vehicles to gather situational intelligence of wildfire behavior. UISAV will apply its multi-robot swarm coverage and coordination approach (Objectives: PB1, PB5) for wildfire detection, monitoring and sensing. Contribute to robotic ground vehicles to gather situational intelligence of wildfire behavior. UISAV will also contribute to the IoT gateway development (Objectives: PB5). In **Task 4.5** UISAV will contribute by its NLP tools to analyze social feeds and detect entities with its Knowledge Base Tools.
 - **WP5: Task 5.1** – Contribute to multi-modal big data frameworks capable of processing earth observation datasets. UISAV will integrate data storage and analytical environments which can interconnect datasets and computing resources such as exa-scale data with cloud and HPC (Objectives: PB3). In **Task 5.3** UISAV will contribute to the development of a semantic framework to formalize the stakeholder involvement in sustainable forest management. UISAV will assist in building and adapting ontologies, adaptation of a knowledgebase with the use of light-weight semantics (semantic tags), annotation and search mechanisms (Objectives: PA2).
 - **WP8: Task 8.1-8.3, Task 8.5 and 8.6** – UISAV as a technology partner will take part in definition of the architecture, information sharing protocols and of the SILVANUS platform integration, testing and validation. UISAV will enact as the leader of Task 8.2 concerning information sharing protocols across first responders and public this exploiting its expertise from SECRICOM and REDIRNET projects and from the EmerPoll platform.
 - **WP9:** UISAV will be involved in all three phases of trials (A/B/C) as well as in the cross-cutting trials actively integrating its technologies. UISAV will be acting as the main technology hub for the Slovak pilot putting together the partners 3MON, TUZVO and HFVZVO. While the UISAV's primary trial will be the Slovakian one it will also contribute to other trials as required and agreed with other partners.
 - **WP10:** UISAV will enact dissemination and exploitation activities as described in the sections below. It will also take part in the stakeholders 'community building and will contribute to standards and compliance for interoperability of the platform.
- UISAV will also facilitate access to its local, national and international HPC infrastructure - UISAV runs clusters with Hadoop ecosystem (HDFS, MapReduce, Apache Spark, HBase, Hive, Pig) as a dedicated computing infrastructure for big-data processing and large data analytics. Furthermore, the UISAV utilizes HPC cluster, which is already a part of European backbone e-infrastructure (e.g. EGI, EUDAT and PRACE) for high-performance and cloud computing.

Relevant publications

The below listed items represent only a selected most-relevant publications. All UISAV's publications can be accessed at ⁴⁹. Underscored names represent authors from UISAV.

- [1] MACHALEK, Aurel - DUNLOP, Dominic - BALOGH, Zoltán - GATIAL, Emil - HLUCHÝ, Ladislav. **REDIRNET - emergency responder data interoperability network**. In IEEE International Conference on Industrial Informatics INDIN. - IEEE, 2016, p. 37-41. (2015: 0.182 - SJR). ISBN 978-1-5090-2871-9. ISSN 1935-4576.
- [2] BALOGH, Zoltán - GATIAL, Emil - HLUCHÝ, Ladislav. **Poll sourcing for crisis response**. In Proceedings of the International ISCRAM Conference. - ISCRAM, 2016, vol., 9 p. ISBN 978-84-608-7984-8. ISSN 2411-3387.
- [3] BALOGH, Zoltán - GATIAL, Emil - HLUCHÝ, Ladislav. **Use of polls to seamlessly collect and aggregate semistructured information for crisis response**. In SISY 2015: IEEE 13th International Symposium on Intelligent Systems and Informatics. New York IEEE, 2015, p.31-36. ISBN 978-1-4673-9388-1.
- [4] HLUCHÝ, Ladislav - BOBÁK, Martin - MÜLLER, Henning - GRAZIANI, Mara - MAASEN, Jason - SPREEUW, Hanno - HEIKKURINEN, Matti - PANCAGE-STEEG, Jörg - SPAHR, Stefan - VOR DEM GENTSCHEN FELDE, Nils Otto - HÖB, Maximilian - SCHMIDT, Jan - BELLOUM, Adam S.Z. - CUSHING, Reginald - NOWAKOWSKI, Piotr - MEIZNER, Jan - RYCERZ, Katarzyna - WILK, Bartosz - BUBAK, Marian - HABALA, Ondrej - ŠELENG, Martin - DLUGOLINSKÝ, Štefan - TRAN, Viet - NGUYEN, Giang. **Heterogeneous exascale computing**. In Recent advances in intelligent engineering : volume dedicated to Imre J. Rudas' seventieth birthday. - Cham, Switzerland : Springer, 2020, p. 81-110. ISBN 978-3-030-14349-7. ISSN 2193-9411.
- [5] LÓPEZ GARCÍA, Álvaro - MARCO DE LUCAS, Jesús - ANTONACCI, Marica - ZU CASTELL, Wolfgang - DAVID, Mario - HARDT, Marcus - LLORET, Lara - MOLTÓ, Germán - PLOCIENNIK, Marcin - TRAN, Viet - ALIC, Andy S. - CABALLER, Miguel - CAMPOS, Isabel - COSTANTINI, Alessandro - DLUGOLINSKÝ, Štefan - DUMA, Cristina - DONVITO, Giacinto - GOMES, Jorge - HEREDIA, Ignacio - ITO, Keiichi - KOZLOV, Valentin - NGUYEN, Giang - ORVIZ, Pablo - ŠUSTR, Zdeněk - WOLNIEWICZ, Paweł. **A cloud-based framework for machine learning workloads and applications**. In IEEE Access, 2020, vol. 8, no. 1, p. 18681-18692. (2019: 3.745 - IF, Q1 - JCR, 0.775 - SJR, Q1 - SJR). ISSN 2169-3536.
- [6] NGUYEN, Giang - DLUGOLINSKÝ, Štefan - BOBÁK, Martin - TRAN, Viet - LÓPEZ GARCÍA, Álvaro - HEREDIA, Ignacio - MALÍK, Peter - HLUCHÝ, Ladislav. **Machine learning and deep learning frameworks and libraries for large-scale data mining: a survey**. In Artificial Intelligence Review, 2019, vol. 52, no. 1, p. 77-124. (2018: 5.095 - IF, Q1 - JCR, 1.055 - SJR, Q1 - SJR, karentované - CCC). (2019 - Current Contents). ISSN 0269-2821. (75 citations)
- [7] GATIAL, Emil, BALOGH, Zoltán, HLUCHÝ, Ladislav. **Information collection and presentation enriched by remote sensor data**. In SISY 2015 : IEEE 13th International Symposium on Intelligent Systems and Informatics. - New York : IEEE, 2015, p. 19-23. ISBN 978-1-4673-9388-1.
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- [9] ŠELENG, Martin - DLUGOLINSKÝ, Štefan - HLUCHÝ, Ladislav - GRÄTHER, Wolfgang. **Improving inter-enterprise collaboration with recommendation tool based on lightweight semantics in emails**. In Procedia Computer Science, 2018, vol. 138, p. 486-491. (2017: 0.258 - SJR). ISSN 1877-0509.
- [10] LACLAVÍK Michal, CIGLAN Marek, STEINGOLD Sam, ŠELENG Martin, DORMAN Alex, DLUGOLINSKÝ Štefan, **Search query categorization at scale**. In World Wide Web 2015 Companion : TargetAd2015 - Workshop on Ad Targeting at Scale. - Florence, Italy : ACM, 2015, p. 1281-1286. ISBN 978-1-4503-3473-0.
- [11] ZELENKA, Ján - KASANICKÝ, Tomáš - BUNDZEL, Marek - ANDOGA, Rudolf. **Self-adaptation of a heterogeneous swarm of mobile robots to a covered area**. In Applied Sciences-Basel, 2020, vol. 10, no. 10, art. no. 3562. (2019: 2.474 - IF, Q2 - JCR, 0.418 - SJR, Q1 - SJR). ISSN 2076-3417.
- [12] ZELENKA, Ján - KASANICKÝ, Tomáš - BUDINSKÁ, Ivana - KAŇUCH, Peter**. **An agent-based algorithm resembles behaviour of tree-dwelling bats under fission-fusion dynamics**. In Scientific Reports, 2020, vol. 10, art. no. 16793. (2019: 3.998 - IF, Q1 - JCR, 1.341 - SJR, Q1 - SJR, karentované - CCC). (2020 - Current Contents, WOS, SCOPUS). ISSN 2045-2322.

⁴⁹ https://www.sav.sk/?lang=sk&doc=ins-org-ins&institute_no=60&action=publications

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- [14] VALAŠEK, Lukáš - GLASA, Ján. **On efficiency of fire simulation realization : parallelization with greater number of computational meshes.** In Journal of Physics: Conference Series, 2017, vol. 936, art. no. 012054. (2016: 0.240 - SJR, Q3 - SJR). (2017 - WOS, SCOPUS). ISSN 1742-6588.
- [15] GLASA, Ján - VALAŠEK, Lukáš - WEISENPACHER, Peter. **CFD-based fire spread visualization for improvement of road tunnel safety.** In Journal of Physics: Conference Series, 2019, vol. 1391, no. 1, art. no. 012147. (2018: 0.221 - SJR, Q3 - SJR). ISSN 1742-6588.

Relevant products, services or other achievements

- **EmerPoll** (TRL 6) – is a crowdsourcing platform for real-time information collection and aggregation based on semi-structured data polls [2, 3, 7]. The system is also well suited as a situational awareness and a context-based information distribution tool. The platform is capable of involving and informing users using computers and mobile devices or even integrate intelligent autonomous bots. The participatory engagement of local actors in the processes and the communication between stakeholders will be resolved in SILVANUS by customizing and adapting an innovative crowdsourcing and situational awareness real-time communication platform called EmerPoll, recently developed by UISAV. The platform uses specially crafted Polls to collect and aggregate information in a semi-structured way in real-time. Polls enable swift context-based distribution of information or preformatted requests to users or organizations dynamically subscribed to information Channels. Users can in turn reply to such requests - again in a semi-structured way - by a template-based sequence of dynamic forms or communication patterns with generic input controls. The information is continuously aggregated and presented live during the collection process to the Poll owner. The individual basic concepts of the EmerPoll platform such as Channels, Templates or Polls can be semantically annotated which enables integration of knowledge models and targeted information distribution and collection. Emer Poll specifically enables:
 - Integration and customization of a crowdsourcing and communication platform to collect and aggregate information on behalf of various stakeholders such as: practitioners, public and private institutions and citizens. Decision makers can run customized polls to collect data from targeted end users (citizens or businesses).
 - The stakeholders can use the EmerPoll platform for coordination, adaptation and mitigation of actions as well as to reach (inform or warn) end users. EmerPoll uses a multi-layered user trust model where each user's credibility is continuously evaluated. More credible users' opinion has higher impact and weight when contributing.
 - Deliver and present user-specific and context-aware information specific to various groups of users or organizations and geographic locations (regions).
 - EmerPoll can contribute to use of polls, customizing presented information (geo-location specific, language and context-aware), providing a service model with possible monetization options (pay per template/channel/poll use) and user-specific information distribution.
 - Exploit integration of bots capable of communicating with humans and other services in a semi-structured way. Use of bots can additionally enrich the communication by results from data analysis or simulations.
 - Provide means for large-scale situational awareness by facilitating swift contextual data-driven information distribution to local actors such as the public and businesses.
- **OnTeA** (TRL 6) – is an Ontology-based Text Annotation Platform based on Regular Expression Patterns. OnTeA allows to analyze documents or text using regular expression patterns and detects equivalent semantic elements according to defined domain ontology. Several cross-application patterns are defined but to achieve good results new patterns need to be defined for each application. OnTeA also creates new ontology individual of defined class and assignees detected ontology elements/individuals as properties of defined ontology class. As part of the OnTeA platform several helper modules were developed out of which the highest notice among users was gained by RDB2Onto – a Tool for Relational Data to Ontology Individuals Mapping, which enables to convert selected data from a relational database to an RDF/OWL ontology document based on a defined template and SQL queries. Such filled in templates can then be stored in ontology-based knowledge memory.
- **IKT Knowledge Base Tools** (TRL 6) – is a set of several integrated information and knowledge-oriented technologies, methods and tools backed by high quality research work [6, 9, 10]. All the tools are natural language processing (NLP) type of tools for gathering information from texts, discovering relations among the entities

detected from the gathered information and building knowledge (ontologies, semantic tags, knowledge graphs) represented in a user-friendly way in order to serve people in their daily work. Modern technologies for high volume data processing such as Hadoop and Spark are integral part of the system what enables large-scale deployment of the solution. Several types of text sources are supported including email communication (large archives), file repositories or Web pages for discovering knowledge and entities as well as relations among them. Some of the main AI tools and technologies include:

- OnTeA – described above,
- LIGA (in-memory LInear large-scale Gazetteers),
- SGDB (Simple Graph Database optimized for fast graph traversing),
- gSemSearch (Graph based Semantic Search) and
- ESNS (Email Social Network Search).

- **Cloud and Storage Infrastructure** (TRL 8-9) – UISAV is one of the Cloud service providers in European Cloud Infrastructure. It has three different cloud sites:
 - the generic OpenStack site IISAS-FedCloud,
 - the accelerated Openstack site IISAS-GPUCLOUD and
 - the accelerated OpenNebula site IISAS-Nebula.

All the above-mentioned cloud sites are integrated into EGI Federated Cloud and work in full production mode. Several EOSC user communities are using cloud services provided by UISAV, most notably NextGEOSS, bio-med, enmr.eu. UISAV also has storage services based on OneData that are integrated with other storage providers (INFN, IFCA, LIP) to provide fast and reliable storage services for user communities.

- **Multi-Robot Coordination and Coverage System** (TRL 5) – UISAV has developed a swarm-based method for coordination of groups of mobile robots (either UAVs or UGVs) with a focus on the self-organization and self-adaptation of the groups. The method [11, 12] is a nature-inspired decentralized algorithm that uses artificial pheromone marks and enables the cooperation of different types of independent reactive agents that operate in the air, on the ground, or in the water. The advantages of our solution include scalability, adaptability, and robustness. The solution works with variable numbers of agents in the group. It is resistant against failures of the individual robots. A transportation control algorithm that ensured the spreading of different types of agents across exploration space with different types of environments was introduced and tested. We established that our swarm control algorithm was able to successfully control three basic behaviors: space exploration, population management, and transportation. The behaviors were able to run simultaneously, and space exploration (the main goal) was never stopped or interrupted.

List of relevant previous projects or activities, connected to the subject of this proposal

The below listed items represent only a selected most-relevant projects. All UISAV's projects can be accessed at: for PDC⁵⁰, DPMC⁵¹.

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
REDIRNET ⁵² EU FP7- 607768 2014- 2016	Emergency Responder Data Interoperability Network - Provided a decentralized framework for interoperability for first responders' systems based on a public metadata gateway controlled by the agencies themselves via a REDIRNET socio-professional web. UISAV has developed a Poll Management and Aggregation Service (PMAS) which is able to request and reserve resources for a crisis mitigation in a very secure, reliable and fast manner. UISAV has contributed also to the architecture design, requirements elicitation from	Expertise in building ontologies for first responders, information sharing services for stakeholders, large-scale crowd-sourcing and information distribution. UISAV will use the EmerPoll platform (based on the PMAS developed in REDIRNET) consisting of a mobile application and a back end to crowdsource information and to provide real-time situational awareness to support

⁵⁰ <http://ups.savba.sk/parcom/index.php?page=projlist>

⁵¹ https://www.ui.sav.sk/pp/des/index_s.php?lang=en&doc=projects

⁵² <https://cordis.europa.eu/project/id/607768>

	Slovak first responders as well as from the Ministry of interior of the SR, development of ontologies for crisis response, the Secure Metadata Gateway and the Socio-professional Web.	participatory processes. The REDIRNET Metadata Gateway can be reused for communication between various stakeholders.
SECRICOM Best Project Award in the SECURITY Call! FP7- 218123 IP, 2008- 2011, http://www.sericom.eu/	Seamless Communication for Crisis Management - The aim of the project was to create a seamless communication infrastructure with advanced intelligent functionality for crisis management with participation of multiple agencies and stakeholders. UISAV has developed a novel Secure Agent Infrastructure (SAI) for secure collection and communication of data. UISAV has also contributed to System analysis and design and Integration of research results.	Expertise in processing large-scale volume of heterogeneous content, secure and reliable communication.
DEEP - Hybrid-DataCloud H2020, 2017-2020, http://deep-hybrid-datacloud.eu/	Designing and Enabling E-infrastructures for intensive Processing in a Hybrid DataCloud - The key concept proposed in the DEEP Hybrid DataCloud project is the need to support intensive computing techniques that require specialized HPC hardware, like GPUs or low latency interconnects, to explore very large datasets. A Hybrid Cloud approach enables the access to such resources that are not easily reachable by the researchers at the scale needed in the current EU e-infrastructure.	Development of complex algorithms based on deep-learning models for low-latency computation to be deployed at the edge devices for the streaming timed metadata extracted from continuous information streams, integration of HPC including use of GPUs with very large data sets.
PROCESS H2020- 777533, 2017- 2020, http://www.process-project.eu/	PROviding Computing solutions for ExaScale ChallengeS - The project paves the way towards exa-scale data services that will accelerate innovation and maximise the benefits of these emerging data solutions. To providing the service prototypes for very large data, the project addresses the work programme goals by using the tools and services with heterogeneous use cases, including open data for global disaster risk reduction.	Development and integration of very large data services with possibly exa-scale data from open sources data for global disaster risk reduction.

Individual exploitation plan

The exploitation of UISAV will be the following:

- UISAV will use the results of SILVANUS project in its further research work, by extending its know-how and specialization in information collection and cloud-related technologies. Semantic and AI systems are a long-term interest of UISAV, and the results of involved work packages will be of special interest to UISAV's research staff. UISAV will also use SILVANUS to apply for further research grants – national, to spread the results in the local scientific community, and international, to continue with further research and development based on SILVANUS outcomes. Additionally, further research will help attract new PhD students for UISAV's post-graduate program.
- UISAV will also be active in commercial exploitation of its know-how, and SILVANUS project will help it to strengthen its competitive advantage in cloud computing, semantic technologies and AI-related technologies. UISAV will try to exploit the products delivered and integrated in SILVANUS firstly jointly with project partners as well as individually by finding relevant customers interested in customization of specific modules or functionalities.
- UISAV project staff will publish its achievements in academic journals and present them on scientific conferences and workshops, as it has been doing in all past projects. UISAV is traditionally present at several IEEE conferences (FSKD, IEEE Cloud Conference, IEEE International Scientific Conference on Informatics) and other cloud-related events. UISAV also extensively publishes in Slovak and Czech journals and events, which helps to bring the most advanced technologies into the Slovak and Czech but also European

and World-wide scientific communities. UISAV will promote the use of its impacted CC journal Computing and Informatics to disseminate information about SILVANUS and its results, including by dedicating to the projects special sections for multiple thematic papers.

Communication strategy for promoting project outcomes

UISAV, as an academic partner, has a communication strategy targeting the use of scientific achievements of the project in scientific community. Specific steps are taken to promote the results in ICT community in Slovakia and near abroad (mainly Czechia, Poland and Hungary), to promote the results and technologies in potential application domains (especially environmental sciences with which UISAV has rich collaboration tradition) and to promote the project's results outside of Europe by publishing in journals with global reach:

- UISAV project staff will publish its achievements in academic journals and present them on scientific conferences and workshops, as it has been doing in all past projects. UISAV is traditionally present at several IEEE conferences (FSKD, IEEE Cloud Conference, IEEE International Scientific Conference on Informatics) and other cloud-related events.
- UISAV also extensively publishes in Slovak and Czech journals and events, which helps to bring the most advanced technologies into the Slovak and Czech scientific communities.
- UISAV will also use the journal Computing and Informatics (CC, impacted, with significant number of readers and writers outside of Europe), which it publishes, to globally disseminate information about the project and its results, including by dedicating to the projects special sections for multiple thematic papers.

Description of significant infrastructure and major items of technical equipment relevant to the project

- **UISAV HPC cluster** - IBM system: 52x IBM dx360 M3, 8x IBM dx360 M4 2x NVIDIA Tesla K20, 2x IBM dx360 M3 NVIDIA Tesla M2070, 2x x3650 M3 managing servers, 4x x3650 M3 data managing servers, x3550 M4 server, InfiniBand 2x 40 Gbps, 2x DS3512 with 72TB disk. The cluster is already a part of international testbeds of European infrastructure in international IST, FP and H2020 projects.
- **UISAV Hadoop cluster** - scalable dedicated computing infrastructure for data processing and analytics with 1x server and 14x client. Node specification: 2x Intel® Xeon® Processor E5-2620 (15M Cache, 2.00 GHz, 7.20 GT/s Intel® QPI, 6x cores, 12x threads) + HyperX threading (24 simultaneous tasks per client), 32GB RAM (2 nodes 48GB), 1TB HDD (2 nodes 500GB). Total storage capacity of the cluster is 13TB.
- **FedCloud and SIVVP** - UISAV has also participates in the egi.eu FedCloud⁵³ infrastructure with Open-Stack-enabled IISAS-FedCloud site, and through the national SIVVP (Slovak Infrastructure for Highperformance Computing⁵⁴) project has access to an extensive infrastructure including the abovementioned AUREL SC.
- **AUREL Supercomputer** - UISAV has access to a supercomputer IBM Power 775 with 4096 cores, 32TB RAM, 5-48GB/s Internal Optical Links, 10GB/s Ethernet connection to data storage, 300 TB internal storage + 600 TB external storage, AIX OS6 (physically located at the Computing Center of the SAV).
- **CloudLab** - a cloud technologies ensemble based on a blade system with HP Proliant BL460c G6 nodes with total 144 cores of Intel XEON X5570 available for the project.
- **Core Infrastructure** - additionally, to these main assets, UISAV has an organization-wide network, workstations, several smaller clusters and private clouds, readily available for small scale deployments and prototype testing.

4.1.31 POMPIERS de l'URGENDE INTERNATIONALE

Partner Name: POMPIERS de l' Urgence Internationale Company website: https://www.pompiers-urgence.org Type: NGO	
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⁵³ <https://wiki.egi.eu/wiki/Fedcloud-tf:ResourceProviders>

⁵⁴ <http://www.sivvp.sk/>

Partner profile

POMPIERS DE L'URGENCE INTERNATIONALE (International Emergency Firefighters) is an international solidarity association dedicated to:

- Providing rescue assistance and aid to vulnerable populations in need after a natural disaster through the involvement of volunteer rescuers,
- Strengthening civil protection mechanisms in emerging countries through:
 - o multidisciplinary certification of fire fighters and civil security personnel
 - o provision of adapted equipment and vehicles
 - o fair assessment of operational and functional mechanisms and action proposals to provide governmental instances with a clear vision of the actual situation,
- Developing a risk-assessment culture to raise public awareness to natural risks through:
 - o situational exercises using an earthquake simulator
 - o access to specialised training
 - o participation in public events.

Related expertise / experience:

The association is made up of rescue professionals and strong of an international experience of crisis situations. All NGO members intervene on a voluntary basis and can be swiftly mobilised to act effectively. Our skills include: - Emergency earthquake response with personnel specialists in search and rescue, detecting and locating buried victims by means of dog-handler teams and electronic devices • Medical and paramedical care of victims of natural disasters • Humanitarian and logistical support • Distribution of drinking water • Certification of trainers and intervening actors in the civil protection's areas of expertise: first aid, search and rescue, disaster search dog-handling, technological risks and CBRN, fire prevention, operational forecasting, forest fires... • Full operational coordination capacity and professional expertise (decision support) • Formulation of specific projects consistent with the institutional procedures • Technical support to help national leaders manage the influx of international means POMPIERS DE L'URGENCE INTERNATIONALE is engaged as first responders' expert in the project. PUI will mobilise its expertise and bring its experience to the project.

CVs of involved key researchers / staff members

Ltc. Philippe BESSON: Lieutenant-colonel (ER), professional officer in the French Fire and Rescue service of Haute-Vienne in Limoges, Chevalier of the Legion of Honor, founding chairman and operation focal point of the organization POMPIERS DE L'URGENCE INTERNATIONALE; Urban Search and Rescue INSARAG USAR Medium team leader. Rescue and fire – disaster preparedness – technological risks specialist – investigator for fire origin, member of the classifiers team for INSARAG. 2015: Operation focal point for earthquake in Nepal, Rescue team leader for explosion manufacture AZF in Toulouse (France) 2012-2015: Training for the CERT in Tadjikistan for AKDN 2008-2011: Official report after analysis of national risks in Kosovo for Department of Emergency Management with French Embassy and Minister of Internal Affairs in Pristina Proposals of several measures to strengthen the presence of the Fire Brigade in Kosovo Program/Project implementation: 2015-2020: Project with the fire service with the province of Guian/Samar 2008-2010: Project to create the first Fire Department in Diego Suarez (Madagascar) 2005-2007: Support of the Fire Department in Pozega and Cacak (Serbia) with training, equipment, trucks and the first school for young firefighters 2015: reclassification INSARAG as USAR Medium team - Operation focal point 2013: team leader of the rescue team INSARAG PUI FRA01 for the typhoon Haiyan in Philippines 2012: structure assessment for the UNDAC team in Brazzaville after explosion 2010: Classification as USAR Medium team by INSARAG 2009: Team leader for the rescue operation in Padang (earthquake November 2009) 2007: Earthquake preparedness program and training – Seismic risk in North Pakistan 2005: Earthquake preparedness program and training for schools in Istanbul /Turkey 2006: Rescue team leader in Java for earthquake 2005: Team leader for rescue operation in Pakistan (earthquake October 2005) 2004: Leader of the first team for rescue operation to the tsunami in Indonesia 2003: Inventor of the earthquake simulator - Team leader for rescue operation to the earthquake in Boumerdes (Algeria) 2002: Training of the civil protection teams in Izmit (Turkey)

International emergency missions : 2018 Indonesia : search and rescue mission in Palu after the earthquake and tsunami, 2018 Madagascar: rescue mission in Madagascar after the typhoon AVA, 2017 St Martin/Madagascar: rescue mission in St Martin (French province) after the hurricane IRMA and in Madagascar after the cyclone ENAWO's flooding devastation 2016 Ecuador/Haiti: rescue mission for the earthquake and storm 2015 Nepal/Madagascar: rescue mission for the earthquake in Nepal and floods in Madagascar 2014 Bosnia: relief mission following the devastating flooding in the Balkans; production and distribution of drinking water 2013 Philippines: relief mission in the aftermath of the Yolanda typhoon, set up of mobile advanced medical posts (AMP) for the care-management of the injured, first-aid and medical evacuation. Production and distribution of 40m³/day of drinking water in Guiuan 2013 Madagascar: relief mission in Tulear, in the aftermath of the Hurana typhoon, set up of an advanced medical post

(AMP) for the care-management of the injured and damage assessment mission 2012 Madagascar: 2 relief missions in the aftermath of the Giovanna typhoon, Giovanna, medical support at the Brickaville hospital 2012 Congo: Structural damage assessment mission and support of the UNDAC team after the explosion of an ammunition depot in Brazzaville 2010 Haiti: 4 relief missions on the quake sites of Port au Prince and Jacmel ; rescue of 2 children buried alive under rubbles.

2009: relief mission after the Aquila earthquake in Italy and the Padang quake in Sumatra; flood relief mission in Burkina Faso 2008 Haiti: 4 first-aid missions, water purification and expert assessment in the wake of the hurricane 2007 Greece/Macedonia: emergency relief mission and technical support to the authorities.

Ltc. Philippe BESSON: Lieutenant-colonel (ER), professional officer in the French Fire and Rescue service of Haute-Vienne in Limoges, Chevalier of the Legion of Honor, founding chairman and operation focal point of the organization POMPIERS DE L'URGENCE INTERNATIONALE; Urban Search and Rescue INSARAG USAR Medium team leader. Rescue and fire – disaster preparedness – technological risks specialist – investigator for fire origin, member of the classifiers team for INSARAG. 2015: Operation focal point for earthquake in Nepal, Rescue team leader for explosion manufacture AZF in Toulouse (France) 2012-2015: Training for the CERT in Tadzhikistan for AKDN 2008-2011: Official report after analysis of national risks in Kosovo for Department of Emergency Management with French Embassy and Minister of Internal Affairs in Pristina Proposals of several measures to strengthen the presence of the Fire Brigade in Kosovo Program/Project implementation: 2015-2020: Project with the fire service with the province of Guian/Samar 2008-2010: Project to create the first Fire Department in Diego Suarez (Madagascar) 2005-2007: Support of the Fire Department in Pozega and Cacak (Serbia) with training, equipment, trucks and the first school for young firefighters 2015: reclassification INSARAG as USAR Medium team - Operation focal point 2013: team leader of the rescue team INSARAG PUI FRA01 for the typhoon Haiyan in Philippines 2012: structure assessment for the UNDAC team in Brazzaville after explosion 2010: Classification as USAR Medium team by INSARAG2009: Team leader for the rescue operation in Padang (earthquake November 2009) 2007: Earthquake preparedness program and training – Seismic risk in North Pakistan 2005 : Earthquake preparedness program and training for schools in Istanbul /Turkey 2006: Rescue team leader in Java for earthquake 2005: Team leader for rescue operation in Pakistan (earthquake October 2005) 2004: Leader of the first team for rescue operation to the tsunami in Indonesia 2003: Inventor of the earthquake simulator - Team leader for rescue operation to the earthquake in Boumerdes (Algeria) 2002: Training of the civil protection teams in Izmit (Turkey).

International emergency missions : 2018 Indonesia : search and rescue mission in Palu after the earthquake and tsunami, 2018 Madagascar: rescue mission in Madagascar after the typhoon AVA, 2017 St Martin/Madagascar: rescue mission in St Martin (French province) after the hurricane IRMA and in Madagascar after the cyclone ENAWO's flooding devastation 2016 Ecuador/Haiti: rescue mission for the earthquake and storm 2015 Nepal/Madagascar: rescue mission for the earthquake in Nepal and floods in Madagascar 2014 Bosnia: relief mission following the devastating flooding in the Balkans; production and distribution of drinking water 2013 Philippines: relief mission in the aftermath of the Yolanda typhoon, set up of mobile advanced medical posts (AMP) for the care-management of the injured, first-aid and medical evacuation. Production and distribution of 40m3/day of drinking water in Guiuan 2013 Madagascar: relief mission in Tulear, in the aftermath of the Hurana typhoon, set up of an advanced medical post (AMP) for the care-management of the injured and damage assessment mission 2012 Madagascar: 2 relief missions in the aftermath of the Giovanna typhoon, Giovanna, medical support at the Brickaville hospital 2012 Congo: Structural damage assessment mission and support of the UNDAC team after the explosion of an ammunition depot in Brazzaville 2010 Haiti: 4 relief missions on the quake sites of Port au Prince and Jacmel; rescue of 2 children buried alive under rubbles.

2009: relief mission after the Aquila earthquake in Italy and the Padang quake in Sumatra; flood relief mission in Burkina Faso 2008 Haiti: 4 first-aid missions, water purification and expert assessment in the wake of the hurricane 2007 Greece/Macedonia: emergency relief mission and technical support to the authorities combating forest fires in the Peloponnese 2006 Indonesia (Java Island) and Pakistan: emergency relief mission in the wake of the Yogyakarta quake and assistance to the wounded in the disadvantaged village communities; post-quake humanitarian aid mission in Balakot 2005 Pakistan: emergency rescue mission in the wake of the Balakot earthquake ; K9 search of victims trapped in the rubbles. Preventive missions and international training: 2017: Training in USAR for Spain and Philippines teams, Training in Bosnia about traffic accident for firefighters 2016:Bosnia: training in forest fire for fire service 2015:Paraguay: rope rescue and USAR training for civil protection - Portugal: training of trainers for Portuguese civil protection in Setubal (European expert exchange program) - Morocco: training in first-aid for a rescue team in Fez- Bosnia: training in apparatus equipment for fire brigade 2014:France: road rescue extrication techniques, training of Bosnian and Paraguayan firefighters, - Philippines: first-aid training of IOM trainers and training of Guiuan firefighters : firefighting techniques, road rescue, rope rescue, driving a pump truck..., (2015-2019), - Jakarta: K9 & USAR training/assessment of "Jakarta Rescue" 2013: Madagascar: post-cyclone assessment- Tajikistan:

USAR training of local rescue teams (as per INSARAG guidelines)- Paraguay: operational management and command training for firefighters 2012: Tajikistan USAR training of local rescue teams (CERT).

Ms. Iliana Korma (female) was born in Athens, Greece and studied applied Mathematics (Maitrise-MSc.) in the University of Pierre & Marie Curie (PARIS 6). She started her career in a French Company expert in air-land combat systems. Through the twenty-one years of personal career, she has jointed various R&D departments of IT companies, participating in a variety of projects. Being in charge of PUI's R&D department and responsible for the coordination, monitoring, follow-up and organization of the European projects and their promotion in France and Europe, she is dealing mostly with the preparation and execution of RTD projects by the EC. Additionally, Ms Korma is teaching ICT in VET centres. Moreover, she is responsible for the project management and the normal execution of both National and European contracts. Ms Korma is also fluent speaker in English, French and Spanish.

Relevant publications, and/or products, services or other achievements

Since 2004, PUI FRANCE (Pompiers de l'Urgence Internationale/International Emergency Firefighters) is a French humanitarian association that works to bring relief and assistance to countries affected by natural or humanitarian disasters. Professional or voluntary, these firefighters decided to voluntarily put their experience and their expertise at the service of people in need. Through innovative methods such as simulator earthquakes, specialized training and participation in public events PUI FRANCE has developed a collaboration with various organizations. In 2010, PUI become the first French rescue team recognized and classified by INSARAG and has developed his cooperation with USAR teams through INSARAG network and international exercises and conferences through EU Civil Protection Mechanism and exchange of civil protection experts (Italy, Germany..). SISMO TRUCK: earthquake simulator with Virtual Reality – project with the region of NOUVELLE AQUITAINE in France.

Role in the project

- **WP1:** PUI will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** PUI will contribute to the participatory process.
- **WP3:** PUI will contribute to the development of the training programme.
- **WP9:** PUI will lead the pilot demonstration as outlined below.
- **WP10:** PUI will disseminate and exploit the project results through established international links.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
V.I.A.T.I.C.U.M. (Volunteers In Action To Improve Competences Union and Mood) ERASMUS+	Project Partner	V.I.A.T.I.C.U.M. project, funded by ERASMUS+ Programme with partners – volunteer organisations from EU Commission. The project focuses on the development of a multilingual app with a series of video, supported by a website not just for volunteers but for everyone.
Search & Rescue (Emerging technologies for the Early location of Entrapped victims under Collapsed Structures & Advanced Wearables for risk assessment and First Responders Safety in SAR operations)	Project Partner	The S&R project will design, implement and test through a series of large-scale pilot scenarios a highly interoperable, modular open architecture platform for first responders' capitalising on expertise and technological infrastructure from both CONCORDE (http://www.concorde-project.eu/) and IMPRESS (http://fp7-impress.eu/) FP7 projects as well as the commercial technological insights of CONCORDEs commercial versions v0.1 and v0.2 (currently under development from S&R partner KT).

Living with seismic hazard - Illustrated practical guide; 18 pages, Inventor of a mobile earthquake simulator with 3 earthquakes and 3 axes function. INPI FRANCE Patent.

Pilot description

Pilot site description:

Partners in charge: Fire service, Prefecture, Municipalities, Agriculture and forest administration,

Many industries with high risk of human dimensions (for example SEVESO industries) are situated near residential or rural areas. Managing a major accident in a delicate situation of forest fire is a challenge, and with the production of smoke cloud and explosive, it is always important to minimize further risks.

Scenario description:

The forest fire scenario has three active fronts, moving towards sensitive targets; With a large amount of smoke and a wind exceeding 70km / hour, the firefighters urgently need priority information:

- mapping of the area,
- identification of access paths,
- urbanized areas,
- roads and access routes,
- temperature, dehydration of plants,
- speed and direction of the wind,
- anticipation of fire development and development axes,
- integration of changing weather conditions.

Fire spread:

The fire is being developed depending on the wind's direction with a speed progressing with at least 3% of the speed's wind. Then, under the influence of the swirling wind, the fire takes different directions producing vortices, while the height of the flames is increasing.

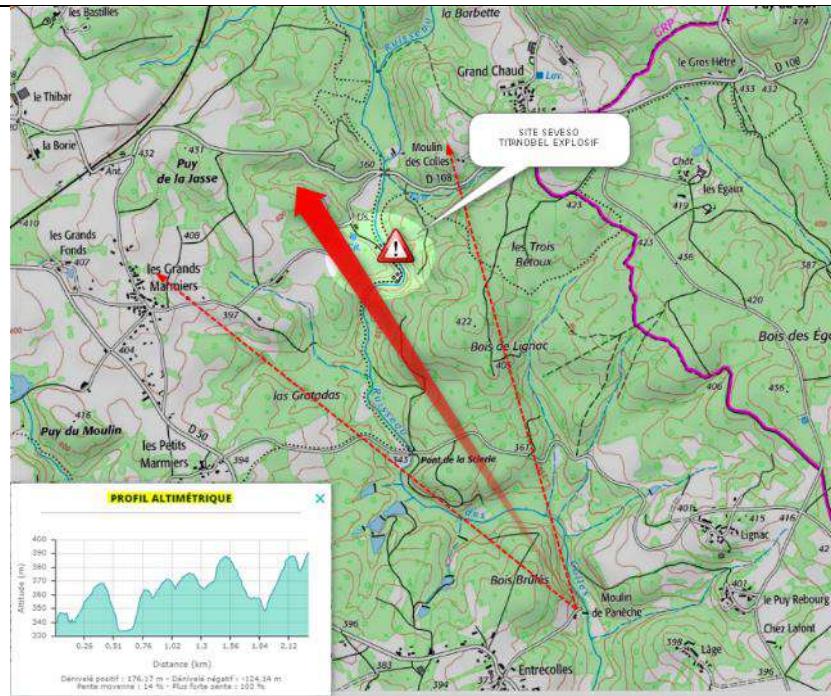
Aerial views:

As the firefighters are using these tools, they will be able to see the smoke and other potentially toxic plumes. They will also be able to view and anticipate the use of the access tracks. This allows first responders to anticipate access and positioning of response vehicles.

The use of several drones simultaneously will:

- measure the ground temperature of the flames and fumes, the speed and direction of the wind with different sensors, over the entire intervention area in order to anticipate the propagation, this information provided continuously will allow the area to be assessed towards which the fire will spread (residences, industries, roads etc ...),
- integrate the measurements made by sensors positioned in vulnerable forest areas,
- drones equipped with gas sensors will make it possible to know the composition of the combustion gases and their dangers for the operators.

Technological risks: The combination of a forest fire risk and a technological risk is an important issue. The consequences of a site explosion or the threat of a chemical dispersion are dramatic.



Kinetics and chain of events:

The previous stages of the scenario will permit, by identifying the possible outbreaks of fires, the elements and human actions that may have an impact on the fire, to identify the possible components of the fire scenarios which will lead to a threat for an installation classified as risks.

- Fire start: proximity to a traffic lane, mapping,
- Nature of vegetation: mixture of deciduous and coniferous trees varying the speed of propagation, use of different sensors,
- Propagation: high speed given a strong wind, of the order of 70 to 80 km / hour,
- Direction: the focus is developing towards a production unit for explosive products,
- Anticipation:
 - calculation by the command post of propagation cones, mapping,
 - identification of threatened targets, nature and quantities,
 - possible chronological sequence, anticipation scenario.

1st event: impact on a technological risk installation

- time to reach the installation at risk, chronology of events,
- implementation of protection or evacuation measures,
- measures to be taken in case of failure of the measures implemented: explosion and spread of fumes.

2^{eme} évènement : impact sur une zone d'habitations

- time to reach the urbanized area, chronology of events,
- implementation of protection or evacuation measures,
- measures to be taken in case of failure of the measures taken.

Demonstration scenario:

- Human participation – lack of adherence to safety protocols
- Emulation of accidental fires resulting from weather conditions
- Total area of coverage

Scenario:

Fire start:

An outbreak of fire near a traffic lane is a highly probable assumption in the scenario given the statistics we have in our disposal. The unfavorable meteorological conditions (drought, wind, dehydration of plants, etc.) and the type of plants promote rapid development of the fire.

Fire start from «Au moulin de Panéche» with a wind in the zone of 146 ° direction of « Puy de la Jasse », for about 2.3 kms.

In the main axis of propagation is the TITANOBEL site which is threatened about 1.8 km from the start of the fire.

Depending on the weather conditions (especially the wind) the site is directly threatened for example:

- wind from 50 km to t + 80mn,
- wind from 30 km to t+ 120mn,

Phase A: Evaluation assessment

- Self-assessment toolkit for environmental modelling
- Ecological assessment of biodiversity within natural parks
- Environmental assessment of fire danger index

Phase B: Continuous monitoring of human behaviour for safety regulations

- Drone inspection of human behaviour for wildfire safety
- Response actuator system to neutralise early stage threats

Contribution to national priorities:

Include reference to national policies

4.1.32 TME MAIN SCHOOL OF FIRE SERVICE

Partner Name: The Main School of Fire Service	
Company website: www.sgsp.edu.pl	
Type: Scientific and research organisation and End-user	

Partner profile

The Main School of Fire Service (pol. Szkoła Główna Służby Pożarniczej, SGSP) in Warsaw (Poland) is the only one in Poland and one of the few state technical-social academies in the world, which trains fire officers and educates specialists in fire safety, civil safety engineering and internal security. SGSP reports to and is scientifically and educationally supervised by the Minister of Interior and Administration. It has full academic rights and constitutes an organizational unit of the State Fire Service (PSP). SGSP, as a technical-social academy, provides studies on the Faculty of Safety Engineering and Civil Protection. The studies curricula include a very broad range of specialized theoretical and practical subjects and trainings. SGSP offers two types of classes: day and extramural, both of the same academic character. Graduates can obtain either bachelor's (Fire Engineer, Fire Safety Engineer, Civil Safety Engineer, Bachelor in Internal Security), master's degree (Master of Engineering in Fire Protection, Master of Engineering in Civil Protection, Master in Internal Security) or doctoral degrees (PhD in Environment Engineering, PhD in security studies).

SGSP, as PSP organizational unit, takes part in rescue and humanitarian actions. SGSP Fire-fighting-Rescue Unit protects Żoliborz District in Warsaw (Poland) and is dedicated to support all huge national actions in Poland (e.g. wildfire in Kuźnia Raciborska in 1992, floods in 1997, 2001 and 2010, evacuation of Polish personnel from Kuwait, The World's Youths Days 2016).

Accordingly to scientific, operational and educational character, SGSP carries out object ventures (projects, conferences, trainings, studies) in rescue, fire protection, civil protection, critical infrastructure protection, internal security, occupational safety and health, crisis management and crisis communication. SGSP representatives serve as experts in NATO, EU as well as in national scientific and rescue institutions.

CVs of involved key researchers / staff members

Maj. Paweł Gromek, DSc Eng. is an associate professor at the Main School of Fire Service in Warsaw, officer of the State Fire Service with experience related to SGSP Firefighting-Rescue Unit (intervention commander and dispatcher), DSc in security studies and master engineer in fire safety engineering. He is a reviewer for International

Journal of Critical Infrastructure Protection, American Journal Experts, MDPI, International Association for Political Science Students. He was/is coordinator and participant of research teams in 25 international and national projects, PRINCE2®Profficiency, ISO 22301 auditor, rewarded by Ministry of Work and Social Politics, Commander of the Main Headquarters of the State Fire Service, President of the Mazovian Province, Commandant-Rector of SGSP and WPROST Journal for service and scientific work related to rescue and people protection. The author or co-author of monographs and scientific papers in the object realm, actively participating in international and national security conferences. He is a member of Association for Fire Safety Engineers and Technicians (awarded by this organization). His expertise areas are emergency operations, risk assessment and new technologies in safety.

Anna Szajewska PhD Eng. is an adjunct at the Main School of Fire Service in Warsaw. An extensive experience in the field of research on forest fire spreading and computer simulation techniques. The scientific activity is related to the issues concerning the development of external fires. The author of over 40 publications issued in scientific journals of national and international range in the field of firefighting, image analysis, thermovision applications in safety engineering, computer vision and decision support. Works on researches involving the external fire issues (forests, soil cover, car fires). The director of postgraduate studies conducted at the Main School of Fire Service "Forest Fire Protection" since 2014 and the director of department Hydromechanics and Firefighting Water Supply since 2018. Actively takes part in conferences related to forest fires topics.

Role in the project

Taking into consideration SGSP profile, it strongly matches the tasks in the proposal. Unique connection of combatting wildfires theory and practice is very valuable from the point of view of not only merit-related topics. However, it could be exceptionally substantial for collecting and tracking users' requirements as well as verification of solutions and toolkits, demonstration, exploitation and dissemination.

The academy will express its research potential to support in analysing forest landscape models for wildfire threat assessment (T2.2.) as well as in exploration of forest resilience from historical case studies (T2.4.). In case of systematic methodology for participatory process (T2.5.), SGSP will serve its contacts and experiences in preparing a procedure to engage the stakeholders and organize their support.

Noticeable impact on the project works will be observed in WP3, as SGSP ascribes into preparation and pre-planning activities for wildfire response (T3.3.), AR/VR content curation for training firefighters (T3.4.), citizen engagement programme for preventing wildfires (T3.5.) and preparing mobile application for citizen engagement (T3.6.), due to theoretical and practical efforts.

Previous projects' experiences and operational background will be used when pilot outcome assessment and replicability studies are concerned (T9.2.).

In terms of WP10, SGSP will disseminate the project results and communicate them across global communities (T10.3.). In addition, the academy will support stakeholders' community building and management (T10.4.) and evaluation of standards and compliance for interoperability of SILVANUS platform (T10.5.).

Relevant publications, and/or products, services or other achievements

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- Jaskółowski W., Szajewska A., Thermogravimetric studies of exotic woods in oxidative environment, Annals of Warsaw University of Life Sciences - SGGW Forestry and Wood Technology, tom 92, s. 137-140, 2015.

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- Szajewska A., Thermovision in fire protection, SGSP, 1, 2018 ISBN 978-83-88446-2018.87-0. (in polish).
- Szajewska A., Classification of a burnt area based on spectral images, MATEC Web of Conferences, Vol. 247, 2018, Fire and Environmental Safety Engineering 2018 (FESE 2018), p. 1-5, 2018
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- Szajewska A., Comparison of the effectiveness of selected indicators classifying burnt areas on the basis of low altitude measurements, Wood and Fire safety, Proceedings of the 9th International Conference on Wood and Fire Safety 2020, Springer, p. 374-278, 2020, <https://doi.org/10.1007/978-3-030-41235-7>.
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List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
Improving Disaster Risk Reduction in Transcarpathian Region, Ukraine – ImProDiReT, EU Civil Protection Mechanism, https://ec.europa.eu/echo/funding-evaluations-financing-civil-protection-europe-selected-projects/improving-disaster-risk_en , to develop new approaches	Risk assessment method related to natural disasters (e.g. wildfires) Social campaign concerning DRR basing on the risk assessment results	Experiences in risk assessment (incl. wildfires, especially with the use of special information and in the context of the assessment methodology design) useful in terms of fire risk index analysis and practical implementation Experiences in social campaign design and conducting for the needs of policy recommendations formulation

and methods for the joint development of DRR strategies involving multiple stakeholders		
European Sensor System for CBRN Applications – EU-SENSE, Horizon 2020, https://eu-sense.eu/ , to contribute to better situational awareness of the CBRNe practitioners through the development of a novel network of chemical sensors, which will provide a technological solution to relevant gaps presented in the ENCIRLCE catalogue of technologies; to improve the detection capabilities of the novel network of chemical sensors through the use of machine learning algorithms to reduce the impact of environmental noise and the application of contaminant dispersion models; to showcase the usability of the EU-SENSE network to CBRNe practitioners in order to validate the system and to maximize its exploitation potential (the objective also entails the preparation of training sessions with CBRNe practitioners in relevant conditions).	Technological assumptions and analysis (from practitioner point of view) of multi-sensor approach	General operational conclusions related to use of multi-sensors by firefighters
DRiving InnoVation in crisis management for European Resilience – DRIVER+, 7FP, https://www.driver-project.eu/ , to develop a pan-European Test-bed for Crisis Management capability development enabling practitioners to create a space in which stakeholders can collaborate in testing and evaluating new products, tools, processes or organisational solution; to develop a Portfolio of Solutions in the form of a database-driven website that aims at documenting all DRIVER+ solutions; to foster a shared understanding in Crisis Management across Europe, through the enhancement of the cooperation framework.	Trial Guidance Methodology (TGM) Experiences in demonstration of new technologies related to spectacular hazards (e.g. wildfires)	Recommendation of TGM use in the project pilots, especially in final demonstration
Risk Management Capability Based on Gaps Identification in the BSR – From Gaps to Caps, BSR-Secure, https://ec.europa.eu/echo/funding-evaluations/financing-civil-protection-europe/selected-projects/risk-management-capability_en , to facilitate future national assessments of risk management capability in accord-	Risk assessment methodology	Implementation of the risk assessment methodology to activities related to wildfire risk index



ance with the EU Decision on the Union Civil Protection Mechanism among the participating states		
Secure european common information space for the interoperability of first responders and police autorithies – SECTOR, 7FP, https://cordis.europa.eu/project/id/607821/pl , to establish the foundations of future Common CCM Information Spaces by expanding the European scientific knowledge base on (cross-border) multi-agency CCM processes and the complications these imply when aiming at setting-up and design cross-border supporting information Systems	Experiences related to multiple information sources and their technical and functional integration in terms of crisis management and disaster management (incl. wildfires)	Use of the experiences in defining and tracking end-users' requirements from collection to the project demonstration as well as in the context of functional support concerning technical design of new solutions
A DEcision Support Tool for Reconstruction and recovery and for the Interoperability of international Relief units in case Of complex crises situations, including CBRN contamination risks – DESTRIERO, 7FP, http://www.destriero-fp7.eu/ , faster and better damage assessment for planning and monitoring of progress of recovery; Improve damage assessment by integrating satellite data, aerial photos and data from the field (e.g. from mobile devices) into a coherent information management tool; facilitate fast and intuitive access for distributed users to visualise the dynamic “common operational picture”, during the planning and reconstruction period. Integrate state of the art visualisation techniques based on I-NAV (Integrated NAVigation Services) developed in the FP6 LIMES project (FP6 Programme – Aero-nautics&Space/GMES Security); Better collaborative decision making during the planning and reconstruction phase Support standardisation of assessment data, interoperability between different information systems from stakeholders and capabilities to compare damage and recovery requirements towards prioritisation and joint decision making; Improve management information in relation to PDNA and RRP DESTRIERO will provide a single access point and online library with PDNA and RRP Frameworks, high level overviews of	Experiences related to multiple information sources and their technical and functional integration in terms of crisis management and disaster management (incl. wildfires)	Use of the experiences in defining and tracking end-users' requirements from collection to the project demonstration as well as in the context of functional support concerning technical design of new solutions

planned and running recovery projects including multi-donor funding information and the possibility to trace related surveillance data for progress monitoring.		
End User Driven demo for CBRNe - EDEN, 7FP, https://cordis.europa.eu/project/id/313077 , to allow CBRNe capabilities to be shared among multi-national CBRNE stakeholders, which is paramount in cross-border incident management, and through time allow for a build-up of common capability across European boundaries	Experiences in demonstration of new technologies related to spectacular hazards (e.g. wildfires)	Use the experiences in the pilots support activities
MOBile NETwork for people's location in natural and man-made disasters – MOBNET, European Global Navigation Satellite Systems Agency, http://mobnet-h2020.eu/ , to design a Search and Rescue (SAR) system for the location of isolated victims in the case of natural or man-made disasters such as earthquakes, hurricanes or large snow storms; to help first responder services to find fugitives or smugglers hidden within buildings; to use of European Global Navigation Satellite (EGNSS) systems (both Galileo early services and EGNOS) and Digital Cellular Technologies (DCT) to play the key role in these situations in which it is difficult, dangerous or even impossible to access the affected areas	Experiences in formulation of functional requirements and tracking them during system design and evaluation	Use of the experiences in formulation of functional requirements and tracking them during system design and evaluation (during pilots)

Individual exploitation plan

- Exchange of knowledge and experiences related to wildfires, including safety management (emergency management, disaster management, crisis management) and new technologies to increase scientific and practical background of academic teachers.
- Implementation of real-life scenarios to training programs for the State Fire Service officers.
- Ensuring an access to chosen simulation tools and public deliverables for support of education processes in terms of emergency operations, emergency management and disaster management.
- Direct contact with new technologies which are implemented to emergency operation in wildfires with a positive potential to use it for further research purposes (papers, projects etc.).

Communication strategy for promoting project outcomes

- Presentation of public project output during scientific festivals in SGSP.
- Expression of the project roll-up in SGSP premises.
- Website at SGSP domain dedicated to the project.
- Reporting the project activities to the Main Headquarters of the State Fire Service.
- Preparing materials to be published in high-score international scientific journals.
- Preparing materials to be published in the Scientific Papers of the Main School of Fire Service.

Description of significant infrastructure and major items of technical equipment relevant to the project

- Alpha vacuum spectrometer for environmental analyses ORTEC.
- Gamma spectrometer for environmental analyses.
- Fast thermo vision camera FLIR X6800.
- Network infrastructure for IoT based devices.
- Two computation clusters for analysis of big data.
- Environmental monitoring laboratory.
- Fire brigade training yard for fire experiments.
- Room for the performing small scale fires (chamber).
- Chemical laboratory of Chemical Rescue Division.
- Differential scanning calorimetry.
- Spectrometers.
- Impactor for air samples.
- Particulate matter counters.

4.1.33 Strategic Regional Agency for the Sustainable Development of the Territory

Partner Name: *Agenzia Regionale Strategica per lo Sviluppo Ecosostenibile del Territorio – Regione Puglia*

Company website: <http://asset.regionepuglia.it/>

Type: Public body



AGENZIA REGIONALE STRATEGICA PER LO SVILUPPO ECOSOSTENIBILE DEL TERRITORIO

Partner profile

ASSET is the Regional Strategic Agency for the eco-sustainable development of the territory – Apulia Region. The tasks are listed in art. 2 paragraph 3 of the Regional Law No. 41 of November, the 2nd 2017. ASSET is a public agency bound to Apulia Region that has its activities in many disciplines (normed by law): sustainable passenger mobility; public works; housing policies; reorganization of healthcare construction; landscape protection; enhancement of cultural and environmental assets; alternative energy production and reduction of energy consumption; prevention and safeguarding of the territory from hydrogeological and seismic risks in support of civil protection, regional bodies, local authorities and concessionaires of public works; strategic planning of investments in terms of sustainable development of the territory; strategic research and development projects. The regional Strategic Agency (ASSET) is a technical operational body to support the Region for the definition and management of policies for mobility, urban quality, public works, ecology and landscape, for the prevention and protection of territory and hydrogeological and seismic risk. ASSET is therefore the Regional agency dedicated, as public engineering, to strategic planning, integrated planning, planning and implementation of public works. The organizational structure of the ASSET is of a regional nature, consisting of about 25 highly specialized units. ASSET also counts the special administrator for the hydrogeological risk for the Puglia region. ASSET has strong competences regarding hydrogeological risk, with staff with over ten years of experience in the subject. The special administrator for the hydrogeological risk of the Apulia Region is one of the internal figures of the ASSET, this constitutes a great added value to the project as specific competences are put into practice.

CVs of involved key researchers / staff members

Giuseppe Garofalo (Male) graduated in Civil Engineering and has postgraduate as PhD in Transportation, Environment and Technology Innovation. In 2006 he joined Autorità di Bacino della Puglia, where he works about hydrogeological instability and territorial planning. He was involved in many research activities focused on hydrogeological instability. He has been involved, as project and technical manager, in several research projects like: “indagini geognostiche e monitoraggio finalizzati all’individuazione delle cavità presenti nel sottosuolo di Lesina Marina (FG)”, “Member of the Qualified Technical Presidium for the Lesina Marina emergency”. Since June 2018 he passed in “ASSET – Agenzia regionale Strategica per lo Sviluppo Ecosostenibile del Territorio – Apulia Region” like Engineer officer. He is involved in several topics like transportation e EU Fund. In particular he is

"Executive Coordinator Policy and Project in ASSET Internationalization Task Force. He currently participates in several EU Projects (Interreg ITA - CRO, Interreg GRE - ITA, FEAMP, Europe Aid programme).

Marino Spilotros (Male) graduated in Economic and Statistics Science and has postgraduate Master: in "Manager of Research", "European Research Funding Programs: Rules, Forms, Management and Accounting". After a period of three years (2003-2006) in Brussels working at the European Commission (DG TREN and DG EAC) and then at the European Parliament as **Technical and political advisor** to several MEPs he started to work in Italy as project and research manager/grants officer for NGO's, ANCI Puglia (Association of Italian Municipalities), Public Bodies and mainly at the University of Bari. Main tasks where: construction of project partnerships, preparation of project proposals in response to calls for funding, management and reporting of project activities, information activities, training activities support activities for participating in calls for tenders for projects, funded by the EU institutions and other national and international organizations (e.g. ADRION, Horizon 2020, EUROAID, INTERREG, ENI MED, ERC, ERASMUS+), survey implementation, data analysis and reporting. Organizing and coordinating training and scientific events. Since July 2019 he started to work for "ASSET – Agenzia regionale Strategica per lo Sviluppo Ecosostenibile del Territorio – Apulia Region" particular he is "Project and Policy officer in ASSET Internationalization Task Force and he is involved in several EU Projects (Interreg ITA - CRO, Interreg GRE - ITA, FEAMP, Europe Aid programme) held by ASSET.

Letizia Musaio Somma (female) - Architect, urban regeneration) - PhD Architect - BIM Specialist. She has international work experience, in different Countries, such as: Spain and Netherlands mainly in architecture and urban project, urban regeneration and reuse project (presentation 2D, 3D drawings). Since July 2019 she started to work for "ASSET – Agenzia regionale Strategica per lo Sviluppo Ecosostenibile del Territorio – Apulia Region". She is member in ASSET Internationalization Task Force and she is involved in several EU Projects held by ASSET, mainly as Project architect in the INTERREG Italy-Croatia - FRAMESPORT (Framework initiative fostering the sustainable development of Adriatic small ports) and in the Urban Laboratory for the Strategic Plan of Taranto (Puglia, Italy). Moreover she gives its contribution as technical support to Mobility and Transportation sector.

Relevant Work Experience/Employment - in order to give contribution to the Project: Lorenzo Viva has international work experience, in different Countries, such as: United Kingdom (London), Italy (Rome, Florence) and China (Shanghai). GIS (*Geographic Information System*) and DataBase Specialist at ASSET – Regione Puglia – Bari, Italy, *from June 2020-present*: involved into territorial analysis and planning with new technology and survey technical equipment, GIS software, I.o.T. and Cloud Computing, strategies and projects for the environmental protection and sustainability. Landscape Architect, Urban Planner and GIS specialist at Philip Cave Associates Ltd. London, UK – *from October 2019 to June 2020*: involved in residential master-planning and design including ecological and territorial analysis, R&D and public realm schemes. GIS Specialist and Cloud Computing at EY - ERNST & YOUNG – Rome, Italy - partnership in 2019 as External Consultant and Strategic Territorial planner: involved in territorial and environmental projects and analysis, projects as well as developing landscape and territorial networks as part of an ecological action to preserve natural, territorial and financial resources, UAS/drone surveys for the environmental sustainability and monitoring. Urban Planner and Landscape Architect, CAD/GIS Specialist, freelancer UAS (drone) Operator: 2018/2019, with different kind of projects in different cities and countries: mainly in Italy, such as the partnership with Vallerini Studio in Florence and also in Spain (Oviedo). National competitions, private gardens, squares, consultancy regarding GIS-CAD software, ecological and territorial projects. Landscape Architect, GIS and DataBase specialist: 2017/2018 at OUDG OrientLandscape Shanghai and Mediterraneo Design & Construction Ltd. Shanghai.

Expertise relevant to the project

ASSET will be in charge to the action in the pilot area Parco Nazionale del Gargano. Today's wildfire problem is rooted in historical and recently modified vegetation conditions, possibly exacerbated by climate change. In particular identify similar to other forms of risk management, the management of wildfire risks begins with an assessment of the probability of a wildfire event and the susceptibility of highly valued resources and assets to wildfire. Strategic risk management in the wildfire context involves many complicating factors, including, but not limited to: i) Many wildlands are historically predisposed to periodic fire; ii) wildfire is a dynamic ecological process that contributed to the development of most Puglia ecosystems; iii) wildfire is a spatial process: fuel continuity is critical in fire spread, and burned areas may be considerable distances from the ignition point; iv) many communities have developed within or adjacent to fire-prone ecosystems; these communities vary widely in their levels of wildfire exposure and susceptibility; and v) socio-political expectations regarding wildland fire management and community fire protection may

not be realistic under current and expected future conditions. Collectively, these factors present challenges to wildfire risk mitigation, although careful application of decision science principles could help inform identification of an effective suite of mitigation investments. Critically, the evaluation of risk mitigation options begins with the questions of what appropriate wildfire management objectives are, and how risk mitigation options realistically vary in terms of cost, likely effectiveness, and the appropriate identification of who bears the responsibility. ASSET's task is to operate in support of the Region and, where required, of local authorities, in the field of territorial and strategical planning, using innovative and technical equipment, such as: UAS-drone, GIS software and GPS Station – in order to create 2D-3D maps. The Asset deals with projects relating to the prevention of environmental damage, ecosystem prevention, structured analysis of the implementation of the ecological level of the territory, software platforms and innovative data management and DataBase, such as GIS software, interoperable platforms between geographic information systems and I.o.T. and drone survey. Furthermore, Asset deals with strategic and smart planning of interventions in the Apulian territory.

The purpose of the Asset is to focus on environmental issues, such as those relating to fires, through innovative instrumentation - multi-sensor thermal cameras for UAS/drone equipment – finding smart solutions to the issues.

Role in the project

- **WP1:** ASSET will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** ASSET will contribute to the participatory process.
- **WP5:** ASSET will contribute to the decision support system for response coordination based on the information collected and aggregated from WP4 activities.
- **WP8:** ASSET will contribute to the integration services
- **WP9:** ASSET will lead the pilot demonstration as outlined below.
- **WP10:** ASSET will disseminate and exploit the project results through established international links.

Relevant publications, and/or products, services or other achievements

ASSET's task is to operate in support of the Region and, where required, of local authorities, in the field of: territorial and strategical planning, using innovative and technical equipment, such as: UAS-drone, GIS software and GPS Station – in order to create 2D-3D maps. The Asset deals with projects relating to the prevention of environmental damage, ecosystem prevention, structured analysis of the implementation of the ecological level of the territory, software platforms and innovative data management and DataBase, such as GIS software, interoperable platforms between geographic information systems and I.o.T. and drone survey. Furthermore, Asset deals with strategic and *smart* planning of interventions in the Apulian territory and also with partnerships at European and international level.

Asset uses the most suitable technical equipment for territorial surveying, GeoDataBase, GIS Applications and GPS equipment – also for the Data post-processing software - and innovative platforms, in order to utilize UAS-drones for recording and creating 3D maps, analyzing surface data for fire inspections and territorial planning, linking the air perspective and the mobile deployment management system, digitization for faster assessment of the situation and more informed emergency services. This is especially possible for the fire department and its rescue operations. Support fire departments in their work with drones (UAS). These flying sensors make it possible to get a very quick overview of operational scenes and, for example, locate hotspots or detect hazardous substances in order to prevent fire and protect the environment through a strategic and participatory planning.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
APPESCA, FEAMP, http://asset.regione.puglia.it/?APPESCA	AP-PESCA/1.441.00,00€/1.386.00,00€	Carry out surveys on the Apulian wildfire sector and monitoring of resources useful for planning activities with a view to sustainability for the definition of guidelines that act as a driving force for the efficiency of the prevention of wildfire and its innovation. the examination of any critical issues and the identification of real needs in terms of services, works and infrastructures.

<p>STREAM, INTERREG ITALY CROATIA, https://www.italy-croatia.eu/web/stream</p>	<p>STREAM - Strategic development of flood management/9.411.657, 83€/300.000,00 €</p>	<p>Through specific internal and external communication activities, organized through a series of workshops, with the CMCC, the Civil Protection of Puglia and the local administrations, with the STREAM project, the ability to react to flood risk will be made as immediate as possible, involving at the same time, in this action strategy, local communities for greater awareness in risk situations. In this regard, ASSET will develop, together with the CMCC, the flood risk maps for the Adriatic and Ionian belt for the three risk probabilities (low, medium and high). With the Civil Protection of Puglia, it will define the program for the management of flood risk.</p>
<p>FRAMESPORT, INTERREG ITALY CROATIA, https://www.italy-croatia.eu/web/framesport</p>	<p>FRAMESPORT - Framework initiative fostering the sustainable development of Adriatic small ports/7.138.832, 9€/341.000,00 €</p>	<p>FRAMESPORT provides the creation of a digital platform capable of collecting and systematizing all the sources of documentary evidence on secondary ports currently existing in Italy and Croatia. The concentration and systematization of this heterogeneous information will provide valuable support to the planning of actions aimed at the common development of the Adriatic port system. All the stakeholders of the daily life of small ports - both private and institutional - are actively involved in planning, becoming active subjects of the socio-economic development of the small Adriatic port; once the priority themes of common interest have been defined, the concrete pilot actions to be undertaken will then be devised and implemented with the same methodology.</p>
<p>AETHER, Interreg V-A Grecia-Italia 2014/2020, https://greece-italy.eu/rhb-funded-projects/aether-alliance-for-the-effective-transnational-handling-of-environmental-resources/</p>	<p>AETHER - <i>Alliance for the Effective Transnational Handling of environmental Resources</i> – 4.500.000,00 € / 2.200.000,00 €</p>	<p>Some main project actions are: SOLE ("Stakeholders' Organization for the Local Environment") STEP ("State-of-the-art Technology-based Environmental Protection") LEPRE ("Local Environmental Patrol for the Reporting of Emergencies") ARCA ("Awareness-Raising Chain Action")</p>

Communication strategy for promoting project outcomes

A particular element in Asset projects is also represented by the involvement of all project stakeholders, through sustainable interventions on the territory, environmental prevention, putting an eye on the climate change, and through participatory planning. Mainly promoting analysis & demonstration actions that will produce results with a wide & long-lasting influence, fully exploiting the Blue Economy potential, promoting the creation of new markets & jobs in the field of ecosystem-oriented services (coastal & maritime tourism & park management & adaptation to climate change). ASSET will first promote a geomorphological monitoring into pilot area (Parco Nazionale del Gargano) that will provide data for the analysis of enabling factors & threats for sustainable co-evolution at local scale involving the park management and the civil protection. The civil protection also can carrying out simulations and training activities using the equipment provided (helicopters, tank trucks, firefighting equipment, etc.). ASSET will promote inclusion and will involve stakeholders and communities without distinctions of nationality, culture, race or religion. It will be used a neutral (non-technical) language in participated process and events, in communication activities and materials. This to give equal-opportunities to all subjects to participate and contribute to the project and the processes, without discrimination of culture or education. ASSET will organize:

- public workshops for grassroots' involvement in pilot areas
- targeted information and training events for capitalization
- Press conferences and scientific articles

- Social media and videos to be used
- The most effective local media

A wider group of stakeholders will also be involved in the design and implementation of the activities of the project. Participation runs through the entire project cycle, from the definition of a strategy and the identification of objectives, via the planning and implementation of activities, right up to the evaluation of the results and the use of the lessons learnt. Participatory Monitoring and Evaluation style and toolbox are used for monitoring and evaluation – and therefore for impact assessment. The inclusion of the target groups in the planning and implementation of an impact assessment is decisive for it to be accepted. This is especially true for the development of indicators and data collection, as well as the evaluation of a project's effects. This is the only way to ensure that local partners can also use the impact assessment's results to good effect.

ASSET will use the previous projects experience and action such as: - SOLE ("Stakeholders' Organization for the Local Environment") - Creation and management of the SOLE Network / Network composed of local governments and their Agencies, Police, Fire Brigade, Coast Guard, Civic Society Organizations, NGOs and Volunteering, for effective coordination and the best use of resources in the event of an environmental emergency;

- LEPRE ("Local Environmental Patrol for the Reporting of Emergencies") - Pilot action for involving citizens in the protection of their local environment. By adopting the Citizens Science approach, LEPRE is the user-friendly app that allows all citizens living in the targeted areas to engage in monitoring their local environment and reporting suspicious threats in real time;
- ARCA ("Awareness-Raising Chain Action") - Awareness-raising action from the bottom up. ARCA is based on three pillars: (a) the mental openness of young people towards environmental issues; (b) their close connection with ICT devices; (c) their ability to influence their parents and relatives. The ARCA communication campaign is aimed at young people who live in the target areas, providing them with the pride of conquering a leading role in safeguarding their environment by activating and managing the LEPRE app;

main outputs

- the protection of cultural and natural heritage;
- tourist pressures in the region;
- problems in urbanization;
- mobility challenges;
- waste management;
- pollution or climate change;
- reduction of cultural negative impacts;
- control of the social gap, participation of the older and new generations in the change;
- innovation as an engine that helps the long-running, collaboration between the public and the private sector;
- better knowledge of the sector and the promotion research and development;
- progressive digitalization;

Who will use the main outputs

- local public authority
- regional public authority
- national public authority
- interest groups including NGOs
- higher education and research
- education/training centre and school
- enterprise, excluding SME
- International organisation under national law
- International organisation under inter-national law
- General public
- Other

How will you involve those target groups (and other stakeholders) in the development of the outputs
All people interested or potentially interested in the process, and in its effects, have resources to put in place to contribute positively to the process and represent a set of relevant points of view. Among the various selection methods there are three major categories:

1. the "open door" method, which consists in publicizing the event and letting people decide freely whether to participate or not, presents the typical critical aspects of self-selection;
2. the "targeted selection" through mapping of the stakeholders, i.e. all the subjects affected by the possible impacts of the process in order to identify all the interests and points of view at stake.
3. the "random selection" of a sample of the reference population.
4. strategic partners, for example associations or bodies / institutions. Scientific dissemination days will be organized with the presence of the scientific community, administrations, stakeholders.

A specific focus will be dedicated to Wildfire education in Gargano area with the support of the civil protection. Its components designed for youth would be the beginning of a much-needed cultural shift that instils life-long knowledge about the importance of mitigation and preparedness to future land and homeowners; and can move forward the goal of reducing loss and long-term recovery impacts from wildland fires.

When children had been afforded the opportunity to participate in bushfire risk reduction activities or discussions, they exhibited a much more sophisticated understanding than children who had been denied such opportunities. Importantly, when children did not have access to information, they constructed their own mental models based on their pre-existing knowledge. For example, in schools, a major emphasis is placed on house fire safety and, when children did not have information about bushfire hazards, they routinely applied their knowledge of house fire to the bushfire context. Thus, children's knowledge of bushfire risk is a function of two processes: socio-cultural participation in their communities and their own independent construction of meaning. Both of these processes must be facilitated and accommodated in children's bushfire education.

Description of significant infrastructure and major items of technical equipment relevant to the project

ASSET will use:

- STEP ("State-of-the-art Technology-based Environmental Protection") - ICT transnational platform for surveillance, early warning, coordination and recovery actions for environmental emergencies. STEP channels and processes peer-to-peer, bottom-up and top-down information flows. Interlaced on a peer-to-peer basis with traditional security bodies (Fire Brigade, Police, Civil Defense and others), the platform is also powered from top to bottom by patrol data
- LIME ("Laboratory for Integrated Management of Environment") - Urban sustainability laboratory for integrated environmental management

The use of new technologies – such as UAS, Unmanned Aerial System / drones - has led to an innovative approach in future-oriented design, through environmental monitoring with new software platforms and relevant technical instrumentation, such as UAS, GPS station, G.I.S., laser scanners and mobile on-the-go LiDAR systems. Other types of projects concern environmental recovery, rehabilitation of the peculiarities of places, risk mitigation and, where necessary, re-naturalization. They are also developed to ensure the protection and enhancement of the territory, with the aim of improving landscape, prevent damages and enhancing urban quality, through all the tools and planning processes available, pursuing an eco-sustainable development and a socio-environmental balance.

- Certified European UAS Operator – Drone Pilot and Certified GIS Specialist.
- Suitable technical equipment for territorial surveying, GeoDataBase, GIS Applications for the Data post-processing, software and innovative platforms: ESRI ArcGis, Cloud Compare, Pix4Dmapper, DJI drones for recording and creating 3D maps, analyzing surface data for fire inspections and territorial planning, in order to prevent fire and protect the environment through a strategic planning.
- An option to look at: Cooperation between leading manufacturers of fire and drone technology, "linking the air perspective and the mobile deployment management system, digitization for faster assessment of the situation and more informed emergency services. This is especially true for the fire department and its rescue operations. Support fire departments in their work with drones. These flying sensors make it possible to get a very quick overview of operational scenes and, for example, locate hotspots or detect hazardous substances", in order to prevent fire, damages to territories and to protect the environment, applying a sustainable and innovative methodology.

Pilot description

Pilot site description:

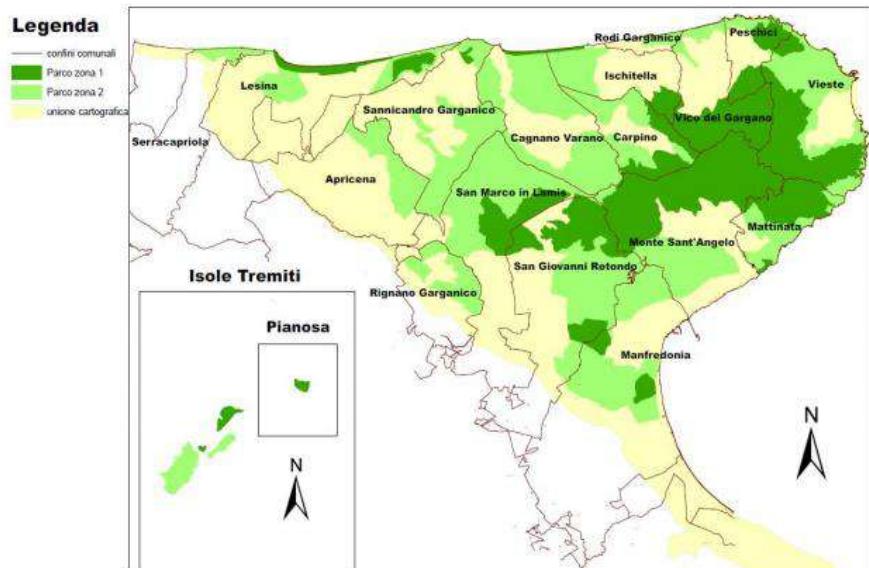
Gargano (Italian pronunciation: [gar'qa:nɔ]) is a historical and geographical sub-region in the province of Foggia, Apulia, southeast Italy, consisting of a wide isolated mountain massif made of highland and several peaks and forming the backbone of the Gargano Promontory projecting into the Adriatic Sea, the "spur" on the Italian "boot". The high point is Monte Calvo at 1,065 m (3,494 ft). Most of the upland area, about 1,200 km² (460 sq mi), is part of the Gargano National Park.

The Gargano National Park is a National Park established in 1991 (according to art. 19 of Law 394/91) and is located on the promontory of the same name, in the province of Foggia, in Apulia. It is managed by the Gargano National Park Authority, established in 1995 (Institutional Decree DPR 05/06/1995), which also manages the Tremiti Islands Marine Nature Reserve, established in 1989 (D.I. 14/07/1989).

The park falls entirely within the province of Foggia, covering nearly the entire promontory and extends over an area of about 120,000 hectares. It includes, totally or partially, 18 municipalities: Apricena, Cagnano Varano, Carpino, Ischitella, Tremiti Islands, Lesina, Manfredonia, Mattinata, Monte Sant'Angelo, Peschici, Rignano Garganico, Rodi Garganico, San Giovanni Rotondo, San Marco in Lamis, San Nicandro Garganico, Serracapriola, Vico del Gargano and Vieste. The boundaries of the park are jagged and are included within the Fortore river, the Candelaro stream and the coast.

Based on the degree of anthropization, the Park provides for internal zoning, which then divides it into two areas:

- Zone 1: of significant naturalistic, landscape and cultural interest with limited or non-existent degree of anthropization;
- Zone 2: of naturalistic, landscape and cultural value with a greater degree of anthropization.

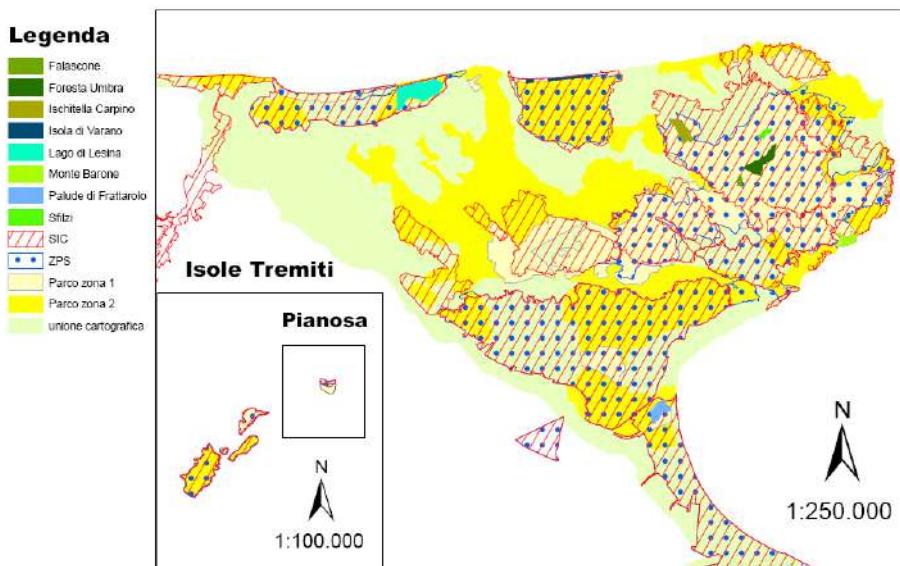


Pic. 1 - Gargano National Park map.

The region of the Park includes, entirely or partially, SCIs (Sites of Community Importance) according to the Habitats Directive (92/43 / EEC) and SPAs (Special Protection Areas) according to the Birds Directive (79/409 / EEC) and of the Habitat Directive.

Codice	Denominazione	Tipo	Estensione (ha)
IT9110001	Isola e lago di Varano	SIC	8.146
IT9110004	Foresta Umbra	SIC	20.656
IT9110005	Zone umide della Capitanata	SIC	14.110
IT9110008	Valloni e steppe pedegarganiche	SIC/ZPS	29.817
IT9110009	Valloni di Mattinata - Monte Sacro	SIC	6.510
IT9110011	Isole Tremiti	SIC	372
IT9110012	Testa del Gargano	SIC	5.658
IT9110015	Duna e lago di Lesina - Foce del Fortore	SIC	9.823
IT9110016	Pineta Marzini	SIC	787
IT9110025	Manaccore del Gargano	SIC	2.063
IT9110026	Monte Calvo - Piana di Montenero	SIC/ZPS	7.620
IT9110027	Bosco Janculia - Monte Castello	SIC	4.456
IT9110030	Bosco Quarto - Monte Spigno	SIC	7.862
IT9110037	Laghi di Lesina e Varano	ZPS	15.195
IT9110038	Paludi presso il Golfo di Manfredonia	ZPS	14.437
IT9110039	Promontorio del Gargano	ZPS	70.012
IT9110040	Isole Tremiti	ZPS	342

Pic. 2 - Gargano National Park SIC and ZPS



Pic. 3 - Map of protected areas with different naturalistic value

Ecological and biodiversity description:

The Park preserves an extraordinary concentration of different habitats: rocky coasts, the big and hot southern valleys rich in rare flower and wildlife species, the central beech woodlands situated at low altitudes (300m asl) and rich in centuries-old specimens, Mediterranean pine forests with Aleppo pines, with specimens more than 500 years old. As far as wildlife is concerned, the peculiarity of the promontory is given by the presence of the roe deer (one of the very few autochthonous nuclei in our Country) and several kinds of woodpeckers (Great-spotted Woodpecker, Middle-spotted Woodpecker, Lesser-spotted Woodpecker, and Lilford's Woodpecker - the Lesser-spotted and Lilford's Woodpeckers are very rare and live in Italy only in protected areas): they enhance the naturalistic value of these forests. Both the undergrowth of Gargano forests and the prairies are very rich in flowers. Gargano is the richest location in orchids in Europe and in the Mediterranean basin, with 56 species and 5 sub-species. Moreover, in the past the promontory played an important role in the connection with the Balkan flora and fauna, as it is demonstrated by the presence of the so-called "trans-Adriatic" species. One of the main reasons of the Park establishment is without a doubt the presence of important wetlands declared biotopes of Community Importance, like the lagoons in Lesina and Varano, the marshes in Frattarolo and Daunia Risi, the mouth of the river Fortore, the lake area of Sant'Egidio, and the marsh of Sfinale. The presence of springs and temporary water

pools called "cutini", as well as the traditional "piscine" (meaning pools) in the northern area of Gargano and along the coast between Vieste and Peschici is very interesting for the survival of amphibians, reptiles, and migratory birds. The wetlands of Gargano and Capitanata have always raised the interest of scientists and tourists for the different environments they offer and for being situated in a strategic position on the migratory routes of aquatic birds between Africa and central-eastern Europe. In the 14th century, the Emperor Frederick II of Svevia was fascinated by these places, inspiring his famous treatise "De arte venandi cum avibus".



PIC. 4 - Natural Reserve "Foresta Umbra"

Annual weather pattern:

The location of the park on the Mediterranean Sea lends to a climate of high temperatures and moist conditions with precipitation during every season. The temperature change throughout the year is gradual and moderate, with the warmest month of the year being July with an average high of 88.9 degrees Fahrenheit and the coldest month being January with an average high of 52.9 degrees Fahrenheit. The overall average temperature of Gargano National park is 59.7 degrees, with the average high being 70 degrees Fahrenheit and the average low 49.6 degrees Fahrenheit. Precipitation is distributed evenly throughout the year due to moist, western airflow from above ocean waters. Gargano's average number of days with rain is 67.7. The sun shines on the park an average of 6.7 hours a day and receives 19.5 inches of precipitation on average each year. Gargano National Park is a fairly humid area with the most humid months in the winter and the least humid months during the summer. The annual average relative humidity in the area is 71.9%. The predominant wind distribution is northwest throughout the year. The wind speed is light with an average of 10mph and ranging between 9mph and 13mph. These prevailing Westerlies are common in the area and move winds from west to east in the mid latitudes. In the graphic above, it is easy to see that wind direction, speed, and probability are fairly easy to predict and prepare for in southern Italy. With average wind speeds around 10mph and avg. direction blowing South-East about 30-40% of the year. Wind speeds and probability slightly increase during the warmer months from March until late September.

Historical report on Wildfires:

By analysing fires in the past, we can infer from data concerning the years from 2003 to 2012 (provided by Territorial Coordination of the State Forestry Corps) that fires on the Gargano area occur almost exclusively in summer (during June, July, August, September)

In that decade, 379 fires have altogether occurred, with a total affected area of 8,836.76 ha. Of which 63% (5,603.4 ha) concerned the wooded area, while the remaining 37% (3,233.4 ha) concerned the non-wooded area (pastures and uncultivated areas).

The municipalities most affected by the phenomenon were: San Marco in Lamis, Vieste, Cagnano Varano, Monte Sant'Angelo, Peschici and Vico del Gargano.

COMUNE	Numero incendi	Superficie Boscata	Superficie Non Boscata	Superficie Totale	Superficie Media Incendio
San Marco in Lamis	27	1017,6825	567,1097	1584,7922	58,6960
Vieste	67	926,9811	42,4620	969,4431	14,4693
Cagnano Varano	41	879,2636	1125,0716	2004,3352	48,8862
Monte Sant'Angelo	30	691,1719	323,4522	1014,6241	33,8208
Peschici	43	577,0124	33,1977	610,2101	14,1909
Mattinata	33	467,5534	74,5273	542,0807	16,4267
San Giovanni Rotondo	27	312,2586	366,8595	679,1181	24,2542
Lesina	13	191,3220	1,0753	192,3973	14,7998
San Nicandro Garganico	20	163,2534	190,7356	353,9890	17,6995
Carpino	19	111,3995	210,8496	322,2491	16,9605
Serracapriola	5	110,4711	71,6374	182,1085	36,4217
Apricena	3	57,9216	129,8650	187,7866	62,5955
Vico del Gargano	23	40,8037	3,9616	44,7653	1,9463
Rignano Garganico	11	25,3891	52,4450	77,8341	7,0758
Manfredonia	11	21,5156	36,1320	57,6476	5,2407
Ischitella	2	6,8437	0,0000	6,8437	3,4219
Rodi Garganico	3	2,5286	4,0000	6,5286	2,1762
Isole Tremiti	0	0,0000	0,0000	0,0000	0,0000
Totale	379	5.603,3718	3.233,3815	8.836,7533	23,3

Pic. 5 - Data concerning the fires from 2003 to 2012

By processing the data concerning the decade 2003 - 2012 in the Gargano area, the main cause of fire was found to be 70% of malicious origin, 29% of unintentional origin and 1% of accidental origin. There were no fires of natural origin. The most recurrent causes of arson are: spites between shepherds, expansion and / or search for new pastures.

Regarding fires of unintentional and accidental origin, they are mainly due to cigarette butts or to the removal of plant remains (burning stubbles).

Available infrastructure [KPIs]:

According to the Legislative Decree 19 August 2016, n. 177, the competences in the field of active fight against forest fires have been entrusted to the National Fire Brigade which, exercises the functions of fighting forest fires (with the aid of ground and air vehicles) with the Regions, coordinating shutdown operations.

On the other hand, the Park Authority is directly involved in the fire awareness campaign as well as being responsible for the prevention and forecasting of forest fires (as required by the law 353/2000). In addition, in recent years, it has activated and supported various actions in support of forest fire prevention, both in collaboration with several associations and with ARIF (Regional Agency for Irrigation and Forestry activities).

Over the years, the Authority has also implemented a number of actions aimed at preventing damages from fires in the Gargano area. Among these there is the arrangement of some water collection spots, including some water pools, the so-called "piscine" (Pantolfe, La Tagliata, Carlo Nero, Monsignore) as well as the unordinary maintenance of forest tracks of great importance for the access of extinguishing vehicles in areas at risk.

To fight fires throughout the territory of the Gargano National Park there are structures, qualified personnel and dedicated vehicles that cooperate in synergy during all phases, from monitoring to emergency intervention in the event of uncontrolled fires.

REPARTO CFS	Telefono	Personale	MEZZI		AUTOBOTTI	
	fisso	Nº unità	Panda 4x4	Fuoristrada	Nº	Modulo AIB (litri)
C.S. Manfredonia	0884/583341	2	1			
C.S. Mattinata	0884/554907	2	1	1	1	2.500
C.S. S.Giovanni Rotondo	0882/452516	3		1		
C.S. Sannicandro Garganico	0882/491135	2	1	1		
C.S. Scrracapriola	0882/681111	3		2	1	2.000
C.S. Vico del Gargano	0884/994926	4	1	1	1	2.000
REPARTO CFS	Telefono	Personale	MEZZI		AUTOBOTTI	
	fisso	Nº unità	Panda 4x4	Fuoristrada	Nº	Modulo AIB (litri)
C.T.A. Monte S.Angelo	0884/561673	9			1	7.500
C.S. Cagnano Varano	0884/853001	3	1	3		
C.S. Lago Salso		3	1	1		
C.S. Monte Sant'Angelo	0884/568000	3	1	2		
C.S. Peschici	0884/964537	3	1	2		
C.S. San Marco in Lamis	0882/834976	4	1	2		
C.S. Sannicandro Garganico bis	0882/472835	7	1	2		
C.S. Umbra	0884/530311	3	1	2		
C.S. Vieste	0884/702210	7	1	3	1	1.100
REPARTO CFS	Telefono	Personale	MEZZI		AUTOBOTTI	
	fisso	Nº unità	Panda 4x4	Fuoristrada	Nº	Modulo AIB (litri)
U.I.T.R. Foresta Umbra	0884/560944	4	2	1	2	3.500/1.000
Posto Fisso Lesina	0884/560944	1		1		
Posto Fisso Margherita di Savoia	0883/656278	3		1		
Posto Fisso Umbra	0884/560944	3	1	1		

Vigili del Fuoco

Comune	Descrizione squadre e mezzi
Foggia (sede centrale)	1 squadra ordinaria (5 unità) con 1 APS o ACT con 12000; 1 squadra AIB con Ford Ranger 4x4 con modulo da 400 l (4 unità) + ABP da 6000 l (2 unità);
Vieste	1 squadra AIB con modulo da 400 l (4 unità) + ABP 6000 l (2 unità)
San Giovanni Rotondo	1 squadra ordinaria (5 unità) con MITSUBISHI + CA con modulo da 400 l;
Manfredonia	1 squadra ordinaria (5 unità) con 1 APS + ACT con 2000 l;
Vico del Gargano	1 squadra ordinaria (5 unità) con 1 APS + CA Land Rover con 400 l;
Totale squadre ordinarie	4
Totale squadre AIB	2
Totale squadre VV.F. volontari	2

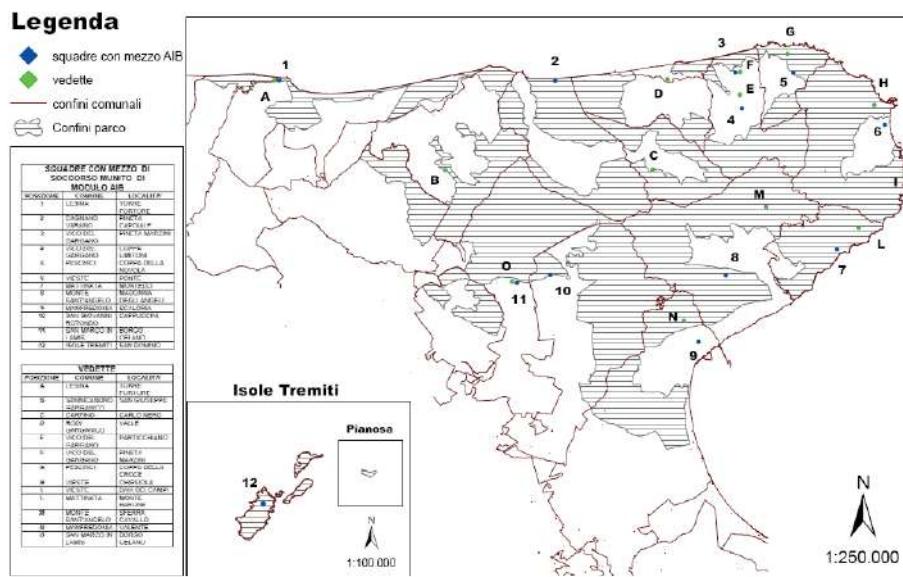
Pic. 6 - Data concerning staff, structures and equipment

Demonstration scenario:

The whole area of the Gargano National Park is covered by specialized operators to prevent the onset of uncontrolled fires. The interventions of active fight against forest fires activated by the Operational Forces include:

- reconnaissance, surveillance and sighting activities aimed at promptly reporting the onset of the fire;
- control of the spread of fire;
- extinction by direct action on the ground;
- interventions with air vehicles;
- quenching and recovery.

To enable the above actions, there is a close synergy activity between SOUP (Permanent Unified Operating Room) of the Civil Protection (which coordinates everything) and ARIF (Regional Agency for irrigation and forestry activities), which through its operators located throughout the region with the task of looking out and first aid, the State Forestry Corps and the National Fire Brigade Corps who intervene promptly in case of uncontrolled fires.



Pic. 7 - Map of ARIF teams and equipment

Phase A:

The Park Authority offer preventive information to visitors and residents on the danger of forest fires and on the correct behaviour to be adopted in order to avoid fire outbreaks, especially accidental fires, carrying out a number of prevention campaigns with posters posted in major hubs, radio spots, on websites and social networks every year. These activities are aimed at reducing the number of fires and promoting the growth of ecological awareness in the citizens and visitors of the park.

Furthermore, to reduce unintentional fires it is strictly forbidden to light fires from 15th June to 15th September (according to the Law 353/2000). Every year the Gargano National Park Authority also carries out the project "Parcogiochiamo", in the 4th and 5th grades of primary schools. Its main theme is the knowledge of biodiversity, as well as its protection and conservation. A fundamental role, within the project, is given to the prevention of forest fires.

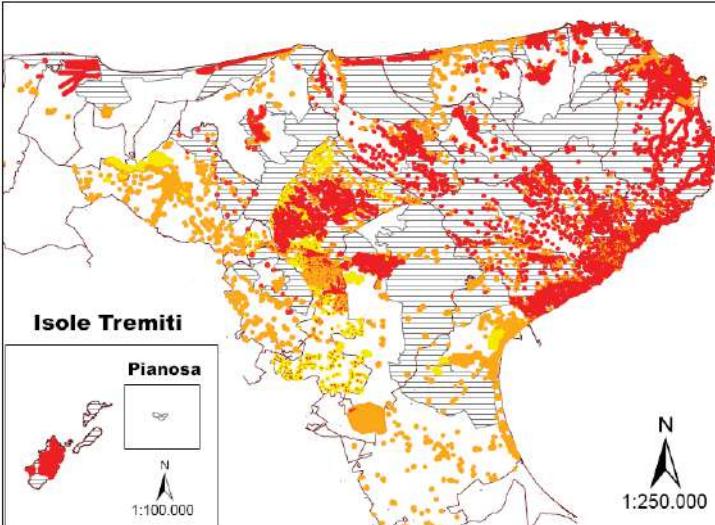
Phase B:

As regards the fire danger index, risk classes have been identified, given the heterogeneity of the vegetation and structures exposed (urban centers, tourist centers, farms, farmhouses, etc.) to the risk of forest fire:

- High risk class (R4): Coniferous woods and Mediterranean scrub present along the Gargano coast with a greater concentration in the north and east and the presence in the same area especially of tourist centers - classic interface;
- Medium risk class (R3): Woods of broad-leaved trees and mountain conifers consisting primarily of holm oaks and reforestation of conifers, present in the area south of the Gargano, mainly in the municipalities of Mattinata, Monte Sant'Angelo, San Giovanni Rotondo and San Marco in Lamis - mixed and occluded interface;
- Low risk class (R2): abandoned crops and abandoned pastures, irregularly spread over the territory - mixed interface.

Legenda

- Rischio Alto
- Rischio Medio
- Rischio Basso
- Confini Comunali
- Confini parco



Pic. 8 - Map of interface-area risks

4.1.34 LETS Italy

Partner Name: LETS ITALIA srl
Company website: http://www.letsitaliasrl.com
Type: SME



The core business of LETS ITALIA is the training first responder squad (public and private company) about emergency (fire, chemical, natural, confined spaces, anthropic...) and study emergency procedure

CVs of key personnel involved in the project

Marcello Sacchetti: chemical engineer, fire safety engineer, 17 years of experience as a health rescuer, trainer for safety in the workplace, trainer for respiratory protection devices, trainer for fire-fighting teams, trainer for work and rescue teams in a confined space, expert in toxic gases Beatrice Rezzaghi: graduated in psychology (high school of human sciences), 6 years of experience as a health rescuer, trainer for safety in the workplace, trainer for respiratory protection devices, trainer for fire-fighting teams, trainer for work and rescue teams in a confined space, expert in toxic gases, graduating in industrial engineering.

Role in the project

- **WP1:** LETS will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** LETS will contribute to the participatory process.
- **WP6:** LETS will contribute to the forest governance policy framework
- **WP7:** LETS will contribute to the future roadmap of forest governance
- **WP10:** PUI will disseminate and exploit the project results through established international links.

Relevant publication

- publications on "ANTINCENDIO" magazine
- Training with personnel from the Fire Department to rescue people in confined spaces
- Coordination with the Provincial Fire Command of Modena for the management of the safety of industrial sites after the earthquake in Emilia Romagna in 2012

Individual exploitation plan

The vision of LETS ITALIA is to improve the potential of risk analysis, to identify methods of protection and to contribute to the improvement of methods and rescue devices

Communication strategy for promoting project outcomes

The approach of LETS ITALIA is the methodological one, based on an analysis of the potential of new technologies, on the analysis of the criticality of technologies and new devices and on direct experiences with the devices of the DOWSER project in simulated scenarios. The activities that LETS ITALIA intends to undertake are mainly to verify the system and its criticality directly on simulated scenarios at different levels of complexity

Description of significant infrastructure and major items of technical equipment relevant to the project

Structure of over 260 square meters with educational classrooms and training facilities (claustrophobic course, maneuver tower for rescuing persons in height, confined space simulators) devices for use in CBRN environments, helicopter stretchers, devices for extraction from confined spaces or rubble, rope rescue systems (natural, industrial environments and in the event of natural disasters)

4.1.35 Parco Naturale Regionale di Tepilora

Partner Name: <i>Parco Naturale Regionale di Tepilora</i> Company website: http://www.tepilorapark.it Type: Public body	 TEPILORA PARCO NATURALE REGIONALE <small>POSADA TORPÈ LODÈ BITTI</small>
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Partner profile

The Regional Natural Park of Tepilora is a Regional Park in Sardinia (Italy) established in 2014 (Regional Law No. 21 of 24 October 2014). It is managed by the Tepilora Regional Natural Park Authority. The park is entirely part of the province of Nuoro and covers an area of about 8,000 hectares. It includes in part, 4 municipalities: Bitti, Lodè, Posada and Torpè. Located in the north-west of Sardinia, the Tepilora Regional Natural Park includes a vast territory that insists on four municipalities: Torpè, Posada, Lodè and Bitti. The park extends from the tepilora forest to the mouth of the Rio Posada; its fulcrum is Mount Tepilora (m.528 s.l.m.), a rocky tip with a triangular profile that stands out in the densely wooded area of Littos and Crastazza and looks towards Lake Posada. Once intended for grazing and cutting wood, in the 1980s the area was afforested for 16% of the total and was equipped for hiking and fire protection, becoming a nature reserve. In the territory of the municipality of Bitti fall the state forests of Crastazza-Tepilora and Sos Littos-sas tumbas owned by the Autonomous Region of Sardinia and managed by the regional agency FORESTAS. In the territory of the municipality of Lodè falls the territory bordered by the forest yard of Sant'anna, owned by the municipality of Lodè and managed by the regional agency FORESTAS.

The Tepilora Regional Park is a body governed by public law and has a complex organization, with a statute that establishes general criteria for internal organization and management of the park. The Tepilora Park is aimed at the conservation and protection of natural resources and the creation of opportunities for sustainable development. The institutive law (L.R. 21/2014) indicates the objective of safeguarding, qualifying, enhancing and strengthening agroforestry-pastoral activities, promotes and encourages the adoption of low environmental impact cultivation techniques, in order to obtain biological and quality productions. Among the institutional purposes are indicated the protection of the environmental heritage of the territory; the promotion of scientific research, environmental monitoring and training activities, aimed at the conservation of biodiversity and the protection of water and river resources; the promotion of an eco-sustainable development model, which does not alter the environment and natural resources, which encourages the requalification of economic activities in forms compatible with the purposes of the same law, also in order to improve the quality of life of resident populations; the protection, recovery and enhancement of the landscape, natural, archaeological, historical-architectural heritage and the defense of typical features, traditions and local culture through the promotion of awareness-raising actions of local communities and operators towards conservation and management of natural and cultural heritage.

In 2017 the Park, as part of an aggregation of 17 municipalities that insist on the Rio Posada catchment area, received the international recognition MaB (Man and the Biosphere) by UNESCO as the first "Biosphere Reserve" in Sardinia, the fifteenth in Italy.

CVs of involved key researchers / staff members

Marianna Agostina Mossa, Director of Tepilora Regional Park from 15.06.2021. Previously, from 1999 to 2021, official of the Autonomous Region of Sardinia, Nature Protection and Forestry Policy Service of the Department of Environmental Defense. Since 2001 Head of the Regional Ecology Network Sector, she has dealt with a) establishment and regulation of protected areas (parks, protected marine areas, natural monuments, areas of significant naturalistic interest, Natura 2000 sites), b) planning, implementation, monitoring and control of EU, national and regional funding for protected areas, c) drafting of strategic documents and financial programs such as POR FESR 2014-2020 and earlier, proposals for the Managing Authority of the Rural Development Program (EAFRD) 2014- 2020, d) planning, management, monitoring and control of EU international cooperation projects. In her role, she have held the position of PROJECT MANAGER of the following community projects:

- "POSBEMED 2 Governance and management of beach-dune systems with Posidonia in the Mediterranean", funded under the INTERREG Med community program, as leader. The project started on 1.11.2019 and will end on 30.06.2022.
- NEPTUNE "Submerged natural and cultural heritage and sustainable management of recreational diving, funded under the INTERREG Maritime Italy - France community program, as a partner. The project will end in February 2022.
- "GIREPAM - Integrated Management of Ecological Networks through Parks and Marine Protected Areas", funded under the INTERREG Maritime Italy - France community program, as leader. The project lasted from 2017 to 2020.
- "CoREM - Cooperation of the ecological networks of the Mediterranean" funded under the Community program PO Maritime Italy - France; From 2010 to 2015.
- "ZOUMATE - wetlands: environment, protection and education", funded under the Community program PO Maritime Italy - France. From 2013 to 2015;
- "ZOUMgest - Wetlands: Management systems to integrate anthropogenic activities and nature protection", funded under the Community program "PO Maritime Italy France"; From July 2009 to July 2012.

She was responsible for the implementation of the POR 2014/2020, Action 6.6.1 Interventions for the protection and enhancement of areas of natural attraction of strategic importance (protected areas in the terrestrial and marine context, protected landscapes) such as to consolidate and promote processes of development". (amount approximately € 36,000,000) and Action 6.5.1 Actions envisaged in the Prioritized Action Framework (PAF) and in the Management Plans of the Natura 2000 Network". She is also a COMPONENT of the Reserve Commission of the Marine Protected Area "Tavolara - Punta Coda Cavallo (Ministerial Decree 183 of 14.05.2018). She is graduated in economics and business and has a postgraduate master's degree in organization science.

Francesco Murgia, former President of the Tepilora Regional Park, currently a member of the Park Assembly: He is a geologist officer at the Infrastructure Sector of the Province of Nuoro in Sardinia, an organization for which he currently also deals with some purely environmental procedures. As a hydrogeologist and speleologist he has carried out numerous researches on the main karst springs of Sardinia in order to optimize the collection for a sustainable use of the water resource; he is currently an elected member of the Board of Directors of the Italian Speleological Society. He has a long experience in the field of Environmental Education and for a long time he was in charge of the Infea Provincial Node for the Nuoro area; again on behalf of the Province of Nuoro, in the context of a specially constituted planning office, he was involved in the drafting of the Provincial Urban Plan within which, in addition to geological and environmental issues, he oversaw the drafting of the Tourist Development Plan; he has carried out a long teaching activity both on general issues of a geological nature and on in-depth studies concerning the defense of the soil and the sustainable use of water resources; in 2013 he was charged with analyzing, on behalf of the Province of Nuoro, the geological and hydrogeological problems that arose in the provincial territory following the flood events of 11/18/2013; between 2014 and 2019 he was appointed by the Ministero of the Environment and the Protection of the Territory and the Sea as a member of the Regional Section of Sardinia of the National Register of Environmental Managers; in the hydrogeological field he is the author of numerous scientific and popular articles and, in particular, of two monographic publications edited by the Italian Institute of Speleology of the University of Bologna that collect multi-year studies and research carried out in the karst aquifers of Monte Albo and Supramonte; In 2018 Francesco Murgia was elected to the council of the Regional Order of Geologists of Sardinia in whose context he plays the role of Secretary.

Marino Satta, Service Technical and Planning, Tepilora Regional Park: civil and environmental engineer, he holds a Master degree in Civil Engineering from the University of Cagliari in 2001, Registered in the Order of Engineers of the province of Nuoro in section A with the number 644 for sectors: Civil, Environmental, Industrial, Information, currently Responsible of the Service Technical and Planning - RUP LLPP (Public Works)with expertise in public works (management of tenders, calls for tenders, planning for the maintenance of the Park's assets), urban planning (planning and issuing of landscape authorizations and opinions),natural resources (flora and fauna, management and enhancement of natural heritage, initiatives for sustainable development).

Alessandro Pala, Agronomy and Land Use, Tepilora Regional Natural Park: Agronomist with a Master degree in Agricultural Sciences and Technologies at the Faculty of Agriculture of the University of Sassari in 2005 and qualification to practice as a Doctor of Agronomy in 2006. Since 2006 he has been a Business Consultant in the Agricultural, Zootechnical, Forestry, Topographical fields, Handling of cadastral practices, Land improvements. From 2017 to 2018 he held the role of Technical Assistant for livestock farms at the ARA SARDINIA (Regional Breeders Association). From 2015 to 2016 at Agrifuturo Soc. Coop. With prevalent mutuality, he carried out inspections in the company as part of the on-site checks CGO-DPU-PSR 2015 (CONDITIONALITY-APPLICATION AWARD UNICO DOMANDE PSR) Photo-interpretation of satellite and aerial data Video capture of the results in the field Province of Nuoro.

Expertise relevant to the project

Analyzing the fires of the past, we can deduce that fires on the Park area and in neighboring areas occur almost exclusively in summer (in June, July, August, September).

Processing the data under consideration in Sardinia, the main cause of fire was found to be 60% of arson, 35% of involuntary origin and 5% of accidental origin.

As for fires of involuntary and accidental origin, they are mainly due to cigarette butts or the removal of plant remains (burning stubble).

The entire area of the Tepilora Regional Natural Park is covered by specialized operators to prevent the onset of uncontrolled fires. Active fire fighting measures activated by the Operational Forces include:

- reconnaissance, surveillance and sighting activities aimed at promptly reporting the onset of the fire;
- control of the spread of fire;
- extinction by direct action in the field;
- interventions with aerial vehicles;
- hardening and recovery.

In order to allow the above actions, a close synergistic activity is underway between SOUP (Permanent Unified Operating Room) of the Civil Protection (which coordinates everything), Forestry and Environmental Surveillance Corps, FORESTAS Regional Agency (Regional Forestry Agency for the Development of the Territory and Environment of Sardinia) and the Fire Brigade Corps which, through their operators, intervene promptly in the event of uncontrolled fires.

Phase A:

The Park Authority offers preventive information to visitors and residents on the danger of forest fires and the correct behavior to be adopted in order to avoid fires, in particular accidental fires, carrying out every year a series of prevention campaigns with posters posted in the main hubs, radio spots, on websites and social networks. These activities aim to reduce the number of fires and to promote the growth of ecological awareness in citizens and visitors to the park.

In addition, in order to reduce involuntary fires, it is strictly forbidden to light fires from 15 June to 15 September (pursuant to Law 353/2000).

Phase B:

With regard to the danger and risk index (regional and municipal) of fire, which define respectively the degree of danger and risk of fire calculated on a regional basis and referring to the individual municipal territory, classes of danger and risk have been identified, given the heterogeneity of vegetation and exposed structures (urban centers, tourist centers, farms, farmhouses, etc.).

The danger expresses the probability of fires occurring together with the difficulties of extinction of the same. It is the result of the sum of the following 6 parameters: incendiary, slope, exposure, altitude, road network, inhabited. The values thus obtained referring to the information layer of the entire Region are reclassified into 4 classes.

Relevant publications, and/or products, services or other achievements

“Piano Forestale Particolareggianto del Complesso Forestale Oasi di Tepilora” (Ente Foreste, 2014);
 “Indagine sul sistema dunare del litorale di Posada a seguito dell’esondazione del 2013 al fine del suo corretto ripristino” (Università di Sassari, 2015);
 “Piano regionale di previsione, prevenzione e lotta attiva contro gli incendi boschivi 2017-2019” (RAS, 2016 e aggiornamenti).

In addition, there have been numerous fire-themed projects in collaboration with other institutions, recently a project shared with the environmental education centers (CEAS) and the regional agency for environmental protection (FORESTAS) has been highlighted.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within X
Acqua e Fuoco (Water and Fire) Legambiente Sardegna (2018) Prevention of flood and fire risks	Fondazione con il SUD € 11.000,00	Floods and fires, two of the main risks to which the ecological balances of the Tepilora Park are subjected. The newly established Park had to cope with the safety interventions made urgent by the flood of 2013, having to postpone to a subsequent phase of work the actions of building awareness in communities. The project starts from this aspect: it creates opportunities for operational collaboration, establishes processes of cultural growth and development (training and educational paths that bring schools to the field, volunteer camps), carries out actions that combine effectiveness in terms of risk reduction and communicative value (elimination of obstructions on the river, planting in areas affected by fire or flooding, strengthening dune protections), makes information available to an enlarged user on the themes and contribution that each can make (site information set-up, interactive story for EAAs, conferences).

Individual exploitation plan

- Elaborate on how the project participation will enhance internal competency of the organisation
- Quantify the internal exploitation of project outcomes and quantify the expected/projected revenue growth due to occur from the project participation

The Tepilora park working in synergy with the competent bodies will be able to implement its knowledge and skills in the field of fire risk prevention. The entire area of the Tepilora Regional Natural Park is covered by specialized operators to prevent the onset of uncontrolled fires. Active fire fighting measures activated by the Operational Forces include:

- reconnaissance, surveillance and sighting activities aimed at promptly reporting the onset of the fire;
- control of the spread of fire;
- extinction by direct action in the field;
- interventions with aerial vehicles;
- hardening and recovery.

In order to allow the above actions, a close synergistic activity is underway between SOUP (Permanent Unified Operating Room) of the Civil Protection (which coordinates everything), Forestry and Environmental Surveillance Corps, FORESTAS Regional Agency (Regional Forestry Agency for the Development of the Territory and Environment of Sardinia) and the Fire Brigade Corps which, through their operators, intervene promptly in the event of uncontrolled fires.

Communication strategy for promoting project outcomes

- Identify the go-to-market strategy for promoting foreground knowledge developed in the project.
- List the internal marketing plan adopted for promoting product sales (including social media and other channels of communication).
- List a set of events in which the project outcome will be showcased (alongside internal marketing plan).

The Tepilora Park was born through bottom-up governance processes and continues to use the bottom-up approach to promote and enhance the territory and the projects it carries out. The governance and the projects of the Park have

a particular element, represented by the involvement of all stakeholders, through sustainable interventions on the territory, environmental prevention, putting an eye on the climate change, and through participatory planning. From 2020 the Park has its own communication strategy, which provides for the involvement of multiple actors. The implementation of this Communication Plan is also a lever towards innovation of the entire organization, helping to increase the efficiency and effectiveness of the Park itself in communication, and more generally allowing to improve the quality of relationships and dialogue within and with the outside world.

Description of significant infrastructure and major items of technical equipment relevant to the project

- Any significant infrastructure such as computational/IT systems to be made available for project activities
- List of any patents to be brought into the project (even pending ones)
- List any additional sources of in-kind contribution to be made available for the project development activities

In accordance with Legislative Decree No. 177 of 19 August 2016, the competences in the field of active fight against forest fires have been entrusted to the National Fire Brigades which, exercising the functions of fighting forest fires (with the help of land and air vehicles) with the Regions, coordinate the extinguishing operations.

In Sardinia, the Regional Fire and Rescue Plan was drawn up with contributions from all the main actors belonging to the regional fire fighting system, such as the Directorates-General for Civil Protection, the Forestry and Environmental Surveillance Corps, the Forestas Agency, ARPAS and the Regional Directorate of Fire Brigades.

The Plan aims to plan and coordinate the firefighting activities of all institutional components and contains the framework of thematic knowledge specially elaborated in order to properly plan the foresight activities, prevention and active struggle, on the basis of an organizational model consisting of the plurality of institutional and non-institutional entities, which contribute, in different forms and areas, to the pursuit of the objectives of the Plan itself, as established by the aforementioned law n. 353/2000 and by L.R. n. 8/2016 and Legislative Decree n. 1/2018.

The Regional Plan is also an important reference element for municipal civil protection planning for the risk of interface fires, so that each municipal administration can equip itself with a lean and expedited tool that allows to secure the population in the event that a fire threatens the settlements or infrastructures present in its territory, also in the light of the Code of Civil Protection on the obligation to provide municipal civil protection planning. The Plan also defines the procedures to be adopted in the case of peri-urban fires and interface on the basis of the collaboration protocol with the Fire Brigades. The document is divided into seven specific parts, consisting of the general report and six annexes, map and table. The allocated operational plans are adopted with determination by the Commander of the Forestry and Environmental Surveillance Corps and contain, in accordance with regional law no. 8, article 23, paragraph 4, in accordance with the regional law of 27 April 2016, the detail and organization of the resources present in the individual territories of responsibility of the Departmental Inspectorates of the Forestry and Environmental Surveillance Corps, in agreement with the Directorate General for Civil Protection and the Forestas Agency.

The Plan focuses on prevention and mitigation activities, which are the first starting point for the fight against forest fires. The prevention action aims to directly involve new actors, especially by enhancing those who can contribute to the control of the territory and to promote fire prevention (farmers and breeders, hunting associations, hoteliers and camping managers) to promote awareness of the culture of safety and the construction of a path to integrate their precious contribution.

In the forecasting activity, the Decentralized Functional Center (CFD) issues daily danger forecast bulletins on the 26 alert areas of Sardinia and it is expected that the color code of the level of danger (green, yellow, orange and red) is associated with an operational phase to be activated. There are four operational phases: Preallerta phase, Attention phase, Reinforced Attention phase and early warning phase. In the event of critical issues of exceptional importance formally received by the Directorate-General for Civil Protection, the Director-General shall assess the areas in which to raise the operational phase corresponding to the level of danger determined by the CFD. To the operational phases already mentioned, is added the operational phase of "Alarm", which is activated both at the occurrence of an interface fire, and in case of forest fire that requires the intervention of regional air vehicles and/or the state air fleet.

For municipal administrations, the correlation between the level of danger and the operational phase is not automatic, but is indicative. On the basis of the "green", "yellow", "orange" or "red" codes deriving from the cfd's forecasting activity, the competent municipalities can identify, in a contextualized way to their territory, the most appropriate operational phase to deal with the situation in relation both to the ability of the municipal structure to respond, and to the vulnerability of the territory, but also to local weather conditions. However, the operational phase may never be lower than that associated with the level of danger (color code) communicated with the CFD's regional forecast.

The indices of danger and municipal risk which define, respectively, the degree of danger and risk of forest fire that are drawn up on a regional basis and referring to the individual municipal territory are calculated without taking into account the fires that have occurred in the last five years. The danger is the result of the sum of the following 6 parameters: incendiability, slope, exposure, altitude, road network, inhabited centers. The risk index is given by the product of the following variables: danger, vulnerability and potential damage, referring to the entire regional territory divided into squares of one hectare and reclassified into four classes: very low, low, medium and high.

The zoning and identification of homogeneous areas in terms of fires refers to the 26 alert zones on which the CFD assesses the daily level of danger, establishing, on them, the danger and incidence of the spatial distribution of fires and surfaces traveled over the last 10 years.

The value of each alert zone is in this way considered as a result of the action of the determinants and predisposing the fires themselves. The study and calculation of the different indices developed with the "Zoning in homogeneous areas" are the basis for a better definition and localization of the objectives to which the plan itself must necessarily strive in the years to come.

Pilot description

Pilot site description:

The Tepilora Regional Nature Park is a Regional Park established in 2014 (under Regional Law No. 21 of 24 October 2014). It is managed by the Tepilora Regional Natural Park Authority. The park is located in North-West Sardinia and covers an area of about 8,000 hectares. It entirely falls within the province of Nuoro, including a vast territory that covers four municipalities: Torpè, Posada, Lodè and Bitti.

The territory covers an area of high naturalistic value, characterised by important natural systems: such as Mount Tepilora (528 m above sea level), the state forest of "Crastazza-Tepilora", part of the state forest of Sos Littos-Sas Tumbas in the territory of the municipality of Bitti, the forest complex of Sant'Anna in the municipality of Lodè, the state forest of Usinavà in the municipality of Torpè, and the course of the Posada river up to its mouth in the municipality of Posada. The park also includes the Biosphere Reserve "Tepilora, Rio Posada and Montalbo", recognised in 2017 in the "Man and the Biosphere Programme - MAB" by UNESCO.

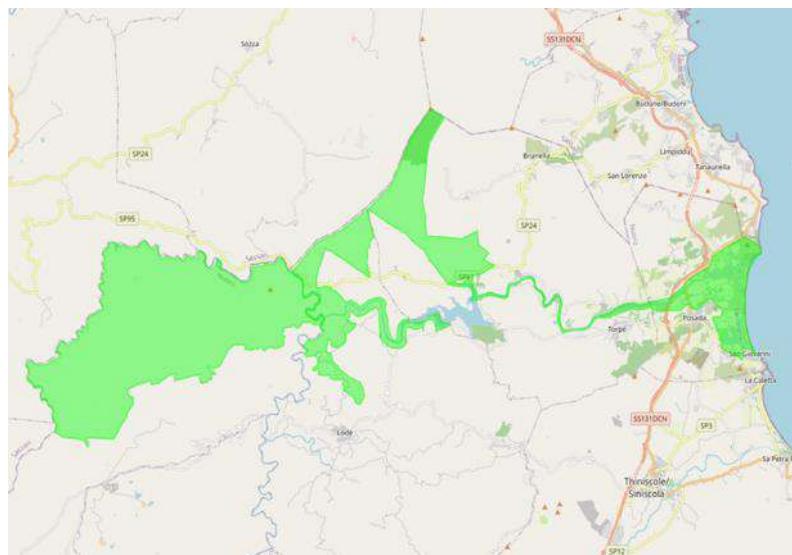


Fig. 1 - Map of the Tepilora Regional Nature Park

Flora

The territory of "Tepilora, Sos Littos - Sas Tumbas Crastazza" is characterised by the presence of the evergreen Mediterranean forest or Mediterranean forest of sclerophylls, a plant association composed of tree-like plants with leathery, evergreen leaves, able to resist the strong sunlight of the summer months. The presence of the Holm oak tree (*Quercus ilex*) is peculiar. The undergrowth includes the strawberry tree (*Arbutus unedo*), the alaternus (*Rhamnus alaternus*) and the broad-leaved phillyrea (*Phillyrea latifolia*). Also noteworthy are the oleaster (*Olea europaea* variety *Sylvestris*), rosemary (*Rosmarinus officinalis*), myrtle (*Mirtus communis*), narrow-leaved phillyrea (*Phillyrea angustifolia*), tamarisk, heather (*Erica arborea* - *Erica scoparia*), and tree spurge (*Euphorbia dendroide*). The

characteristic thorny shrubs of the garigues, with their tiny leaves that fall in summer, include *Genista corsica* and *sparzi* (*Calicotome villosa* and *Calicotome spinosa*).

There are some species of orchids (*Ophrys* spp, *Orchis* spp and *Serapias* spp), liliaceae such as asphodel, hen's milkweed (*Ornithogalum* spp) and some species belonging to the garlic family (*Allium* spp). On the whole, deciduous woodland (33%), coniferous woodland (14%), Mediterranean scrub (17%) and garrigue (12%) prevail. Artificially recolonised areas occupy 16% of the territory.

Fauna

The Park's fauna includes species typical of the Mediterranean scrub such as the wild boar (*Sus scrofa meridionalis*), the Sardinian hare (*Lepus capensis mediterraneus*), the fox (*Vulpes vulpes ichnusae*) and the wild cat (*Felis lybica sarda*). In recent years, numerous specimens of fallow deer (*Dama dama*) and mouflon (*Ovis ammon musimon*) have been sighted in the forest areas of Sos Littos - Sas Tumbas.

The most interesting element is the presence of the golden eagle (*Aquila chrysaetos*), whose nesting site is located near Mount Tepilora. However, it is not difficult to spot the peregrine falcon (*Falco peregrinus*), the sparrowhawk (*Accipiter nisus*) and the buzzard (*Buteo buteo arrigonii*). In recent years, the Sardinian Forestry Authority has successfully embarked on a programme for the repopulation of the Sardinian partridge (*Alectoris barbara*), providing the necessary pre-environmental aviaries.

Finally, the area of the Posada river and its ponds is particularly attractive for its rich marsh vegetation and the birdlife that populates it: piro piro (*Actitis hypoleucos*), gambeccchi (*Calidris minuta*), corrieri (*Charadrius hiaticula*), fratini (*Charadrius alexandrinus*), gulls (*Laridae Rafinesque*) and some species of rails such as the purple gallinule (*Porphyrio porphyrio Linnaeus*), water rails (*Rallus aquaticus Linnaeus*), coots (*Fulica atra*) and moorhens (*Gallinula chloropus*) which nest in the riparian vegetation.

Climate aspects:

Crastazza

The climatic description of this area is reported through the analysis of precipitation and temperature in their most significant parameters taken from the observatory of Alà Dei Sardi. The average annual rainfall over 42 years of observation is 1,079 mm. The average seasonal rainfall is: Inv. 415, Prim. 276, Est. 54, Aut. 334; rainy days 79 (source - P.V. Arrigoni- Fitoclimatologia della Sardegna). The area is characterised by a maximum of precipitation in winter and a minimum during the summer period. Using the relative seasonal rainfall coefficients, a Winter-Autumn-Spring-Summer (IAPE) rainfall regime is determined, which is the most common for the island. The Fournier index, the value of which (25.8) expresses a considerable erosive capacity of the climate, contributing considerably to pedological degradation, accentuated in the case of the Bitti forestry station by the previous poor protection offered by the vegetation, the slope and the soil deriving from a rather loose granitic substratum. The thermal character of the station emerges from the following data : - Average annual max. 18.2 °C - Average annual min. 7.7 °C - Average annual max. 12.9 °C - Average max. hottest month (July) 29.7 °C - Average min. coldest month (January) 1.6 °C - Average hottest month 22.8 °C - Average coldest month 3.9 °C - Average annual minimum 4.6 °C - Average annual maximum 36.3 °C - Annual temperature range 18. 9 °C These values, in particular the annual average (12.9 °C), the average of the coldest month (3.9 °C) and the average of the annual minimums (- 4.6 °C), together with the rainfall values for annual (1 079 mm) and summer (54 mm) precipitation, place the station in question in the Lauretum-Cold Subzone of the Pavari phytoclimatic classification. Examination of the Wolth and Leith climatogram highlights a physiologically significant dry period of around 72-80 days, which, although not pathological for the vegetation, causes a strong slowdown in vegetative activity with a consequent lower production of biomass in the ecosystem.

Tepilora

The climate of this area is characterised by high spring-summer temperatures and irregular rainfall, and therefore, considering the soil characteristics, the conditions are not ideal for a rapid recovery and reintroduction of tree cover. The Tepilora area also lacks a thermal-pluviometric station, so for the purposes of phytoclimatic classification, reference was made to the nearby thermal-pluviometric station of Torpè. Precipitation varies from one year to the next, with rainy years alternating with extremely dry periods lasting more than five to six months. From a phytoclimatic point of view, the area can be ascribed to the Lauretum zone, a warm and medium sub-zone

Historical fire report:

Analysing fires in the past, we can deduce that fires in the Park area and surrounding areas occur almost exclusively in summer (in June, July, August and September).

Processing the data under examination in Sardinia, the main cause of fires was found to be 60% of arson origin, 35% of unintentional origin and 5% of accidental origin.

As regards fires of unintentional and accidental origin, they were mainly due to cigarette butts or the removal of plant remains (burning stubble).

The data on the number of fires and the area covered by fire divided into forest and non-forest in Sardinia from 2010 to 2020 are shown in the table below:

Anno	n.	Superficie percorsa (ha)			
		boschiva	non boschiva	totale	media (totale/n.)
2010	3806	2267.29	9931.60	12198.89	3.21
2011	3421	3584.29	15160.23	18744.52	5.48
2012	2715	3003.55	12891.89	15895.44	5.85
2013	2169	3576.91	11394.07	14970.99	6.90
2014	4608	2334.89	11807.32	14142.20	3.07
2015	3130	1368.23	7177.11	8545.34	2.73
2016	2591	3739.72	11293.93	15033.65	5.80
2017	3646	5638.42	7758.74	13397.16	3.67
2018	1338	54.72	2069.76	2124.49	1.59
2019	3340	1929.56	4960.80	6890.36	2.06
Media	3076	2749.76	9444.55	12194.30	4.04
2020	2517	1926.19	6120.33	8046.52	3.20
2020 / Media periodo	-18%	-30%	-35%	-34%	-21%

The following image reports the perimeters of the areas affected by fire in the municipalities of the Tepilora Regional Nature Park from 2015 to 2019:

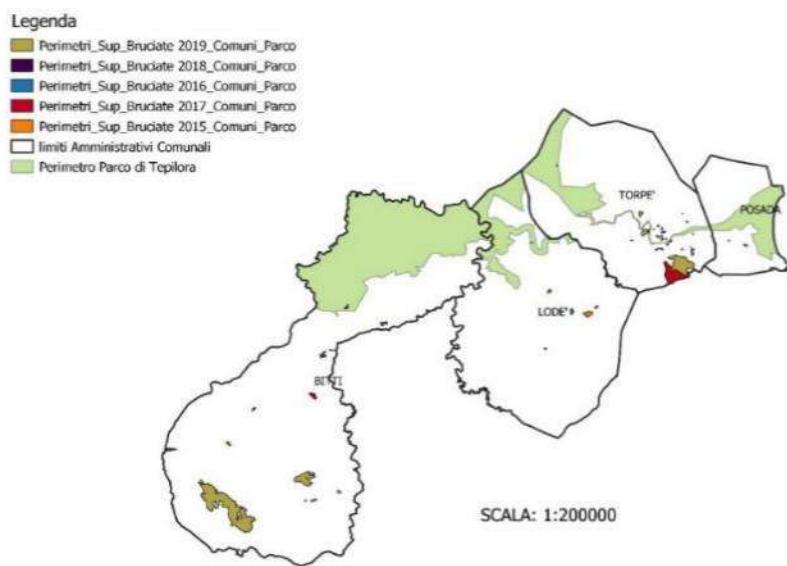


Fig. 2 - perimeters of the areas affected by fire in the municipalities of the Tepilora Regional Nature Park from 2015 to 2019

Data on the number of fires and the fire-affected area divided into forest and non-forest in the park's municipalities from 2015 to 2019 are shown in the following table:

MUNICIPALITY	Number of fires	Wooded area (Ha)	Unforested area (Ha)	Total area (Ha)
Bitti	18	222,82	268,43	491,24
Lodè	6	14,74	10,19	24,93

Posada	2	0,00	2,14	2,14	
Torpè	26	136,23	141,35	277,58	
Total	52	373,79	422,11	795,90	

Fig. 3 - Fire data in the municipalities of the Tepilora Regional Nature Park from 2015 to 201

Available infrastructure:

According to Legislative Decree No. 177 of 19 August 2016, the competences in the field of active fight against forest fires have been entrusted to the National Fire Brigade which, exercising the functions of forest fire fighting (with the help of land and air means) with the Regions, coordinates the extinguishing operations. In Sardinia, the Regional Fire Fighting Plan was drafted with the contributions of all the main players in the regional fire-fighting system, such as the General Directorates of Civil Protection, the Forestry and Environmental Surveillance Corps, the Forestas Agency, ARPAS and the Regional Directorate of the Fire Brigade. The objective of the Plan is to plan and coordinate the fire-fighting activities of all the institutional components and contains the framework of thematic knowledge specifically elaborated in order to appropriately plan the activities of forecasting, prevention and active fight, based on an organisational model consisting of the plurality of institutional and non-institutional entities, which contribute, in different forms and areas, to the pursuit of the objectives of the Plan itself, in accordance with the provisions of the aforementioned Law no. 353/2000 and Regional Law no. 8/2016 and Legislative Decree no. 1/2018.

The regional plan also constitutes an important reference point for municipal civil protection planning for the risk of interface fires, so that each municipality can equip itself with a streamlined and rapid tool that allows it to protect the population in the event that a fire threatens settlements or infrastructure in its territory, also in the light of the Civil Protection Code on the obligation to provide municipal civil protection planning.

The Plan also defines the procedures to be adopted in the event of peri-urban and interface fires on the basis of the cooperation protocol with the Fire Brigade.

The document is divided into seven specific parts, consisting of the general report and six annexes, cartographic and tabular.

The subdivisional operational plans are adopted by decision of the Commander of the Forestry and Environmental Surveillance Corps and contain, pursuant to Regional Law No. 8 of 27 April 2016, Article 23, paragraph 4, the details and organisation of the resources present in the individual territories within the competence of the Subdivisional Inspectorates of the Forestry and Environmental Surveillance Corps, in agreement with the General Directorate for Civil Protection and the Forestas Agency. The Plan focuses on prevention and mitigation activities, which represent the first starting point for fighting forest fires. The prevention action aims to directly involve new actors, making the most of those who can contribute to the control of the territory and help prevent fires (farmers and breeders, hunting associations, hoteliers and campsite managers) in order to promote awareness of the culture of safety and the construction of a path to integrate their valuable contribution. In its forecasting activity, the Decentralised Functional Centre (CFD) issues daily hazard forecast bulletins on Sardinia's 26 alert zones and the colour code of the hazard level (green, yellow, orange and red) is associated with an operational phase to be activated. There are four operational phases: Pre-alert phase, Warning phase, Reinforced Warning phase and Pre-alarm phase. In the event of critical situations of exceptional importance formally received by the General Directorate of Civil Protection, the General Director assesses the zones in which to raise the operational phase corresponding to the level of danger determined by the CFD. In addition to the operational phases already mentioned, there is also the "Alert" operational phase, which is activated both in the event of an interface fire and in the event of a forest fire that requires the intervention of regional air resources and/or the State air force.

For municipalities, the correlation between hazard level and operative phase is not automatic, but indicative. On the basis of the "green", "yellow", "orange" or "red" codes deriving from the CFD forecasting activity, the competent municipalities can identify, in a contextualised manner for their own territory, the most appropriate operational phase to deal with the situation in relation to both the response capacity of the municipal structure and the vulnerability of the territory, but also to local weather conditions. However, the operational phase can never be lower than that associated with the danger level (colour code) communicated by the regional CFD forecast.

The hazard and municipal risk indices that define, respectively, the degree of danger and risk of forest fires, which are processed on a regional basis and referred to the individual municipalities, are calculated without taking into account the fires that have occurred in the last five years. Danger is the result of the sum of the following 6 parameters: ignitability, slope, exposure, altitude, road network, built-up areas. The risk index is given by the product of the following variables: hazard, vulnerability and potential damage, referring to the entire regional territory divided into one-hectare squares and reclassified into four classes: very low, low, medium and high.

The zoning and identification of homogeneous areas in terms of fires, refers to the 26 alert zones on which the CFD assesses the daily danger level, establishing, on them, the danger and incidence of the spatial distribution of fires and areas covered in the last 10 years.

The value of each warning zone is thus considered as the resulting expression of the action of the factors determining and predisposing fires. The study and calculation of the various indices developed with the "Zoning in homogeneous areas" are the basis for a better definition and localisation of the objectives to which the plan must necessarily aspire in the years to come.

Scenario dimostrativo:

The area of Tepilora Regional Nature Park is totally under the control of specialised operators in order to prevent the outbreak of uncontrolled fires. The active forest firefighting interventions activated by the Operational Forces include:

- reconnaissance, surveillance and spotting activities aimed at providing early warning of fire outbreaks;
- control of fire spread;
- extinction by direct action in the field;
- interventions with aerial vehicles;
- tempering and recovery.

In order to allow the above actions to be carried out, a close synergic activity is underway between SOUP (Sala Operativa Unificata Permanente - Permanent Unified Operations Room) of the Civil Protection (which coordinates everything), the Forestry and Environmental Surveillance Corps, the regional agency FORESTAS (Agenzia Forestale Regionale per lo Sviluppo del Territorio e dell'Ambiente della Sardegna - Regional Forestry Agency for the Development of the Territory and Environment of Sardinia) and the Fire Brigade, whose operators intervene promptly in the event of uncontrolled fires.

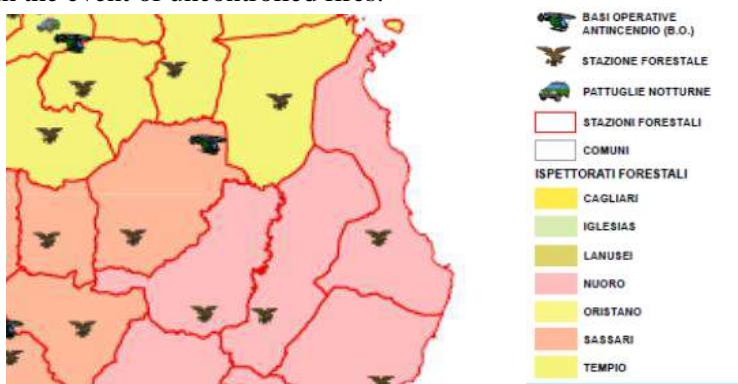


Fig. 4 - Operational structure of the Forestry and Environmental Surveillance Corps in the municipalities belonging to the park area and surroundings

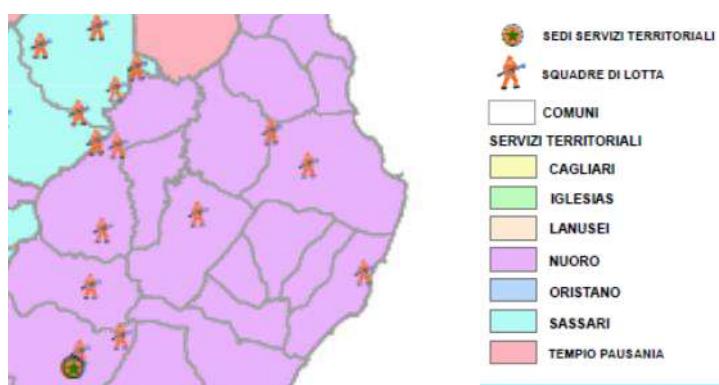


Fig. 5 - Operational structure of the FORESTAS Agency in the municipalities belonging to the park area and surroundings

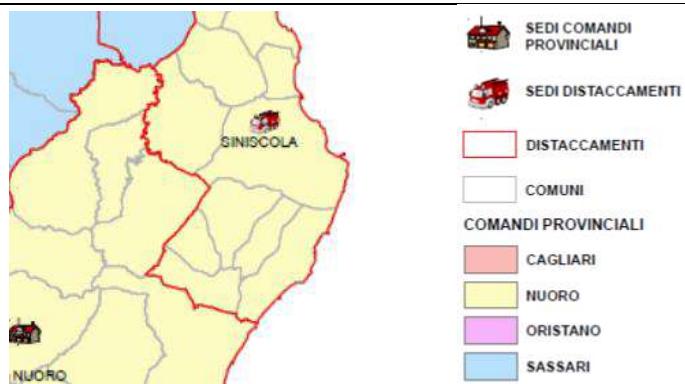


Fig. 6 - Operational structure of the fire brigade in the municipalities in and around the park area

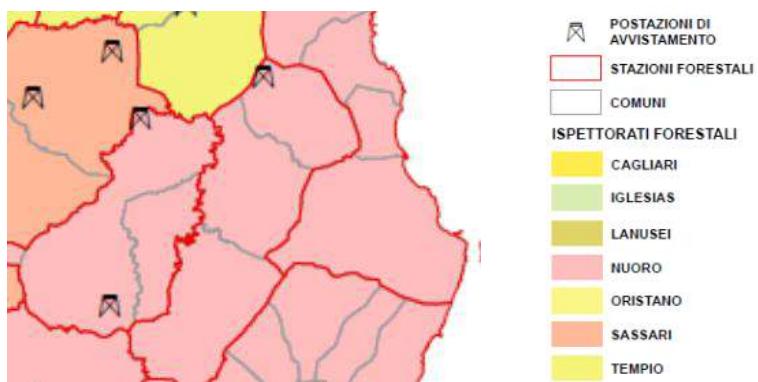


Fig. 7 - Fire spotting posts in the municipalities in and around the park area

Step A:

The Park Authority provides preventive information to visitors and residents on the danger of forest fires and on the correct behaviour to adopt in order to avoid fires, in particular accidental fires, carrying out a series of prevention campaigns each year with posters posted in the main hubs, radio spots, on websites and social networks. These activities aim to reduce the number of fires and promote the growth of ecological awareness among citizens and visitors to the park.

In addition, in order to reduce unintentional fires, it is strictly forbidden to light fires from 15 June to 15 September (in accordance with Law 353/2000).

Step B:

Regarding the fire hazard and risk index (regional and municipal), which respectively define the degree of fire hazard and risk calculated on a regional basis and referred to the individual municipal territory, hazard and risk classes were identified, given the heterogeneity of the vegetation and structures exposed (urban centres, tourist centres, farms, agritourisms, etc.).

The hazard expresses the probability of fires occurring together with the difficulty of extinguishing them. It is the result of the sum of the following 6 parameters: ignitability, slope, exposure, altitude, road network, inhabited areas. The values thus obtained referring to the information layer of the entire Region are reclassified into 4 classes.

Subsequently, the entire regional territory is divided into 4 hazard classes with reference to areas equal to a square of one hectare as specified in the table:

Grado di pericolosità	Descrizione pericolosità
1	Molto basso
2	Basso
3	Medio
4	Alto

The following image shows the subdivision of the Park area into 4 hazard classes

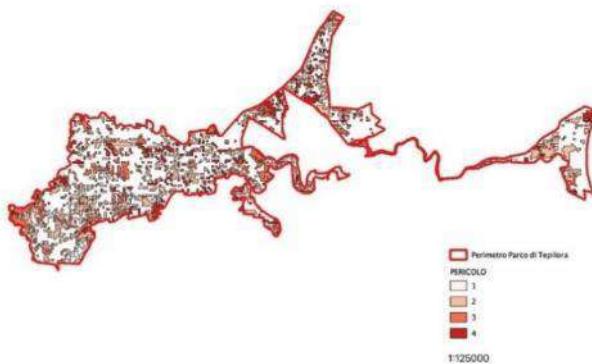
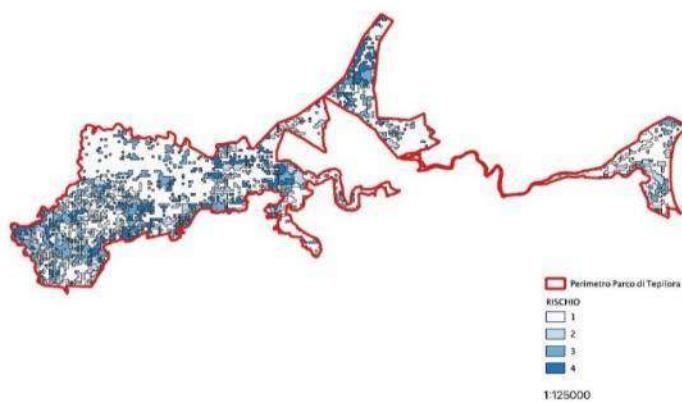


Fig. 8 - Map of fire danger in the Park area

The fire risk is given by the product of the following variables: hazard, vulnerability and potential damage and refers to the entire regional territory divided into areas equal to a square of one hectare as specified in the table:

Grado di rischio	Descrizione rischio
1	Molto basso
2	Basso
3	Medio
4	Alto

The following image shows the subdivision of the Park area into 4 risk classes



PIANIFICAZIONE COMUNALE E INDICE DI PERICOLO E DI RISCHIO

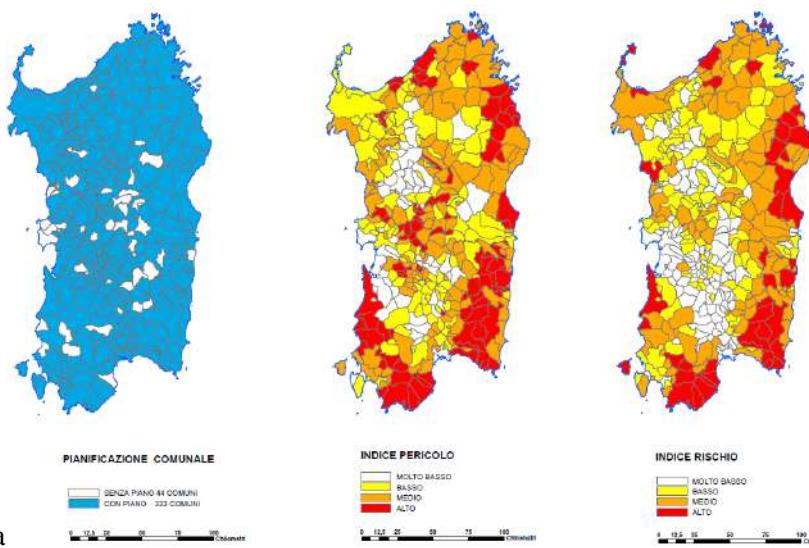


Fig. 9 - Map of fire risk in the Park area

Fig. 10 Municipal Planning and hazard and risk index in Sardinia

4.1.36 FUNDATIA PENTRU SMURD

Partner Name: FUNDATIA PENTRU SMURD	
Company website: www.fundatiapentrusmurd.ro	
Type: NGO	

Partner profile

SMURD Foundation is a non-governmental organization, established in 2006, as a private juridical institution, non-profit, political free, which supports, through all the projects developed, the activity of the Emergency Mobile Service for Resuscitation and Extrication (abbr. SMURD) and, in general, the integrated emergency medical assistance from Romania. SMURD Foundation mission is to improve the life quality of all Romanian citizens, supporting the development of the emergency and first aid integrated medical and technical system in Romania.

The scope of SMURD Foundation is to improve the quality of life of people living and working in Romania by supporting the development of the integrated, medical and technical emergency and first aid system, to operate independently and without obtaining profit; to promote the transparency and professionalism; to support the formation of a strong system of integrated healthcare, emergency and first aid technique through sustainable partnerships between the authorized institutions such as but not limited to the Ministry of Administration and Interior, namely the General Inspectorate for Emergency Situations and Special Aviation Unit, Ministry of Public Health, Local Public Administrations.

SMURD, the Romanian acronym for the Emergency Mobile System for Reanimation and Extrication, is a public, integrated emergency medical and technical service, without legal personality. Within SMURD are working three types of employees: medical staff belonging to the hospitals, part of the mobile intensive care units and the aero-medical rescue crews, paramedics, firemen specially trained and hired within the Inspectorates for Emergency Situations and the pilots belonging to the Special Aviation Unit, the Ministry of Interior. There is also a small number of firefighters/paramedics employed by local administration.

The SMURD Foundation is actively involved in the following public services:

- health and social assistance services, including but not limited to educational services, development of integrated services for emergency medicine and first aid;
- establishment of mobile units for emergency and first aid;
- services for disadvantaged persons, including but not limited to minorities and other disadvantaged groups;
- promoting of other activities of public interest.

CVs of involved key researchers / staff members

Dr Raed Arafat (m) is President of the Board of Administrators of the Foundation for SMURD and Secretary of State in the Ministry of Interior, Head of the Department for Emergency Situations which is the operational structure without legal personality of the Ministry of Interior with coordinating powers, permanently at national level, of the emergency prevention and management activities, ensuring and coordinating the human, material, financial and other resources required to restore normal status, including first aid and emergency medical assistance in emergency units and compartments. His national activity is extended at international level through his participation in NATO as Co – President and high-level expert of the Health, Food and Agriculture Commission and previous WHO expert - European Regional Office – for the evaluation of the emergency services in Tajikistan. He is the President of the Professional Committee of the European Emergency Medicine Society since 2012 and visiting professor, Institute of Medicine and Pharmacy Timisoara (Romania), visiting professor, University of Medicine and Pharmacy Iasi (Romania), lecturer, University of Medicine and Pharmacy Cluj-Napoca (Romania) and Professor Honoris Causa University Babes-Bolyai Cluj-Napoca (Romania). He participated in several European funded projects such as CARISMAND project (H2020-ID 653748), "Professionals in the integrated intervention, collective accidents and disasters" (POSDRU/81/3.2./S/58809), "VoluntarI – promoting a public policy to enhance community resilience to emergency situations with the use of technology- interactive platform smart volunteer" – POCA/111/1/113009 as well as H2020 – Engage society for risk awareness and resilience (ENGAGE) and H2020 – Network Of practitioners For Emergency medical systems and critical care (NO-FEAR).

Dr Cristian Boeriu (m) is Associate Professor of Emergency Medicine, coordinator of the academic activity of the Emergency Medicine Discipline, University of Medicine and Pharmacy Târgu Mureş as well as the director of the Clinical Sciences – Internal Medicine Department M3 of the same University and former Chief physician, Emergency Unit – Mobile Service for Emergency Resuscitation and Extrication Mureş dealing with the medical and administrative activities and coordination and managing the Residency Training Program in emergency medicine. He was involved in the elaboration of disaster medicine training software scheme, funded through Leonardo da Vinci project "European Distance Training Interactive and Collaborative Tools for the Civil Protection (e-DISTRICT CiPro)" - Agreement number 2004-I/04/B/F/PP-154114, and a long term expert for the projects Professionals in the integrated intervention, collective accidents and disasters" (POSDRU/81/3.2./S/58809) and "Improved curricula and interactive teaching methods for bachelor medicine fields " POSDRU ID 63827.

Dr Ioana Mirela Daramus (f) is programs director with an extensive experience of coordination, evaluation and monitoring of specific programs, strategies development, identification and access of funds, with more than 50 written, coordinated and implemented projects since 2000 to date. She have developed and coordinated the Swiss funded projects that supported the development of the emergency services in Romania since 2002 to 2019 (Remssy 3 and 4 and ER 1 and 2) and was a key expert for the development of a similar project in the Republic of Moldova and coordinated the project Professionals in the integrated intervention, collective accidents and disasters" (POSDRU/81/3.2./S/58809), project that developed a virtual reality system, the only one of its kind in South eastern Europe at that time. This system allows a more cost efficient system of training of the first responders teams and was further used in national and international NATO trainings in the region, considering the portability of the solution.

Role in the project

- **WP1:** SMURD will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** SMURD will contribute to the participatory process.
- **WP3:** SMURD will contribute to the development of the training programme.
- **WP6:** SMURD will contribute to data management plan and privacy impact assessment
- **WP7:** SMURD will contribute to the future of forest management
- **WP9:** SMURD will lead the pilot demonstration as outlined below.
- **WP10:** SMURD will disseminate and exploit the project results through established international links.

Relevant publications, and/or products, services or other achievements

1. Arafat, R - "The State and Disasters", within the book "Medicine de catastrophe" Publisher Lavoisier, Paris, ISBN 978-2 -257-20676-3, in January 2017, <http://www.lavoisier.fr/livre/medecine/medecine-de-catastrophe/julien/descriptif-9782257206763>
2. Arafat, R- Evolution and organisation of the Integrat Emergency Medicine System in Romania, chapter within the Romanian edition of the Nancy Caroline- Emergency care in the street, 7th edition, 2018, ISBN: 978-606-710-652-7
3. Arafat R, Daramus I – “Training of professionals, communication and education of the population regarding disaster situations”, Romanian edition of “Medicine de Catastrophe”, 2018, ISBN: 978-606-710-653-4 ...
4. Doarn, CR, Latifi, R., Hostiuc, F., Arafat, R., Zoicas, C - "A Multinational Telemedicine System for Disaster Response: Opportunities and Challenges" Netherlands, Publisher IOS Press, ISBN 978-1 -61499-727-6 to book printed and online 978-1-61499-728-3 . The book is part of the "NATO Science for Peace and Security, Volume 130" - January 2017, <http://www.iospress.nl/book/a-multinational-telemedicine-systems-for-disaster-response-opportunities-and-Challenges>
5. Prof. Asoc. Dr. Raed Arafat, As. Principal Hajnal Erszébet Vass, Conf.dr. Cristian Marius Boeriu ,First aid manual for paramedics, second edition, Editura Etnos, 2016, ISBN: 978-606-93972-3-7

List of relevant previous projects or activities, connected to the subject of this proposal

1. **H2020 – Engage society for risk awareness and resilience (ENGAGE)** - Natural and man-made disasters remind us how the ability of societies to adapt and prosper depends on the collective action of the whole society. But the significant role citizens and communities can play at the grassroots level has been overlooked in research. ENGAGE will turn this around, showing how individuals and local practices can interrelate effectively with planned preparedness and response, practitioners and technology. To achieve this bold goal ENGAGE will start with the knowledge, strategies, methods, tools and practices used by real world practitioners and citizens, and mature results from earlier projects. It will combine and extend these to create innovative solutions to disaster management and new ways of fostering trans-disciplinary collaboration and learning across disciplines. A model for assessing and methods for improving societal resilience will be complemented by an evolving knowledge platform providing actionable solutions meeting the diverse needs of authorities, first responders and citizens. ENGAGE will use empirical data on individual and collective contributions to societal resilience and take into account contextual aspects such as socio-economic conditions, digital literacy, culture, gender, social capital, trust and diversity. It will focus on aspects that can be directly enhanced such as risk awareness, communication, social media, citizens' as well as authorities' and first responders' involvement. Real world field validations will be used to demonstrate and validate ENGAGE solutions and their transferability to diverse contexts across Europe. The consortium is complemented by a Knowledge and Innovation Community of Practice that already has 37 members and will grow during the project. This team includes representatives from authorities, first responders, citizens associations, NGO's, SMEs, industries, schools and academia. Together, they will propose validated solutions contributing to specific SENDAI actions.

2. **H2020 – Network Of practitioners For Emergency medicAl systems and cRitical care (NO-FEAR).** NO-FEAR is a 5-year (June 2018 – May 2023) Coordination and Support Action project that will bring together a pan-European and beyond network of emergency medical care practitioners, suppliers, decision and policy makers to collaborate and exchange knowledge, good practices, and lessons learned. Members of the network will have the opportunity to work together and collaborate to develop a common understanding of the innovation potential that fills operational gaps and pinpoint areas for future research. This multi-disciplinary, multi-national, and multi-sectorial collaboration will be supported by virtual tools, including the NO-FEAR platform and networking events (e.g., workshops, demonstrations, exercises) every 6 months.

3. **Resources and Volunteers management** – app developed by the Code for Romania for Department for Emergency Situations, a tool for managing volunteers and the resources that civil society can provide in case of a major seismic or natural disaster. The application allows inventory of the available resources, maintains a clear situation about the quantities, types of materials and where are stored, as well as the status of volunteers organized on distinct specialization.

4. **“VoluntarI – promoting a public policy to enhance community resilience to emergency situations with the use of tehnology- interactive platform smart volunteer” – POCA/111/1/1/113009** – develop an interactive platform for the training and management of the volunteers, develop civic responsibility, involve local communities in public life and participating in decision-making processes, promote equal opportunities and

non-discrimination, as well as sustainable development in the context of emergencies. Also within the platform was developed an independent tool for monitoring and evaluation of alternative public policy on Increasing the resilience of communities to emergencies through the use of technology, "evaluation.volunteers".

Individual exploitation plan

- The project results can serve as relevant input for change in procedures related to interventions in forest fire scenarios;
- Part of FptSMURD's activities relate to awareness-raising. By involving the local community in the activities of the project the proactive approach of prevention will result in a diminishing number of forest fires;
- Access to relevant best practices and use-cases will provide the know-how for implementing more efficient measures related to forest-fire interventions and prevention.

Communication strategy for promoting project outcomes

FptSMURD will promote the public project activities and results using not only the regular channels for communication (website, Facebook and YouTube pages, newsletter, online newspaper) but also in all the related workshops and conferences where it participates (regional, national and international coverage). Through its sustainable partnerships with the Ministry of Administration and Interior, namely the General Inspectorate for Emergency Situations and Special Aviation Unit, Ministry of Public Health, Local Public Administrations, FptSMURD will be able to properly disseminate to the target audience the added value of the project.

Description of significant infrastructure and major items of technical equipment relevant to the project

- The Foundation for SMURD developed and supports the functioning of the National Emergency Medical Training Center within the Emergency Hospital in Targu Mures, which is one of the most modern training centers in Central and Eastern Europe for medical and command and control personnel involved in emergencies.
- The center allows training and simulation in emergency medical situations, as well as in coordinating high-level emergency interventions. The equipment of the center includes complex medical simulators, real simulation environment such as the street and the detachable car in order to simulate the release, an ambulance cabin, a resuscitation room and others. At the same time, within the center there is a virtual simulator acquired through structural funds and which allows the creation of very complex situations as close as possible to reality. The endowment of the center was made from funds of the Ministry of Health, the Foundation for SMURD and European Funds through the POSDRU program.

4.1.37 Romanian Forestry Association

Partner Name: Romanian Forestry Association – ASFOR	
Company website:	
Type: NGO	

Partner profile

The Romanian Forestry Association – ASFOR is a professional, non-governmental association consisting of economic agents active in the field of forestry, wood processing and forest owners, which represents, promotes and supports the economical, legal and social interests of its members, both nationwide as well as on international level. The Romanian Forestry Association – ASFOR is organized in 13 administrative offices. ASFOR members enjoy the following benefits (free of charge): Up-to-date professional newsletters and representation in front of authorities; technical assistance and legal counselling; professional counselling in obtaining the certificate for forest exploitation; counselling for implementing and applying the Due Diligence system for wood and wooden products.

ASFOR has participated as dialog partner on the development of the Romanian Mountain Law (Law no. 197/2018) with provisions relevant to the MOUNCHAIN project.

ASFOR has a long experience in working in multi-disciplinary groups with national and European organizations (FAO, EOS, CEETTAR).

ASFOR operates in the field of forestry, with a focus on logging and timber industrialization.

CVs of involved key researchers / staff members

Aurelian Liviu GOGA: (male) legal specialization in the field of forest economy, with 10 years of experience in the field, ASFOR vice president and legal advisor, will ensure the coordination of the project implementation within ASFOR and the relationship with ASFOR members and partners.

Dr. Mircea Segarceanu (m) has extensive experience in European cooperation projects, having been WP leader and a member of the Managing Board of several EU funded projects (FP7, H2020 and JPI Urban Europe), in his previous capacity as Head of International Cooperation Programme for the main funding agency for RDI in Romania (UEFISCDI). He was also a key expert in the drafting of Romanian Research, Development and Innovation Strategy 2014-2020 and elaborated the State Aid Scheme for EEA Financial Mechanism in Romania. He has a bachelor's degree in electrical engineering and has finished his PhD Programme in industrial chemistry (New Polysulfone Matrix Composite Membranes) with application in fuel cells for hybrid engines.

Ciprian Dumitru MUSCĂ: (male) PhD in the field of forestry, with over 15 years of experience in the administration and exploitation of the forest fund, ASFOR President, within the project will ensure the connection with the Forestry Directorates, Private Schools and the Romanian state authorities for the good development of the project.

Adrian BORZA: (male) Bachelor of Forestry, with over 30 years of experience in forest management programs, is a technical advisor and Due Diligence within ASFOR, will provide the necessary forestry technical expertise for the proper conduct of the project.

ASFOR brings to the project key knowledge and expertise regarding Romanian companies from forestry and wood processing field, Romanian policy and wood market. We have a key focus on rapid analysis, response and communication with Romanian companies.

Role in the project

- **WP1:** ASFOR will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** ASFOR will contribute to the participatory process.
- **WP3:** ASFOR will contribute to the development of the training programme.
- **WP6:** ASFOR will contribute to data management plan and privacy impact assessment
- **WP7:** ASFOR will contribute to the future of forest management
- **WP9:** ASFOR will lead the pilot demonstration as outlined below.
- **WP10:** ASFOR will disseminate and exploit the project results through established international links.

Relevant publications, and/or products, services or other achievements

The Romanian Forestry Association – ASFOR publish the Meridiane Forestiere (Forestry Meridians) magazine, one of the main communication channels between the association and decision-makers of various state institutions, such as the Parliament, the Government and specific Ministries, but also between ASFOR and economic agents active in the forestry economy, as well as with organisations interested in the fate of the Romanian forests. The magazine comes out once every two months, i.e. six editions per year, and is dispatched free of charge to 1.500 national and international entities. Constant topics include an editorial, latest legal and professional information, standards applied to forest economy, syndicate activities, profiled scientific events, details about fairs and exhibitions, as well as inquiries and product offerings.

ASFOR operates nationwide through 13 offices, which are equipped with IT and communications equipment, which will be involved in the project activities.

ASFOR will provide both human resources through its employees, as well as access to human resources and equipment for its members for the smooth running of the project. ASFOR will also ensure access to logging and harvesting areas in Romania, according to the requirements of the project.

List of relevant previous projects or activities, connected to the subject of this proposal

n/a

Individual exploitation plan

ASFOR actively participates in raising the level of professionalism of its members. Participation in the project will allow the acquisition of a new set of practical knowledge and procedures, which will improve the competitiveness of its members.

All ASFOR members are directly involved in the forest economy. ASFOR's participation in the project will facilitate the transmission of relevant information to improve practices in the field. ASFOR has national coverage and works closely with all relevant actors in the wood industry, including forests owners. As such, all relevant project outputs will be swiftly disseminated throughout the network and have a high chance of becoming standard practices.

Communication strategy for promoting project outcomes

ASFOR proposes for the dissemination of information three communication channels that have proven their effectiveness: (1) the ASFOR newsletter; (2) the magazine Meridiane Forestiere edited by ASFOR; (3) the national advisory network of ASFOR, whose main role is to disseminate information to all economic operators involved in the forest economy.

ASFOR operates the website www.asfor.ro, together with the associated Facebook and Youtube page.

ASFOR is a partner in organizing Forest Romania Fare - the only outdoor forestry trade-fair in Romania, with practical demonstrations, where the most important producers of forest machinery and equipment will exhibit the latest technologies, appropriate to the Romanian market and integrated solutions for sustainable management of the forest.

ASFOR annually organizes the Foresters' Day event, an event dedicated to the reunion of its members to facilitate discussions on topics of interest to the forestry economy.

Description of significant infrastructure and major items of technical equipment relevant to the project

ASFOR operates nationwide through 13 offices, which are equipped with IT and communications equipment, which will be involved in the project activities.

ASFOR is the owner of the registered trademark ASFOR and the certification mark LEMN ROMÂNESCU (Romanian Wood).

ASFOR will provide both human resources through its employees, as well as access to human resources and equipment for its members for the smooth running of the project. ASFOR will also ensure access to logging and harvesting areas in Romania, according to the requirements of the project.

Pilot description

Pilot site description:



“Rodna” Mountains National Park is the second largest national park in the country, with an area of 47.177 ha, of which 3.300 hectares were declared to be a Biosphere Reserve in 1979. The importance of this protected area geology and geomorphology is due to both mountains and the presence of numerous species of flora and fauna, endemic and relict glacial.



Rodna Mountains culminate the highest peaks of Eastern Carpathians (Pietrosul Rodnei, 2303 m) and they are placed in north of Romania. They belong to the Northern Carpathian group, known as Maramures and Bucovina Carpathians, and dominate the boundary region, the highest altitude gap being recorded in the midst of Maramures hollow, which is placed in north of Romania, Eastern Carpathians, county of Maramures and Bistrita-Nasaud.

The map to the right represents all the natural protected areas in Romania and highlights the pilot site among them.

Rodna National Park is a protected area of national interest that corresponds to the second category

IUCN. Rodna Mountains National Park is designated internationally as a Biosphere Reserve by the UNESCO Committee, within the "Man and Biosphere" Program.

The national park overlaps both the site of Community importance (SCI) and the special avifauna protection area (SPA).

Ecological and biodiversity description:

The natural area has several types of habitats (Alpine and boreal shrubs, Shrubs with sub-arctic species of *Salix*, Shrubs with *Pinus mugo* and *Rhododendron myrtifolium*, Boreal and alpine meadows on siliceous substrate, Mountain meadows, Caliphate grasslands and Alpine calcareous meadows *Nardus* mountain forests rich in species on siliceous substrates, Dacian beech forests (*Sympyto-Fagion*), *Luzulo-Fagetum* beech forests, *Larix decidua* and / or *Pinus cembra* forests in the mountain region, Acidophilous *Picea abies* forests in the mountain region (*Vaccinio-Piceetea*), Edge communities with high hygrophilous grasses from the plains to the mountains and alps, Petrifying springs with travertine formation (*Cratoneurion*), Transitional peat bogs and oscillating peat bogs (not fixed to the substrate), Rubble from the mountain to the alpine level (*Androsacetalia alpinae* and *Galeopsietalia ladani*), limestone and calcareous shale from the mountain to the alpine (*Thlaspietea rotundifolii*), herbaceous vegetation on the banks of mountain rivers, woody vegetation with *Myricaria germanica* along mountain rivers, active peatlands, pioneer alpine formations of *Caricion bicoloris-atrofuscae*, caves where public access is forbidden, swamp cliffs with chasmophytic vegetation on siliceous rocks, woody vegetation with *Salix eleagnos* along mountain rivers and rocky slopes with chasmophytic vegetation on limestone rocks) that shelter a diverse range of flora and fauna specific to the Carpathian chain of the Orientals

More than 1.100 species of flower plants are to be found in these mountains. Endemic species, typical for this massif are the following ones: *Silene nivalis*, *Festuca versicolor* ssp. *dominii*, *Minuartia verna* ssp *oxypetala*; other species, also endemic but not only for these mountains are *Centaurea carpatica* ssp. *carpatica*, *Centaurea pinnatifida*, *Dianthus tenuifolius*, *Papaver alpinum* ssp. *corona-sancti-stephani*, *Poa granitica* ssp. *disparilis*, *Poa rehmannii*, *Festuca nitida* ssp. *flaccida*, *Trisetum macrotrichum*, *Heracleum carpaticum*, *Heracleum palmatum*.

Some rare species worth being mentioned: *Salix alpina*, *Salix bicolor*, *Astragalus penduliflorus*, *Androsace obtusifolia*, *Laserpitium archangelica*, *Conioselinum tataricum*, *Carex bicolor*, *Carex lachenalii*, *Carex pediformis* ssp. *rhizodes*, *Kobresia simpliciuscula*, *Juncus castaneus*, *Draba Fladnitzensis*.

On wetlands some glacial relics are to be found, such as: *Scheuchzeria palustris*, *Carex limosa*, *Carex magellanica* ssp. *irrigua*, *Carex pauciflora*, *Carex chordorrhiza*, *Empetrum nigrum*, *Salix bicolor*. The following species are being protected under law: *Leontopodium alpinum*, *Gentiana lutea*, *Gentiana punctata*, *Angelica archangelica*, *Nigritella rubra*, *Taxus baccata*.

Numerous invertebrates are endemic or relict: 28 species of aquatic worms, 12 species of Lumbricidae, of which *Allolobophora carpatica* is an endemic species for Rodnei and Maramureş Mountains. Many species of Collembola have been identified, but the most important one is *Tetrachanthella transylvanica*. Diplopoda are represented by 20 species, of which 9 are endemic species, such as: *Glomeris promineus*, *Polydesmus daday*. As for Chilopoda, 36 species have been identified, of which 6 species are endemic, such as: *Clinopodes rodnensis*, *Lithobius matici*. Orthoptera are represented by 39 species, of which *Isophia brevipennis*, *Pholidoptera transylvanica* and *Miramella ebneri carpatica* are endemic species.

Lepidoptera are represented by more than 295 species, some of them being internationally protected: *Erebia pharte carpatica*, *Erebia epiphron transylvanica*, *Erebia sudetica* etc. Numerous vertebrates can be found in this park, many of them being characteristic for Eastern Carpathians. Rivers stand for the appropriate habitat for many species of fish, such as: brown trout (*Salmo trutta fario*), grayling (*Thymallus thymallus*) and minnow (*Phoxinus proximus*). As for reptiles, worth mentioning is a relic species, the common lizard (*Lacerta vivipara*), which has been pinpointed in specific habitats, while the most representative birds are the black grouse (*Tetrao tetrix*), which breeds just in north-Romanian mountains, capercaillie (*Tetrao urogallus*), and golden eagle (*Aquila chrysaetos*).

Some representative mammals can be found, such as: chamois (*Rupicapra rupicapra*), alpine marmot (*Marmota marmota* - introduced in this area), red deer (*Cervus elaphus*), roe deer (*Capreolus capreolus*), wild boar (*Sus scrofa*), brown bear (*Ursus arctos*), wolf (*Canis lupus*), lynx (*Lynx lynx*) and pine marten (*Martes martes*).

Annual weather pattern: Baltic influences are apparent in this mountain; due to high altitude the climate is severe. The annual average temperature is about 7-8°C downhill and negative (-1.5°C) uphill. In January, the temperature averages -3°C downhill and -9°C uphill respectively. For July, the corresponding figures are 18°C and 7°C respectively. Rainfall exceeds 1.200-1.300 mm/year.

Historical report on Wildfires:

At national level, there are on average 166 forest fires per year, with a total affected surface area of approx. 50.000 Ha (data over the last 60 years). However, the average surface of forest fires has increased by 53% and their frequency has doubled in the last decade.

Based on a national study, the “Rodna” Mountains National Park forest area is deemed as a low risk with regards to the probability of forest fires. Nevertheless, national statistics show that 61% of forest fires start by human negligence and 35% are due to unknown causes, most likely also due to human error. Natural causes are responsible for less than 1% of forest fires. One of the main attractions of the pilot area are its offering of hiking trails and camping areas, so human negligence is an important factor to consider in the prevention and mitigation of forest fires.

Most forest fires occur during spring time (March and April), followed by the summer months July and August. These periods also coincide with the increased influx of tourists on the hiking trails and camping sites.

Available infrastructure [KPIs]:

- No. of fire fighters
- Water hydrants
- Equipment
- Operational capacity
- Coordination setup among teams

Demonstration scenario:

- Emulation of accidental fires resulting from weather conditions
- Effectiveness in response coordination between regional command centre
- Total area of coverage

The use case will aim at:

- Utilizing preventive measures for reducing human negligence forest fire incidence;
- Improving firefighter response time and operational capacity by using unmanned surveillance, such as drones and other devices;
- Implementing regular surveillance activities at the pilot site;
- Utilizing AR-VR technology in training exercises for firefighters;
- Integrating the particularities of protected natural areas in the preventive measures and intervention scenarios by a joint ongoing effort between firefighter department and natural park curators;

Phase A: Evaluation assessment

- Ecological assessment of biodiversity within natural parks
- Environmental assessment of fire danger index
- Training activities to enhance preparedness

Phase B: Continuous assessment of environmental threat towards wildfires

- Real-time modelling of environmental threats to ignite wildfires
- Early stage detection of wildfire ignition
- Response actuator system to neutralise early stage threats

Contribution to national priorities:

Include reference to national policies

4.1.38 Center for Security Studies (Kentro Meleton Asfaleias)

Partner Name: Center for Security Studies (Kentro Meleton Asfaleias)

Company website: <http://www.kemea.gr/en/>

Type: Research



Partner profile

The Center for Security Studies (KEMEA) is a think tank on homeland security policies and a public research organization established in 2005 (L. 3387/2005) within the Hellenic Ministry of Citizen Protection, aiming to support security policy implementations and civil protection consultation in Greece at a strategic level.

The **activities KEMEA is involved in, include:** (a) Certification of private-security professional practitioners at national level; (b) Research and development in the context of National and European projects in the topics of physical and cyber security and civil protection, in close cooperation with Law Enforcement Agencies (LEAs), working under the auspices of the Ministry of Citizen protection, civil protection national and regional authorities; (c) Training of practitioners from public services and organisations in new systems and technologies supporting security and civil protection activities; (d) Organisation of table-top and field exercises to test and evaluate preparedness and response of public services, organisations and authorities to emergencies and crises.

Main role of KEMEA is to **bring together national LEAs, First Responders, Civil Protection stakeholders, Critical Infrastructure operators and other involved parties in the disaster management cycle and society's security and resilience, so as to enable them to collaborate, to exchange experiences and built synergies** for (i) adopting common and complimentary preparedness measures; (ii) standardising communication flow; (iii) establishing common response capabilities; (iv) collaborating with the industry, research institutions and academia for developing new operational capabilities; (v) anticipating and adopting targeted actions towards disaster risk reduction and resilience enhancement. Meanwhile, the close collaboration of KEMEA with all the above-mentioned parties, together with the expertise of its associates, allows for the **evaluation of existing methodologies and guidelines in the field of civil protection, adaptation to specific needs of the Greek reality, as well as validation studies of innovative systems and recommendations to related stakeholders.**

KEMEA constitutes the **National Authority** regarding Critical Infrastructure (CI) Protection, as well as the Contact Point with the European Commission relevant authorities and the EU Member-States.

KEMEA is a **member of a number of European associations and organisations** including the “European Security Research and Innovation Forum (ESRIF)”, the “European Organisation for Security (EOS)”, the “Public Safety Communication Europe Forum (PSCE)”, the “European Association of Research and Technology Organisations (EARTO)”, “the European Emergency Number Association (EENA)”, the European Association for Biometrics (EAB) and has established links to the ENLETS community (European Network of Law Enforcement Technology Services). KEMEA also closely **cooperates** with the RAN Centre of Excellence and since 2016, it is a Framework Partner of CEPOL. KEMEA has an outstanding record in security research including community policing and several ongoing research in the area of fighting organised crime, terrorism and is leading the POL RAN Working group. Furthermore, KEMEA is appointed as the Greek “National Contact Point” for the implementation of Directive 2008/114/EC, regarding the protection of European Critical Infrastructure.

KEMEA as a scientific, consulting and research agency for the Hellenic Ministry of Citizen Protection will bring and promote projects scope, goals, objectives and results to the attention of a number of **end users organisations** supervised by the Ministry. These organisations are indicatively the Hellenic Police, the Fire Corps, and the General Secretariat for Civil Protection. Furthermore, KEMEA is member in a number of Pan-European **networks of practitioners and other actors** in the field of security like ILEAD, FIRE-IN, EXERTER and the coordinator of MEDEA. Members of the aforementioned networks will be informed about the research outcomes of the project in a number of networking activities and events like the Community of Users and EU Security research event that KEMEA frequently participates in.

CVs of involved key researchers / staff members

Georgios Sakkas (PhD) (male) is a Geologist with a PhD in Seismology and an MSc degree in Geophysics-Seismology. His research interests include the study of historical and modern earthquakes, education of the public in case of earthquake occurrence and the estimation of seismic hazard (PHSA, DSHA), earthquake vulnerability, seismic risk, landslide hazard and risk, as well as other geohazards, civil protection, disaster management, resilience and mitigation against multi-risk assessment. He is a proficient user of GIS and an excellent programmer in Matlab, Python and HTML. He has more than 25 scientific publications in peer reviewed scientific journals and international conferences. Currently, he is an associate researcher at the Center for Security Studies (KEMEA), of the Hellenic Ministry of Citizen Protection, actively involved in various EU projects (e.g. Horizon 2020) and studies (e.g. national studies for civil protection topics for European and national bodies), regarding civil protection, disaster resilience, crisis management, natural disasters and border surveillance.

Galatea Kapellakou (Ph.D.) (female) is a member of the Athens Bar Association specialised in Intellectual Property law. She has worked as a Consultant at UNESCO in the Cultural Diversity Division and participates as an IP expert in EU funded projects (Twining, Technical Assistant, Europe Aid). She is a Doctor of Laws, University of

Nantes and University of Athens (Ph.D. in Copyright Law, co-tutelle). She also holds a Master of Laws (LL.M.) in IP Law from the University of Nantes (D.E.A.) and a Master of Laws (LL.M.) in International Sciences from the University of Athens. She has teaching activities at Greek Universities in the fields of Law and Informatics and Copyright Law. She regularly publishes articles and researches in Law Journals and collective works. She collaborates with the Center for Security Studies (KEMEA) of the Hellenic Ministry of Citizen Protection in Athens participating in EU funded research projects in the security sector.

John Tsaloukidis (MSc) (male) is a Geologist with a MSc degree in Environmental, Disaster and Crisis Management Strategies in the Dep. of Geology and Geo-environment of the University of Athens. His research interests include analysing geological, meteorological and climatic data, weather forecasting and studying shifts in weather phenomena and patterns, due to the climatic change. He is currently participating in EU funding projects, regarding natural and manmade hazard mitigation, crisis management and critical infrastructure protection, as a research associate at the Center for Security Studies (KE.ME.A.), of the Hellenic Ministry of Citizen Protection.

Ilias Gkotsis (MSc) (male) is a Mechanical and Aeronautics Engineer with an MSc degree in Energy Production and Management. Currently, he is a PhD candidate in the Dep. of Transportation Planning & Engineering of NTUA. He has worked as Instructor on Mechanical Engineering courses in several IVTs, from 2009 to 2011. For 5 years he has been member of the implementation team of EU and National funded projects in the Transport sector, including traffic modelling and simulation, transport network management and environmental protection. From 2012, he is heavily involved (proposal writing, implementation, project/ financial management and coordination) in EU and Nationally Funded R&D projects as an associate researcher at the Center for Security Studies (KEMEA), of the Hellenic Ministry of Citizen Protection. Indicatively, he has been managing and coordinating proposals and projects (FP7, H2020, NSRF 2007-2014, NSRF 2014-2020, DG ECHO, CIPS, ISF, etc.) in the field of Security (Disaster Resilience, Civil Protection, Critical Infrastructure Protection, Protection of Public Spaces, Border Surveillance, Networks of Practitioners, etc). Finally, he is a certified UAV pilot by the HCAA and the Chief Pilot of KEMEA's UAV team.

George Eftychidis (male) has a University degree in Forestry and Environmental Protection from the Aristotelian University of Thessaloniki (Gr) since 1987. For years, he has worked in the private ICT sector on public and private contracts dealing with security, environmental and civil protection applications. In addition, he has participated in several European and National R&D projects and he cooperated with EC services as a reviewer and expert in policy making missions. His R&D topics of interest refer to modeling and simulating natural hazards and assessing related risks, using information technology. He contributed to the implementation of GIS and web applications for assessing forest fire behaviour, propagation rate and growth patterns using properly developed simulation tools. Such tools are currently used operationally by public services in EU countries. He contributed also to the development of forest fuel and risk analysis maps at the local, regional, national and EU level. During the last decades, he gained extensive experience in managing and coordinating national and European R&D projects. Furthermore, he cooperated with several public EU organizations regarding the analysis of needs and requirements of end users in security, civil protection and environmental safety issues and he contributed to disseminate results of research projects to the respective community. Currently, he is an associate researcher at the Center for Security Studies (KEMEA), of the Hellenic Ministry of Citizen Protection.

Vassiliki Varela (BSc) (female) holds a University degree in Forestry and Environmental Protection from the Aristotelian University of Thessaloniki (Gr) since 1987. She has worked for more than 20 years in the private ICT sector in public and private contracts dealing with environmental management and spatial data specifications and quality control. Furthermore, she has participated in several European and National R&D projects related to Forest Fires management as technical team leader or Principal Investigator. She is a GIS expert with many years of experience in GIS-based programming and in analysis and development of Natural Hazards management information systems. She also has significant experience in the development and exploitation of spatial datasets for environmental purposes and a very good knowledge of Spatial Data Standards and National and European Spatial Databases. Her main scientific interests are found in spatial analyses for Environmental protection, processing and mapping of physical parameters and study and adaptation of world-wide used Environmental indices and models, in the Mediterranean areas and particularly in Greece. Currently, she is an associate researcher at the Center for Security Studies (KEMEA).

Role in the project

KEMEA, has significant experience in projects, related to disaster management, as well as strong connections with First Responders, not only from Greece, but also from the rest of the EU. KEMEA is involved in the project and its expertise will be exploited in the following activities:

- Leader of Task 1.6, which is related to the management of external legal and ethical advisory board.
- Leader of Tasks 6.5 and 6.6, regarding privacy and societal impact assessment and contribution to EU legal framework for climate-related risks, respectively.
- Leader of Task 7.4 “Policy recommendations for sustainable and resilient forest management services”

Despite of leading the aforementioned four (4) Tasks, KEMEA will contribute to several more from almost all WPs of the SILVANUS project. Specifically:

- WP1 “Project coordination” – Participation in Tasks 1.1 “Project management”, 1.2 “Innovation management and scientific coordination” and 1.4 “Data management and ethics advisory board”.
- WP2 “Environmentally sustainable, resilient forest models and assessment framework” – Participation in Tasks 2.2 “Forest landscape models for wildfire threat assessment”, 2.4 “Forest resilience from historical case studies” and 2.5 “Systematic methodology for participatory process”.
- WP3 “Culture of deterrence and prevention against wildfires based on sustainable forest management services” – Participation in Tasks 3.2 “Forest fire ignition models”, 3.3 “Preparation and pre-planning activities for wildfire response”, 3.4 “AR/VR content curation for training firefighters” and 3.5 “Citizen engagement programme for preventing wildfires”.
- WP4 “Advanced detection capabilities for early-stage detection of wildfires” – Participation Tasks 4.2 “Tailored Weather/Climate models output for forest fire threat risk assessment” and 4.6 “UAV deployment for remote sensing and identification of wildfire”.
- WP6 “Enhanced resilience programme for forest management” – Participation in Task 6.1 “Ecological resilience programme”.
- WP7 “Policy recommendations on environmental sustainability and forest restoration” – Participation in Tasks 7.2 “Models for the assessment of quantitative aspects of forest resilience” and 7.3 “Governance models for forest restoration”.
- WP8 “Platform design specification, architecture and integration” – Participation in Tasks 8.2 “Information sharing protocols across first responders and public” and 8.3 “Information sharing protocols between SILVANUS mobile command centres”.
- Participation in all the Tasks of WP9 “Large-scale demonstration activities of project outcomes” and WP10 “Dissemination and exploitation”.

Relevant publications, and/or products, services or other achievements

- GSCP and KEMEA (2019). “National Risk Assessment for Greece (NRA-GR)”, Report prepared by KEMEA on behalf of the General Secretariat of Civil Protection, Greece submitted to European Commission, DG ECHO (p.214).
- J. Goldammer, G. Xanthopoulos, G. Eftychidis, G. Mallinis, I. Mitsopoulos, A. Dimitrakopoulos & The Global Fire Monitoring Center (2019). “Report by the Independent Committee established by the Prime Ministerial Decision Y60(GG3973/B/2018) on Analysis of the Underlying Causes and the Investigation of the Perspective Management of Future Forest and Wildland Fires in Greece”, National Printing House (p.156).
- Eftychidis, G., Varela, V., Gkotsis, I., Kazantzidou-Firtinidou, D., Papathanasiou, C., Petsioti, P., Sakkas, G. (2020). “Research, Operational Needs and Crisis management policy Interface”, 3rd Scientific Forum for Disaster Risk Reduction in Greece, Athens, 5-6 March 2020.
- Varela, V., Kazantzidou-Firtinidou, D., Gazi, A., Sakkas, G., Papathanasiou, C. (2019). “Pilot Coordination Center for Critical Infrastructure Protection”, 2nd Scientific Forum for Disaster Risk Reduction in Greece, Athens, 14-15 March 2019.
- Kazantzidou-Firtinidou, D., Sakkas, G., Papathanasiou C., Eftychidis, G. (under review). “Methodological approach for planning for emergency sheltering due to earthquake disasters”, In: Special Issue “Technology Advances and Support for Security Practitioners”, Book series “Security Informatics and Law Enforcement”, Springer, Switzerland.
- Gkotsis I., Petsioti P., Eftychidis G., Terzi M., Kolios P. (2020) Multiple drone platform for emergency respondense missions. Special Issue “Technology Advances and Support for Security Practitioners” of Security Informatics and Law Enforcement, Springer, ISSN: 2523-8507
- Gkotsis, I., Kousouraki, A. C., Eftychidis, G., Kolios, P., Terzi, M. (2020). Swarm of UAVs as an emergency response technology. Huang, C. (Ed.), Nivolianitou, Z. S. (Ed.). (2020). Risk Analysis Based on Data and Crisis Response Beyond Knowledge. London: CRC Press, <https://doi.org/10.1201/9780429286346>

- I.Gkotsis, P. Michalis, G. Leventakis, L.Georgaklis, K.Votis, S.Rogotis, D.Tzovara, (June 2015), "Comprehensive Aerial System Coupled with Sensor Network for Early Fire Detection, Prevention, Monitoring, Prediction and Fighting", 2nd ESFSS, Nicosia, Cyprus

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
FIRE-IN Grant agreement ID: 740575, Horizon 2020, https://fire-in.eu/en (ongoing)	<p>FIRE-IN has been designed to raise the security level of EU citizens by improving the national and European Fire & Rescue (F&R) capability development process. FIRE-IN addresses the concern that capability-driven research and innovation in this area needs much stronger guidance from practitioners and better exploitation of the technology potentially available for the discipline. FIRE-IN addresses these objectives through four main areas of activity: (i) the identification and harmonisation of operational capability gaps based on the contribution provided by a significant and heterogeneous practitioner network, (ii) the identification of promising solutions to address those gaps through monitoring and screening of research outcomes and the continuous involvement of research and industry representatives, (iii) the definition of a F&R Strategic Research and Standardisation Agenda (SRSA) based on the previous elements as well as (iv) the development of a concept for more efficient use of test & demonstration and training facilities to support innovation and joint skill development. KEMEA participates in the project and will make sure that relevant knowledge is exchanged.</p>	<p>Common capability Challenges for landscape fires. Solutions from the public FIRE-IN platform. Public Strategic Research Agenda and Policies Recommendations.</p>
MEDEA, Grant agreement ID: 787111, Horizon 2020, https://www.medea-project.eu/ (ongoing)	<p>The MEDEA project, during its 60 months of implementation provides funding for four interrelated actions: (i) Establish and Operate the MEDEA network, a multi-disciplinary network of security practitioners, with active links to policy makers and users/providers of security innovations across the M&BS countries focusing in Border Protection and other Security- and Disaster-Related tasks. (ii) Engage participants in anticipatory governance on emerging security challenges that the Mediterranean and Black Sea regions would face in the coming years (present until +10 years) (iii) Push for the “co-creation” of security technology and capabilities innovations between practitioners and innovation suppliers, which is based upon their evaluation and prioritization on multi-criteria analysis (technology, operational and cost-benefit, etc.) and also linked to Human Development, Policy Making and Organizational Improvements in-terms of facilitating its use by the practitioners (iv) Establish and annually update the Mediterranean Security Research and Innovation Agenda (MSRIA). KEMEA is the coordinator of the project and will ensure knowledge exchange.</p>	<p>Capability Gaps for natural hazards. Policies for gaps in various natural hazards aspects.</p>
FirEURisk- DEVELOPING A HOLISTIC, RISK-WISE STRATEGY FOR EUROPEAN WILDFIRE MANAGEMENT (Topic: CLA-15-2020 Type of action: RIA) (selected for GA)	<p>FirEURisk will develop, evaluate and disseminate a science-based integrated strategy to: 1) expand current wildland fire risk assessment systems, including critical factors of risk previously not covered; 2) produce effective measures to reduce current fire risk aspected future climate and socio-economic changes. This will be achieved in close collaboration between researchers, stakeholders and citizens, integrating novel technologies, guidelines and</p>	<p>Synergies. Knowledge on conducting fire risk assessment. Knowledge on management strategies for climate change and</p>

preparation 15th of December 2020	<p>policy recommendations to improve current systems and practices from regional to EU scales. The project will address all wildfire types, with particular focus on mega-fires, the Wildland Urban Interface and fire challenges in the Northern EU. A risk-centred management strategy will integrate wildfire prevention, suppression and restoration practices and policies in a holistic conceptual framework, and implement an operational platform that supports joint coordination, professional training and operational exercises, involving multiple stakeholders and addressing all relevant wildfire management tasks, to improve protection of citizens exposed to wildfires. FIREURISK will (a) model socio-economic issues and human activity influencing fire ignition, vulnerability and exposure, (b) evaluate the impact of National and EU policies on land use change, rural economy and development, in context of expected future fire regime changes, and (c) consider potential cascading effects linked to wildfire situations. This will allow FIREURISK to deliver innovative risk-informed regional planning approaches that are effective in increasing the resilience of local communities, ensuring safety and enhancing protection of assets and economic activity. The resulting advances in fire risk reduction will be linked to innovative organisational and efficient business models that promote cost-effective bioeconomy and nature-based solutions.</p>	socio-economic issues
NRA-GR – National Risk Assessment for Greece (General Secretariat for Civil Protection)	<p>The study was assigned to KEMEA by the General Secretariat for Civil Protection and was submitted to DG-ECHO of the European Commission, according to Art. 6.1 (d) of Decision 1313/2013/EU as amended by Decision (EU) 2019/420. The aim of the study was risk assessment for natural, man-made and technological hazards at national level. In the framework of the implementation of the project, the most important hazards of interest for Greece, both in terms of frequency of occurrence and impact, were studied and quantified. Indicatively the following hazards were studied, and relevant scenarios were developed: earthquakes, floods, landscape fires, extreme weather events, tsunamis and volcanos, cyber security issues and industrial, radiological and nuclear accidents. The hazards were examined based on their impact on human life and health, as well as in terms of their socio-political, economic, environmental and cultural impact, while a normalised scale (1 – 5) was used for their quantification, according to the guidelines of the European Commission. The study resulted in an approach for the quantification of risk assessment per hazard type and also the comparative assessment and categorisation of different hazards.</p>	Knowledge for wild-fire risk assessment and approaches.
AEGIS- Developing an Intelligent Transborder Integrated Innovative System of Resource Management, Decision Making and Education to Address Natural and Technological Disasters, Man-made and Social Crisis (INTERREG Greece- Cyprus 2014-2020) (CCI 2014TC16RFCB055)	<p>AEGIS project aims to enhance the competence and administrative capacity of the competent civil protection authorities of the participating regions of Greece and Cyprus to respond to natural and man-made disasters and crises, through the pilot design and development of an integrated cross-border innovative system, for resources management, decision making and training and development of an integrated cross-border innovative system, for resources management, decision making and training. KEMEA is subcontracting the lead beneficiary Regional Development Fund of North Aegean for (a) the design and coordination of a table-top exercise in cooperation with the civil protection stakeholders of the Region of North Aegean; (b) the organization and the coordination of the participation of the Region of North Aegean to the cross-border full-scale exercise in</p>	Experience and knowledge for setting up integration platforms and the information that should be embedded. Cooperation issues in cross-border operations.

	<p>cooperation with the civil protection stakeholders of the Region of North Aegean and Cyprus. KEMEA participates also to the evaluation of the new decision support system, by means of the hot and cold debrief as a process of the evaluation of the exercise.</p>	
SHELTERS, Emergency sheltering in Greece based on seismic risk assessment and operational optimisation (KEMEA)	<p>Provision of a technical-economic study in the field of civil protection and emergency sheltering in Greece based on seismic risk assessment and operational optimisation. Project mandated by the Council of Europe, on behalf of the General Secretariat of Civil Protection. In the context of modernising Greece's capabilities in designing and organising emergency sheltering for people affected by natural disasters, the study provides the necessary stock of temporary sheltering material, its optimal distribution throughout the country, human resources and means required for the operation and management of the camps, as well as an estimation of the associated costs. All the above-mentioned figures are based on seismic risk assessment, real loss and emergency management data transmitted by relevant public entities in Greece, international literature and sheltering guidelines.</p>	<p>Experience and knowledge aspects on how to estimate sheltering capabilities. Approaches for finding shelters for impacted and dislocated persons.</p>
FERMIS - Fire Event Remote Management Information System (GA. 2898)	<p>Fire-fighting, by detection, prevention, monitoring and analysis is commonly based on estimations made by experts from visual observations and data provided from ground stations, satellites and other means. Recently, the evolution of Unmanned Aerial Vehicles (UAVs) technologies, the miniaturization of sensors and the new advances in communication and control systems have extended UAV technology to a wide range of civilian applications such as fire detection, localization and observation. FERMIS aims to fulfill the expectations and needs of the market for the next generation of Airborne sensors, by providing a complete set of tools and sensors that will improve current supported UAV features and will further expand them into ""multi-sensing flying platforms"". The main goal of FERMIS is to design, develop and demonstrate a comprehensive solution for early fire detection, prevention, monitoring, prediction and fire-fighting, by using advanced and integrated aerial sensing systems coupled with innovative sensors and a cloud-based architecture software.</p>	<p>Experience and knowledge gained from the FERMIS project, regarding the use of UAVs in detection, localization and response to wildfires, could be of great significance for the ambition of SILVANUS, in terms of early detection and sensing of forest fires.</p>

Individual exploitation plan

KEMEA is the think tank and scientific consultant of the Ministry of Citizen Protection of Greece and appointed "National Contact Point" for the protection of European Critical infrastructures (ECIs). In this aspect, it has a training and research role inside the Ministry of Citizen Protection and a top priority to construct a roadmap for the Hellenic first responders. SILVANUS outcomes will be internally used by KEMEA and promoted to the Hellenic Ministry of Citizen Protection and first responders (e.g. fire service, Hellenic police, etc.) as well as, to other related crisis management, planning and response organisations (volunteers or private). The results of SILVANUS will also be promoted to the Pan-European network of KEMEA that consists of research institutions, civil protection authorities, first responders organisations and associations, local communities and other volunteering organisations. In addition, national and European stakeholders and policy makers will be informed. During the project implementation, **KEMEA will bring together** relevant stakeholders to collaborate and exchange experiences in the field of wild-fires management; after the end of the project, KEMEA will **promote developed innovative forest and land use management guidelines and policies, in order to be adopted by the Ministry of Citizen Protection and other European organisations (industrial, research/academic, civil protection).**

It is expected that the participation of KEMEA to SILVANUS will strengthen its position in key areas of wild-fires preparedness, prevention, response and restoration. It will furthermore add to the portfolio of KEMEA with respect to applied technologies.

The work will augment the long-term experience of KEMEA in the areas of security, and particularly to disaster management, wildfires management and training of first responders for proper response, a sector that KEMEA is highly engaged and active.

Communication strategy for promoting project outcomes

KEMEA will elaborate ways to increase the impact of SILVANUS with respect to disaster resilience, wildfires management and resilience through project findings and results exposure to relevant networks (e.g. fire and rescue innovation network FIRE-IN, Pan-European network of police organizations iLEAD, Pan European Networks of practitioners and other actors in the field of security MEDEA, etc.) and Organisations/Associations (e.g. EARTO, EENA, PSCE, EOS, etc.) that KEMEA participates. In addition, KEMEA will publish press releases and relevant information in its website and through social media pages. Furthermore, SILVANUS will be presented in conferences and workshops, national and international, that KEMEA will participate and create links with other ongoing projects.

Description of significant infrastructure and major items of technical equipment relevant to the project

KEMEA Operational Center Simulation Infrastructure

The Operational Center Simulation Infrastructure (OCSI) of KEMEA is a test environment and a fully operating legacy system simulator, which supports system development, integration, validation and testing from the mockup scale, up to demo, pilot and preoperational level. OCSI of KEMEA is based on ArcGIS Enterprise platform combined with MS SQLServer RDBMS, which is hosted in dedicated servers in KEMEA premises.

OCSI covers practically any type of GIS functionality and spatiotemporal data management, supporting a wide range of powerful data science tools, workflow automation and data visualization as well.

The OCSI platform supports standards from several Geospatial Standards Organizations including OGC, ISO/TC211, IHO as well as a variety of other open IT standards related to metadata, communication protocols, data sharing, open architecture implementation and can be integrated with other platforms, services, devices and systems.

Up to now, the implemented applications and services of the OCSI include web-services, web-apps and desktop software tools for natural hazard simulation and modelling, meteorological data processing, knowledge bases and geodatabases relative to Critical Infrastructure Protection, Fire and Flood management DSS, Border Control Management Applications. OCSI of KEMEA serves interested parties as a fully functional facility to test, validate and demonstrate relevant new applications, services and integrated solutions.



Figure 1. KEMEA Operational Center Simulation Infrastructure

KEMEA Unmanned Aircraft System (UAS) Equipment

KEMEA owns the following UAS equipment, that is involved in several projects and studies, for analysis and assessment of a ROI, plus validation, evaluation and demonstration purposes of a research solution:

- 1x Matrice 210RTK with X5s, Z30 and XT2 payloads,
- 2x Mavic Platinum,
- 3x Mavic enterprise dual,

- 1x Spark
- 1x WintraOne with SONY RX1R II + PPK payloads
- 1x SAFE-T with AirModule for Matrice 210

A detailed description of the models is presented below.



Matrice 210 RTK¹, is a 643mm diameter quadcopter Unmanned Aerial Vehicle (UAV) which weighs about 4,8kg with a maximum weight flight of 6.14kg, maximum flight duration of 32min and a maximum flight range of 8km. It has a Real Time Kinematic (RTK) module. **RTK** is a satellite navigation technique used to improve the accuracy of position data from satellite positioning systems (Global Satellite Systems, GNSS, BeiDou, providing precision in centimeters. The above UAV is suitable for photogrammetry, topographical plans, digital background creation, fire-fight missions, HazMat identification, search and rescue actions, risk assessment, CI inspection, border surveillance etc. It can fly and land easily (automatically or manually) from any area. Its high-performance engines combine with 17-inch propellers in order to ensure steady flight even in strong winds. In addition, the dual power system automatically heats the batteries when flying at temperatures below zero, while a closed design ensures weather and water resistance (IP43) so it can fly in a wide range of situations. It also has the ability to carry and use two cameras simultaneously, or one upward-facing camera. The dual gimbal configuration unlocks 5 different combinations. An FPV camera is built in for navigating, including models capable of thermal imaging, high-definition video and zooming for detail. Its foldable body, plus removable batteries, propellers and landing gear, make it easy to store and transport in a case.



Mavic pro Platinum², is a 335mm diameter quadcopter UAV, electrically driven, with a total weight of 743g and a flight duration of 30min. This UAV has an electromagnetic day sensor: 1 / 2.3 "(CMOS), 12.35 Megapixel and a FOV 78.8 °, 26 mm lens. Its camera is supported on a 3-axis base (pitch, roll, yaw) for greater stability and accuracy, allowing Pitch motion: -90 ° to + 30 ° and Roll: 0 ° or 90 ° (horizontal and vertical) degrees in shooting. It has an Ocusync controller with 1080p / 720p resolution and a live feed of up to 7km (this distance is noticeably reduced due to the many interferences that exist).



Mavic 2 Enterprise dual³, is a 354mm diagonal, quadcopter, electrically driven, weighing 899g with a maximum flight weight of 1100g and a flight duration of 31 minutes. Mavic 2 Enterprise Dual has many display modes: FLIR MSX, infrared and RGB.

Flight autonomy provides omnidirectional obstacle control (sensing2), an advanced detection system comprised of 8 high resolution optical sensors and 2 infrared sensors located on the sides of the aircraft. The result is a powerful set of sensors that determine the relative speed and distance between the aircraft and an object so that it can fly and float with more stability over a wide range of open and complex environments. This makes it an imaging unit capable of adapting to any mission required. Mavic 2 Enterprise is equipped with various accessories such as the M2E Spotlight, the M2E Speaker and the M2E Beacon. It communicates with staff on the ground, suspects or survivors with the Mavic 2 Enterprise speaker and allows the reproduction of alerts or voice calls in real time. With Mavic 2 Enterprise Spotlight, it illuminates low-light areas for up to 30 meters, and with the Mavic 2 Enterprise Beacon flashing strobe it is visible for up to three miles. Also, advanced System3 pilot assistance allows the drone to cleverly detect objects and movement and to easily fly around or over obstacles, especially in narrow spaces.



Spark⁴, is a small-scale quadcopter UAV that features all DJI technologies. It has a maximum flight duration of 16min, it is 170mm in diameter and weighs 300g. It features a 1-2/3" CMOS and FOV 81.9 °, 25 m optical sensor, enabling video and photo capture at 12MP and supports a camera on the 2-axis Gimbal, giving it more stability and precision. It features Gesture mode where it can be signalled to move or come closer with a wave of the hand. It also features TapFly, Active Track and Auto Return Home with built-in GPS. Spark is suitable for small flights. It operates in lulling conditions, with great flexibility in indoor and confined spaces. Finally, it is easy to carry.



The WingtraOne⁵ is a VTOL mapping drone with 125cm wingspans. WingtraOne in sustained winds higher than 8 m/s (19 mph), has a Max. take-off weight 4.5 kg, 52min flight duration, Max. take-off altitude above sea level up to 5000m (16,400 ft) AMSL and Operational cruise flight speed 16 m/s (35.8 mph). Two modules that exploit GPS and GLONASS information are ready for Galileo, BeiDou. The WingtraOne has vertical take-off and landing (VTOL) and the endurance of a fixed-wing drone able to survey mid-to-large scale projects. Its hybrid VTOL design and, SONY RX1R II + PPK (up to 42MP), WingtraOne provides aerial surveys of unparalleled image quality and accuracy (Down to 1 cm (0.4 in)). Survey times up to 80% faster than ground methods or quadcopter drones.



Safe-T⁶ is an industrial smart tether station for Unmanned Aerial Vehicles (UAV), offering real-time semi-persistent observation and surveillance capabilities thanks to its patented micro-tether. The solution enables unlimited access to a global aerial vision, in real time and in a secure manner. Providing a continuous and redundant power supply at 1.200W nominal, secured by a UPS safety battery, the Safe-T micro-tether is armoured with kevlar to withstand over 1000 Newtons of traction, 10 g/m and 80m length, provides an unbroken and unjammable data transfer. It is compatible with Matrice 210 RTK (AirModule for Matrice 210) and has autonomy for 4 hours.

4.1.39 Hellenic Rescue Team

Partner Name: ELLINIKI OMADA DIASOSIS SOMATEIO (Hellenic Rescue Team)	
Company website: http://hrt.org.gr/	
Type: End-user (NGO)	

Hellenic Rescue Team (HRT) is a volunteer non-profit Search and Rescue (SAR) organisation, with a human potential of 2.000 volunteers all over Greece and Headquarters in Thessaloniki. HRT participates in SAR missions in cases of urgent needs and massive disasters, either in Greece or abroad. It is acknowledged by Civil Protection Authorities in Greece and EU and a member of the United Nation - International Search and Rescue Advisory Group (UN-INSARAG), and the only Greek member in the International Maritime Rescue Federation (IMRF) and the Internationale Kommission fur Alpines Rettungswesen/Commission Internationale de Sauvetage Alpin (IKAR/CISA). HRT's main mission is the search and rescue of people in need and the organisation of Aid Missions in naturals and manmade disasters all over the world, nevertheless a major objective (and vital tool to achieve our mission) is Research and Development in the area of Search and Rescue, crisis and crowd management, telecommunications, ICT for first responders.

Within the Hellenic Rescue Team area, there are seven specialised departments, mainly:

- USAR - Massive Disasters: HRT has at its disposal a team in state of alertness, fully technologically equipped. HRT's corporate planning is to intervene in any part of the world, in case of earthquakes, floods and extended catastrophes as Turkey and Athens (99), Morocco and Algeria (03), Pakistan (04), Haiti (2010).
- Mountain Rescue: the richest in experience HRT Department, having participated in over 100 missions of Search and Rescue also has all the appropriate apparatus and the perfect training to intervene in mountain accidents and air crashes, accomplishing even the most difficult operations.
- Water Search and Rescue: its members are experienced scuba divers, speed-craft controllers, sailors, bay-watchers and support crew who are participating in Search and Rescue (SAR) at sea, rivers, and lakes. They are in constant cooperation with the Hellenic Coast Guard and the Hellenic Air Force. Most recently, HRT through its Water Rescue Department (WRD) was very active in the refugee crisis in the Eastern Aegean saving numerous lives. Furthermore, through its partners in IMRF, HRT has increased substantially its ability in sea rescue through specialised training.
- First Aid: professionals in health domain support the rescue departments of HRT providing first aid during our missions. In addition, they train new HRT's members in First Aid.
- Research, Technology and Telecommunications: the development of the specialised knowledge of HRT's members led to the exploitation of modern technology and its focusing on creating applications and devices useful in Search and Rescue. The Department has a portfolio of a variety of pioneer inventions.
- Humanitarian Missions: this department collects, carries over and distributes humanitarian aid to populations suffering from disasters and abnormal crisis. In addition, in cooperation with the Greek Government as well as the European Union (ECHO), HRT is in charge of the management of aid programs towards third countries. In the past, some of these countries have been: Afghanistan (1999), Iraq and Iran (2004), Indonesia and Sumatra (2005), Lebanon (2006), Gaza (2009), Haiti and Chile (2010).
- Training: HRT organises special schools and seminars by professional trainers, in Greece and abroad, in order to provide its members with all the technical knowledge that is required.

CVs of key personnel

Mr. Iosif Vourvachis (male) is a Civil Engineer with an MSc equivalent degree (5-year course) from the Aristotle University of Thessaloniki and an M.B.A. at Panepistimion Makedonias (University of Macedonia, Greece, in 2004). He has a long experience in managing EU projects and has participated in many FP7 and other EU funded projects as a team leader or project manager. He has lead and coordinated WPs and Tasks in various FP7 & H2020 projects.

He leads the HRT R&D team in all project as well as the financial management. He holds the position of the Development Manager in HRT and he will act as HRT's lead project manager.

Mr. Zafeiris Trobakas is the Director of Training of HRT since the establishment of the organization over 27 years ago. He has an extensive experience of more than 35 years in training first responders and he is responsible and oversees all training courses carried out in HRT, in all fields of operation (mountain, sea, urban, first aid, etc.). He has been a member for 6 years in ICAR workshops that focused in mountain rescue. Furthermore, he has been a trainer for mountain rescue for the special Hellenic Special Forces in 2000, 2001, 2006 and 2009 and he has trained a branch of Turkish Fire Department in Duzceili in 2004. Moreover, Mr Trobakas has been a speaker in various mountain rescue seminars in Greece and he has carried out studies based on observation and experiments on meteorology and telecommunications in remote mountain areas and how they can affect mountain rescue operations.

Mr. Nerantzis Lorenzo, holds a Bachelor Degree in Economic Science and Finance, and a Master Degree on Human Rights Law. He has many years of professional experience in developing countries and has been employed as a Financial Specialist in Social Cash Transfer Programs, funded by the EU and the World Bank, in Ecuador and Malawi for 3 years. He speaks fluently 4 languages (Greek, Italian, Spanish, English) and has academic experience in 5 different European universities. As a member of the Hellenic Rescue Team (HRT), he has been trained in First Aid, Radio, Search and Rescue techniques, and has participated in several mountain rescue missions in Greece. Additionally, he is a holder of a radio amateur license and has experience in using and experimenting the amateur bands frequencies and setting the VHF/UHF radio network of HRT

Ms. Meni Kourkouta, holds a Bachelor Degree in Journalism and Mass Communications (Aristotle University of Thessaloniki). She has 20 years professional experience in printed and web editing, journalism, communication, events organizing and sponsorship related projects. She has been working 9 years for HRT, as a Press Officer and Public Relations Manager and she has also been involved in international projects. Moreover, she undertakes sponsorship and fundraising projects and events planning. She speaks 3 languages (Greek, English, Italian) and is member of the Macedonian and Thrace Journalists Union.

Mr. Dimitrios Iliadis, holds a Bachelor Degree in Library & Information Science and currently he is attending a Master on Informatics and Management (JPC IM) offered by the Aristotle University of Thessaloniki. Dimitris has been a volunteer rescuer since 2015 with expertise at the Water Rescue Department and the Department of Research, Technology, and Telecommunications. He is also responsible for the design and implementation of training courses of the above Departments. In cooperation with the Director of Training, he carries out the relevant activities for the new volunteers across the HRT branches in Greece. Dimitris has participated in plenty of training programs and exercises with the Hellenic Air Force, Navy, Coast Guard, and Fire Service, including other European rescue organizations such as RS+(Norway), SSRS (Sweden), DGZRS (Germany), and KNRM (Netherlands).

Mr. Alexandros Giordanis, holds a Bachelor Degree in Logistics & Supply Chain Management, awarded by the International Hellenic University. He has work experience as a Logistics Management Intern at a multinational company. In addition, he has received distinction as one of 15 best ideas of the World of Difference program, of the Vodafone Foundation. His research interests span the fields of supply chain optimization, operation research, circular economy and humanitarian logistics. He speaks 3 languages fluently (Greek, Polish, English). As a member of Hellenic Rescue Team, he has been trained in First Aid, Search & Rescue (SAR), Mountain Rescue and Avalanche safety, and has participated in several rescue operations. Mr Giordanis is a member of the Hellenic Logistics Association of Northern Greece

Role in the project

HRT will support in the demonstration activities in Thessaloniki that will be mainly focused in Phase A as well as the collection of User Requirements.

Moreover, HRT will carry out the required dissemination activities for the project promotion as well as will support local stakeholder engagement in the project.

Role in the project

- **WP1:** HRT will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** HRT will contribute to the participatory process.
- **WP3:** HRT will contribute to the development of the training programme.
- **WP6:** HRT will contribute to data management plan and privacy impact assessment
- **WP7:** HRT will contribute to the future of forest management
- **WP9:** HRT will lead the pilot demonstration as outlined below.
- **WP10:** HRT will disseminate and exploit the project results through established international links.

Relevant publications

HRT is an experienced Search and Rescue organisation with a record of numerous Search and Rescue operations in various fields and many events, relevant to the project's core idea.

Moreover, during the past five years HRT participated in various research projects where HRT had similar roles to the respective proposal: definition on requirements and field testing.

HRT is not new to R&D activities. Throughout the last years and mainly with its own limited financial resources, HRT successfully implemented (among others) the following projects:

1. “Detecting survivors in wreckage: A new antenna and SW for BIORADAR BR 402”. Gathering feedback and experience from participation in numerous SAR missions around the world, our rescuers come up with a set of requirements and specifications that survivor detection equipment should have. HRT fully modified a small hi tech commercial system for detection and evaluation of small mechanical movements like human beings. The system uses electromagnetic waves (radar waves) through obstacles. It works on the principle of send and receive, using a standard PC to analyse the received signals. HRT, after many experiments and field testing, created a new improved antenna and rewrote the software of the RADAR in order to substantially improve its reliability and speed. The RADAR is still in operation with great success in the field.
2. “Crisis Management Radio Network Design and Deployment”. Communications are vital for all first responders and rescuers. The safety of the people in distress and of the rescuing teams depends on reliable and sound communication channels. Mobile networks do not provide adequate coverage especially in isolated areas and even if they do, their cost is often unaffordable. Very High Frequency – Ultra High Frequency (VHF-UHF) communications provide a solution but the problem of limited coverage of portable VHF devices still exists. Our telecommunications research department has developed a unique radio network composed of links and repeaters focusing on dangerous and unapproachable locations. The final locations were selected after a long-term allocation study by our teams. All radio points (links and repeaters) are autonomous and equipped with batteries, photovoltaic panels, thunder protection and secured from strong wind and cold. Thanks to such researchers, HRT developed a new methodology for radio network deployment in rough conditions and new protocols and methods for setting up radio communications in difficult, isolated mountainous terrains. Recently, HRT managed to link this radio network with the Internet and transfer radio signals in remote locations even abroad. HRT is constantly updating and maintaining the system and managed to establish and demonstrate in a field exercise communication with a diver 15m below water and with a civil aviation airplane in flight just outside Greek borders.
3. “The effect on Radio meteorology in radio signal transition”: a long-term study by HRT on the use of radio waves and radio equipment (e.g. links and repeaters) for controlling devices and transferring data to and from remote locations.

“Innovative methodologies for SAR missions with the use of helicopters”: Manual and Training material/seminars.

Past relevant projects

1. H2020 SC5 “SAFERS” - Structured Approaches for Forest fire Emergencies in Resilient Societies
2. H2020-SU-SEC “PathoCERT” - Pathogen Contamination Emergency Response Technologies
3. H2020 DRS02-SU-SEC “Search and Rescue” - Emerging technologies for the Early location of Entrapped victims under Collapsed Structures and Advanced Wearables for risk assessment and First Responders Safety in SAR operations
4. H2020 SEC “beAWARE - Enhancing decision support and management services in extreme weather climate events”

5. FP7 SEC “**CONCORDE** - Development of Coordination Mechanisms During Different Kinds of Emergencies”.
6. FP7 SME “**RESCUECELL** - Portable Kit For Detecting Trapped And Buried People In Ruins And Avalanches”.
7. FP7 SEC “**COSMIC** - The COntribution of Social Media In Crisis management”.

Infrastructure to be made available to SILVANUS

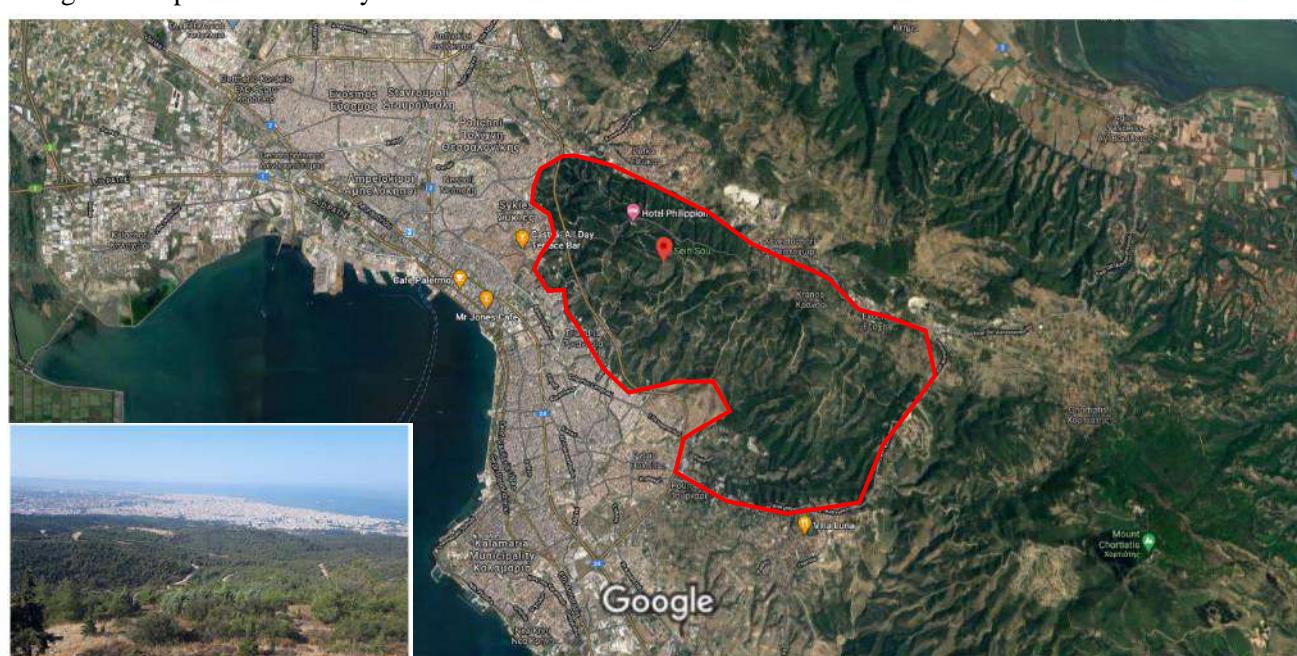
All the items in the list below can be used for the field pilots, based on the requirements for their execution, the scenario and pilot set up.

- A van which serves as a mobile operations centre called “Hermes”, which carries all necessary equipment for managing a crisis, such as a communication centre, internet connection, satellite communication, etc.
- 19 rescue vessels for sea rescue;
- 2 rescue runners;
- 2 snow vehicles;
- Suitable suits for ground personnel, who are involved in fire response;
- Various first aid and SAR equipment;
- Nationwide communication network.
- 2 mobile Wi-Fi communication antennas

Phase A – HRT activities

Pilot Site

The pilot site that will be used to support the demonstration activities in Phase A in Thessaloniki by HRT will be the peri-urban forest of Seih Sou. The area of the forest is just 15 minutes from the centre of Thessaloniki and is often used for recreational purposes by people that go hiking, mountain running, cycling or just a walk in the forest. Each year HRT is assigned by the Civil Protection Authorities in Thessaloniki the specific area in the forest to patrol during the fire period from May until October to observe and alert in case of a fire.



Imagery ©2020 CNES / Airbus, European Space Imaging, Landsat / Copernicus, Maxar Technologies, Map data ©2020 1 km

Image 1: Area of peri-urban assigned to HRT to patrol (in red)

Fire history

In July 1997 a major fire broke out that lasted for 3 days. Approximately 50% of the forest area at the time was burnt, as shown in images 2 and 3.

Since that incident, smaller fires have broken out again, however due to significant effort done by local authorities and first responders, fortunately there has not been any major incident.

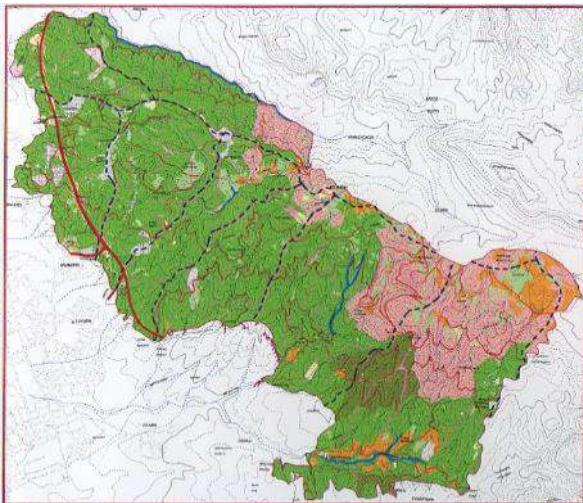


Image 2: Plantation before the fire⁵⁵

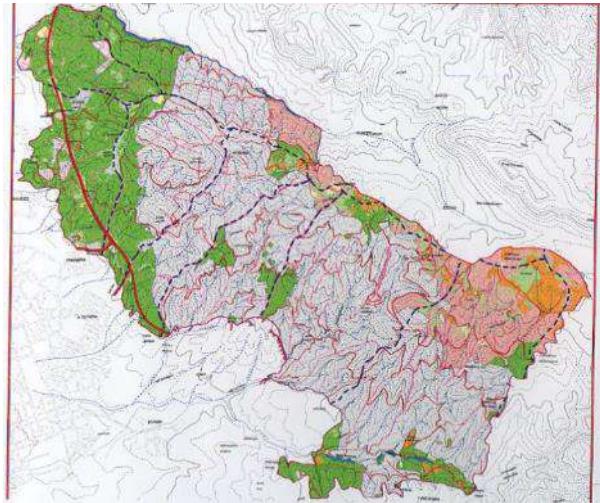


Image 3: Plantation after the fire⁵⁶

Foreseen demonstration activities

HRT is planning to carry out activities to enhance citizen engagement to promote fire safety awareness and safe behaviour in the forest. Additionally, the goal of the activities will be to encourage citizen involvement during the preparedness and prevention phase. These activities will be aimed towards all citizens, especially those who visit the forest for recreational purposes and will:

- Carry out infodays in order to educate citizens about safe behaviour in the forest and to also to train them on the use of the developed mobile application (T3.6) and how they can support the prevention activities though its use. In general, attention will be given on how citizens can support all stages of a wildfire event and what they can do before, during and after.
- Test further the use of the developed mobile app with its members during their patrols in the fire period. The goal will be to locate and evaluate.
- Create info-points that will distribute dissemination material promoting both the scope of the project and the use of its mobile application for the overall objective of preventing a forest fire to break out, motivating at the same time citizen engagement.

Regardless the fact that not many fires break out in the Seih Sou forest, it is important to educate and train citizens since this also supports the change of attitude and behaviour which can be beneficiary not only when these citizens are in Thessaloniki, but also when they visit another place as well.

As a validation aspect, the partners will conduct a survey on human behaviour change due to the citizen engagement programme.

KPIs

- Number of citizens that will participate in the info-days
- Number of citizens that will actively use the mobile application

4.1.40 ARISTOTLE UNIVERSITY OF THESSALONIKI – AHEPA HOSPITAL

Partner Name: Aristotle University of Thessaloniki – AHEPA Hospital

Company website: <https://www.auth.gr/en/uni>

Type: End-user (Healthcare provider for fire fighters)



⁵⁵ Directorate of Reforestation Thessaloniki

⁵⁶ Directorate of Reforestation Thessaloniki

The Aristotle University of Thessaloniki is the largest university in Greece. The main campus is located in the centre of the city of Thessaloniki and covers an area of about 33.4 hectares. It comprises 10 faculties which consist of 40 schools and 1 single-School Faculty. Some educational and administrative facilities are located off campus for practical and operational reasons. A number of these facilities are located outside the city of Thessaloniki or even in other cities. The School of Medicine is one of the four Schools of the Faculty of Health Sciences, Aristotle University of Thessaloniki. It was founded as Medical Faculty of the Aristotle University of Thessaloniki in 1942, during the German occupation of Greece. Its establishment took place 17 years after the foundation of Aristotle University. The main goal of the School of Medicine of the Faculty of Health Sciences, Aristotle University is to educate the medical students as well as to provide Greece health professionals with the highest scientific standards. An additional aim is to make high quality research either by itself or in collaboration with other Greek and international research centers. During their undergraduate studies the students participate in various research programs of laboratories and departments. These outcomes are mainly presented in the annual Medical Congress of the School of Medicine.

The main educational goal of the School is the dissemination of ethical values that govern the medical practice to students as well as to ensure that the young medical doctors will acquire all scientific knowledge which will enable them to diagnose and effectively manage medical problems after obtaining their degree. Moreover, the faculty of the School of Medicine is the staff of several hospitals as well as other units of the National Health System, and thus provides an important social work. The AHEPA University General Hospital of Thessaloniki is considered one of the biggest hospitals in Greece. Covers 680 beds and all the spectrum of medical and surgical specialties of medicine. The central service of AHEPA hospital is located in the territory of Aristotle University of Thessaloniki, No 1, Stilponos Kyriakides str, 54636, within the administrative region of the municipality of Thessaloniki. The structured areas of the hospital cover 50,000 sqm, built in several time points, to cope with the emerging needs

Experience

In recent years, AHEPA has been heavily involved in several National and European projects with focus on the reformation and the reorganization of the health community. The research project includes the performance of experimental and clinical studies, as well as their presentation in scientific conferences and / or in the form of publications in scientific journals. The studies are performed by the faculty members of the clinic in collaboration with the specialized doctors and / or the medical students, but also in collaboration with colleagues of other clinics or other scientific fields, Greece and abroad. The main goal of the research is to promote science in order to improve the health of patients.

Key Personnel

Prof. Christoforos Kosmidis (Male) is an associate professor with 3rd Department of Surgery, "AHEPA" University Hospital, Aristotle University of Thessaloniki, Medical School. Professor Kosmidis received his bachelor and the PhD from the same department in 1991 and 2005 respectively. His teaching work counts more than 20 years, starting from 1994 till today, with many courses and lectures regarding surgical treatment, Laparoscopic Experimental Surgery, New technologies in general surgery and many other relevant topics. During his studies and his carrier, he has written several papers in major scientific medical journals and conferences while he actively participates in scientific conference committees and journal editorial positions.

Professor Kosmidis has participated as Principal or Co -Investigator in several clinical trials and is also member of several scientific societies, such as the following:

1. Surgical Infection Society of Greece
2. Hellenic Society of Colorectal Surgery
3. Sports Medicine Society of Greece
4. Hellenic Society of Endoscopic Surgery and other Invasive Techniques
5. International Colorectal Cancer Club (ICRCC)
6. International Hepato-Pancreato-Biliary Association
7. Hellenic Society of Early Diagnosis and Treatment of Breast Cancer
8. Surgical Society of Greece
9. Hellenic Cancer Society- Macedonia and Thrace Branch, Headquarters in Thessaloniki, Greece (Vice President for 2,5 years)

Dr. Pavlos Zarogoulidis, M.D (male), is an associate pulmonologist at Pulmonary-Oncology Department of «Theagenio Cancer Hospital», Thessaloniki, Greece. He has a MSc in «drug, design, development and therapy» and his PhD is regarding inhaled chemotherapy for lung cancer. In his everyday practice he performs diagnosis of lung

cancer with bronchoscopy, radial and convex probe endobronchial ultrasound and finally medical thoracoscopy. He is a member of the European Respiratory Society (ERS), American Thoracic Society (ATS), European Association for Bronchology and Interventional Pulmonology (EABIP), Chinese Association for Bronchology and Interventional Pulmonology (CABIP), American Society of Clinical Oncology (ASCO), International Society of Aerosol Medicine (ISAM), International Association for the Study of Lung Cancer (IASLC) and World Association for Bronchology and Interventional Pulmonology (WABIP). He had his training in medical oncology in the Medical Oncology Department Christie Hospital, Manchester U.K. and his interventional pulmonary training in the Interventional Pulmonary Department, Ruhrland Clinic, University of Duisburg-ESSEN, ESSEN, Germany. He is an editor in "Journal of Thoracic Disease", editor in "Translational Lung Cancer Research", editor in "Journal of Nanomedicine and Biotherapeutic Discovery", editor in "Immunome research", editor in "Journal of Cancer", associate editor in "World Journal of Respirology", editor on "Annals of Translational Medicine", founder editor of "Annals of Occupational & Pulmonary Medicine", editor in Scientific Reports (nature publishing group), editor in Medicinal Chemistry (bentham Science group) and editor in International Journal of Nutrition and Health Sciences. Editor in Chief of Journal of Biomedicine. He has participated as in ERS poster coordinator 2011, ERS scientific committee for NSCLC AWARD 2012, ERS Reviewer committee for NSCLC abstracts 2013, ERS C0-Chairman Thematic Poster Session, Systemic therapy of lung cancer and quality of life 2013 Barcelona and ERS Reviewer committee for NSCLC abstracts 2015. He has more than 280 publications and he is collaborating with several departments from the U.S.A (Lonny Yarmus, Ko Pen Wang, David Feller Kopman, Division of Pulmonary and Critical Care Medicine, Sheikh Zayed Cardiovascular & Critical Care Tower, Baltimore, U.S.A Michael Simoff, Bronchoscopy and Interventional Pulmonology, Pulmonary and Critical Care Medicine, Henry Ford Hospital, Wayne State University, School of Medicine, MI, USA, Robert Browning, Pulmonary & Critical Care Medicine, Interventional Pulmonology, National Naval Medical Center, Walter Reed Army Medical Center, Bethesda, U.S.A, J Francis Turner, Division of Pulmonary and Critical Care Medicine University of Tennessee Graduate School of Medicine Knoxville Tennessee USA.), Europe (Wolfgang Hohenforst-Schmidt, Sana Clinic Group Franken, Department of Cardiology/ Pulmonology/ Intensive Care/ Nephrology, "Hof" Clinics, University of Erlangen, Hof, Germany, Johannes Brachmann, II Medical Clinic, Coburg Hospital, University of Wuerzburg, Coburg, Germany, Thoms Vogl, Department of Diagnostic and Interventional Radiology, Goethe University of Frankfurt, Frankfurt, Germany, Lutz Freitag, Kaid Darwiche, Department of Interventional Pneumology, Ruhrlandklinik, University Hospital Essen, University of Essen-Duisburg, Tueschner Weg 40, 45239 Essen, Germany.) and China (Haidong Huang, Chong Bai; Department of Respiratory and Critical Care Medicine, Shanghai Hospital, The Second Military Medical University, Shanghai, China.). He is a junior lecturer of pulmonary oncology for the past four years in the Aristotle University of Thessaloniki, Thessaloniki, Greece.

Role in the project

- **WP1:** AHEPA will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** AHEPA will contribute to the participatory process.
- **WP3:** AHEPA will contribute to the development of the training programme.
- **WP5:** AHEPA will contribute to monitoring the health of frontline fire fighters
- **WP7:** AHEPA will contribute to the future of forest management
- **WP9:** AHEPA will lead the pilot demonstration as outlined below.
- **WP10:** AHEPA will disseminate and exploit the project results through established international links.

Relevant Publications

- Tsiodra, T., Sardeli C., Porpodis K., Pilikidou M., Apostolidis G., Kyrra K., et al. (2020). Sex Differences and Adverse Effects between Chemotherapy and Immunotherapy for Non-Small Cell Lung Cancer. *J Cancer*. 11(11), 3407-3415.
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Relevant Projects

- INCISIVE H2020: The increasing amount and availability of collected data (cancer imaging) and the development of novel technological tools based on Artificial Intelligence (AI) and Machine Learning (ML), provide unprecedented opportunities for better cancer detection and classification, image optimization, radiation reduction, and clinical workflow enhancement. The INCISIVE project aims to address three major open challenges in order to explore the full potential of AI solutions in cancer imaging: (1) AI challenges unique to medical imaging, (2) Image labelling and annotation and (3) Data availability and sharing. In order to do that INCISIVE plans to develop and validate: (1) an AI-based toolbox that enhances the accuracy, specificity, sensitivity, interpretability and cost-effectiveness of existing cancer imaging methods, (2) an automated-ML based annotation mechanism to rapidly produce training data for machine learning research and (3) a pan-European repository federated repository of medical images, that will enable the secure donation and sharing of data in compliance with ethical, legal and privacy demands, increasing accessibility to datasets and enabling experimentation of AI-based solutions.

- The INCISIVE models and analytics will utilize various cancer imaging scans, biological data and EHRs, and will be trained with 1 PB of available data provided by 8 partners within the project. INCISIVE solution will be investigated in four validation studies for Breast, Prostate, Colorectal and Lung Cancer, taking place in 8 pilot sites, from 5 countries (Cyprus, Greece, Italy, Serbia and Spain), with participation of at least 2,600 patients and a total duration of 1.5 year. INCISIVE moves beyond the state of the art, by improving sensitivity and specificity of lower cost scanning methods, accurately predicting the tumor spread, evolution and relapse, enhancing interpretability of results and “democratizing” imaging data.
- PROTEIN H2020: Proper nutrition is essential for good health, well-being and the prevention, mitigation or treatment of a number of non-communicable diseases (NCDs). Food is not only a source of calories, but also a complex mixture of dietary chemicals, some of which are directly related to cardiovascular diseases, diabetes, allergies and some types of cancer. Foods, diet and nutritional status, including overweight and obesity, are also associated with elevated blood pressure and blood cholesterol or even resistance to the action of insulin. These conditions are not only risk factors for non-communicable diseases, but major causes of illness themselves.
- However, today's diet is characterized by irregular and poorly balanced meals. Unhealthy eating habits in our daily life are not only risk factors for non-communicable diseases, but also major causes of stress and tiredness, i.e., lack of energy. Knowledge about our dietary habits based on the analysis of diverse types of information, including individual parameters, can contribute greatly towards answering key questions to respond to societal challenges regarding food and health.
- Motivated by the aforementioned, the PROTEIN project aims to develop an end-to-end ecosystem that will engage people to a healthy, pleasurable, nutritional and sustainable diet by offering a daily program adapted to their needs and driven by their personal preferences, physical and physiological characteristics as well as their health status. Specifically, the main objective of PROTEIN is to create an ICT-based system for providing personalized nutrition based on the collection and analysis of large volumes of data related to users' dietary behavioural patterns, physical activity, and individual parameters. PROTEIN proposes a radically novel approach to advice and support consumers in everyday living, while ensuring users' privacy protection i.e., data will be anonymized and securely stored in the Cloud for processing.
- i-Prognosis H2020: Transition from healthy status to Parkinson's Disease (PD) is vaguely tractable, since symptoms can be so subtle in the early stages that they go unnoticed. Lack of biomarkers and/or findings on routine MRI and CT scans, PD is left undiagnosed for years, gradually affecting the life of over 6.5 million of older adults (>55-60 yrs) worldwide, increasing the risk of their health deterioration. Epidemiological studies conclude that early intervention could have an inverse relation with the PD-related risks of progressive frailty, falls and emotional shift towards depression. Based on this evidence, the cardinal objective of i-PROGNOSIS is the development of (i) an ICT-based behavioural analysis approach for capturing, as early as possible, the PD symptoms appearance, and (ii) the application of ICT-based interventions countering identified risks. To achieve this, awareness initiatives will be employed, so as to construct i-PROGNOSIS community, targeting > 5000 older individuals within the duration of the project, in order to unobtrusively sense large scale behavioural data from its members, acquired from their natural use of mobile devices (smartphone/smartwatch). Ensuring anonymisation and secure Cloud archiving, i-PROGNOSIS will develop and employ advanced big data analytics and machine learning techniques, in a distributed and privacy aware fashion, so as to instantiate a PD Behavioural Model and construct reliable early PD symptoms detection alarms. To those identified and clinically validated as early stage PD patients, ICT-based interventions will be provided via the i-PROGNOSIS Intervention Platform, including: a) a Personalised Game Suite (Exer-Games, DietaryGames, EmoGames, Handwriting/VoiceGames) for physical/emotional support, b) targeted nocturnal intervention to increase relaxation/sleep quality and c) assistive interventions for voice enhancement and gait rhythm guidance. In this way, i-PROGNOSIS will constructively contribute to active and healthy ageing.

Infrastructure

The AHEPA University General Hospital of Thessaloniki is considered one of the biggest hospitals in Greece. Covers 680 beds and all the spectrum of medical and surgical specialties of medicine. It is a State Hospital associated with the 4th Health District of Health Services of Macedonia and Thrace as an independent service, with administrative and economic autonomy. The hospital is also responsible for the function of two Regional Health Centers, one at Sohos region and another at Nea Maditos region, as well as the local Health Stations around these villages (Table 1), covering all issues of primary health care for people living in these areas and seasonal tourists. Nevertheless, the Hospital is responsible for patients from all around Macedonia and Thrace, due to its high expertise in tertiary health care.

4.1.41 Ospedale Israelitico

Partner Name: Ospedale Israelitico

Company website: www.ospedaleisraelitico.it

Type: End-user



The Jewish Hospital is a private health facility included in the National Health System with various medical and surgical specialties authorized and accredited by the SSR. It is present in the Lazio Region with a network of four poles, through which it provides outpatient and hospitalization, medical and surgical services, with particular reference to the Geriatric specialty. Healthcare activities as well as administrative ones are supported and supervised by an integrated information system whose hybrid infrastructure, 90% in cloud and 10% resident, ensures with over 300 client workstations, access to clinical data of patients and administrative ones, for the governance of the Structure. The Information Systems Office belonging to the Development Department, ensures in collaboration with the ICT suppliers, the management of the technology park and the ERP. It contributes to innovation with the other Departments and acts as a lever for the general evolutionary processes of the Structure, the Systems themselves and the processes adopted.

CVs of involved key researchers/staff members

Riccardo Fragomeni - graduated in Diagnostic Technical Sciences c / o University of Rome - La Sapienza. Director of Innovation & Development - JEWISH HOSPITAL - I manage the Information Systems, the Special Projects Office and the Health Technology Assessment Office on the staff of the General Management. I coordinate the management of the IT infrastructure of the PdL and the computerization of all clinical and administrative processes of the hospital. From 2015 to 2017 I was Director of the IT Department of the SG Calibita Hospital, Fatebenefratelli. I directed all the clinical and administrative processes of the hospital under the responsibility of IT. Coordinated the operational management of the SIAS, SIES, SIO flows of the Structure and developed in close relationship with the Departments, the projects for the evolution and renewal of software applications Until 1995 Owner of several research contracts CNR, National Research Council - software development "processing and representation of experimental clinical data from Computer Aid Radiotherapy Oncology - Treatment Planning System". Until 2000 I was a Research Consultant at the Laboratory of Medical Physics and Expert Systems (neuronal networks & fuzzy logic) Regina Elena Hospital of the Experimental Research Center, IFO. Participated in scientific publications in the field of software systems to support Radiotherapy Oncology and in various congresses in the field of Telemedicine & eHealth IT solution.

Giulio Tedesco - graduated in Pharmacy and Pharmaceutical Technologies and specialized in Hospital Pharmacy at the "La Sapienza" University of Rome. He holds a second level Master in clinical and health research projects and a specialization course in Clinical Bioethics at the "Cattolica del Sacro Cuore" University in Rome. Since 2008 he has worked in numerous different health facilities and hospitals, in the clinical and administrative fields, dealing with projects for the efficiency of internal processes, clinical research projects and health projects with national and international partnerships.

Alessandro Cataldo - graduated in 1996 in Medicine and Surgery at La Sapienza University of Rome, specialized in 2003 at the Catholic University in Hygiene and preventive medicine. Deputy Health Director, Hospital Risk Manager.

Stefano Anticoli - degree in Economics and Commerce, Deputy Administrative Director. I am responsible for coordinating the administrative activity of the Accounting Office and I am the Head of the Hospital Management Control Office

Role in the project

- **WP1:** ORI will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** ORI will contribute to the participatory process.
- **WP9:** ORI will lead the pilot demonstration as outlined below.
- **WP10:** ORI will disseminate and exploit the project results through established international links.

Relevant publications, and/or products, services or other achievements

- **POST-ONCOLOGICAL HUMERAL RECONSTRUCTIONS AFTER ALLOGRAFT FAILURE**

*Lucian Lior Marcovici, Carmine Zoccali, Iakov Molayem, Roberto Biagini, Alessia Pagnotta
UOC di Geriatria - Ospedale Israelitico – Roma, SICM Società Italiana Chirurgia della Mano 2019, Firenze*

- **Modern Approach to the treatment of dry eye, a complex multifactorial disease: a PICASSO board review.**

P. Aragona, G. Giannaccare, R. Mencucci, P. Rubino, E. Cantera, M. Ronaldo - Br J Ophthalmol 2020

- **Histomorphometric Analysis of Newly Bone formation after Maxillary Sinus**

Augmentation with two different osteoconductive materials: a randomized, parallel, single-blind, clinical trials.

Grasso Giuseppe**, Mummolo Stefano*, D'Ambrosio Giuseppe**, Iezzi Giovanna***, Bernardi Sara*, Macchiarelli Guido*, Marchetti Enrico. *Department of Life, Health and Environmental Sciences, University of L'Aquila, L'Aquila, Italy. **Dentistry Service, Jewish Hospital, Roma, Italy. *** Department of Medical, Oral and Biotechnological Sciences, University of Chieti Pescara, Italy. MDPI, Journal 2020

- **Clinical Frailty Scale as predictor of in hospital mortality in a Geriatric Ward**

S. Ronzoni, C. Scalise, M. Costarella, F.F. Rossi; J.M. Escudero Ortega; M. Bongiovanni UOC di UOC di Geriatria - Ospedale Israelitico – Roma

- **Approach in aromatase inhibitors - induced osteoporosis: results from an Italian multicenter observational study**

Silvia Migliaccio¹ Alessandro de Sire² Chiara Marocco³ Rachele Fornari³ Marco Paoletta² Emanuela A. Greco³ Inbal Dona Amar⁴ Antimo Moretti² Stefano Ronzoni⁵ Francesca Gimigliano⁶ Vincenzo Vinicola⁷ Fiorella Chiacchiararelli⁸ Francesco Guadalascara⁹ Renato Pastore¹⁰ Paolo Falaschi¹¹ Giovanni Minisola¹² Orazio Falla¹³ Domenico Castellitto¹⁴ Andrea Lenzi³ Paola Villa⁴ Giovanni Iolascon²

1 Department of Movement, Human and Health Science, Section of Health Sciences, University "Foro Italico", Rome, Italy 2 Department of Medical and Surgical Specialties and Dentistry, University of Campania "Luigi Vanvitelli", Naples, Italy 3 Department of Experimental Medicine, Section of Medical Pathophysiology, Endocrinology and Nutrition, University "Sapienza", Rome, Italy 4 Department of Obstetrics & Gynecology, Catholic University of Sacred Heart, Rome, Italy 5 Unit of Geriatry, "Israelitico" Hospital, Rome, Italy 6 Department of Mental and Physical Health, University of Campania "Luigi Vanvitelli", Naples, Italy 7 Unit of Medicine, Osteoporosis Clinic, Fondazione Santa Lucia, Rome, Italy 8 "Ospedale Civile di Anzio, Ambulatorio di Osteoporosi", Anzio (Rome), Italy 9 Orthopaedics Unit, San Paolo Hospital, Naples, Italy 10 Unit of Endocrinology, "Fatebenefratelli" Hospital, Isola Tiberina, Rome, Italy 11 "Azienda Ospedaliera Sant'Andrea", University Sapienza, Rome, Italy 12 "S. Camillo" Hospital, Rheumatologic Unit, Rome, Italy 13 Endocrinology and Osteoporosis Unit, Hospital of Palestrina, Rome, Italy 14 Bone Metabolism and Osteoporosis Unit, Hospital of Sora, Frosinone, Italy

Clinical Cases in Mineral and Bone Metabolism 2018; 15(3):334-339 – CCMBM 3 2018-1b XP-2018.qxp - 28/11/18 19:13 Pagina 334

Individual exploitation

Through its contribution as end-user to the project, in addition to scientific publications on the subject, the Hospital will acquire new systems and methods for managing safety in the event of unforeseeable disastrous adverse events. In particular, thanks to the "on site" verification of the IT solutions developed by the project and the use of robots, APPs and Digital Platforms available for patients, it will be able to increase the experience in the field, positioning itself as a reference center for the production of tested models of interception of missing patients in a closed environment, digital platforms and recovery paths validated in an 'indoor' hospital environment, for the management and governance of the Emergency.

4.1.42 Perifereia Stereas Elladas (Region of Central Greece)

Partner Name: Perifereia Stereas Elladas (Region of Central Greece)	
Company website: https://www.pste.gov.gr	
Type: End-user	

Partner profile

The Region of Central Greece (PSTE) is one of the 13 administrative regions of Greece, it occupies the eastern half of the traditional region of [Central Greece](#), including the islands of Euboea and Skyros, its capital city is Lamia and to the south it borders the region of Attica. Central Greece is the most populous geographical region of Greece, with

a population of 4,591,568 people, and covers an area of 24,818.3 km² (9,582.4 sq mi), making it the second largest of the country. Its climate is temperate along its coastlines, and dry in the interior. The region is one of the most mountainous in Greece, having some of the highest elevations in the country. The GDP was 8.8 billion € in 2018, accounting for 4.7% of the Greek economic output. GDP per capita adjusted for purchasing power was 18,900 € or 63% of the EU27 average in the same year. The GDP per employee was 81% of the EU average. Central Greece is the region in Greece with the fourth highest GDP per capita. The PSTE implements the strategy "Smart Region", supported by the services of regional government, initiatives and citizens. The aim of the strategy is to introduce innovative ideas and practices in governance, transparency, economy, social solidarity, environment, culture and to give citizens a platform for participation. The Region of Central Greece has also appointed an Authorized Regional Advisor for Innovation, New Technologies and Digital Governance and a Deputy Governor for Agriculture & Rural Development. Finally, the PSTE has been a participant to a number of EU funded program in its effort to make rural life attractive to young people as permanent residents while it is worth noting the creation of the Agrofood S.A. - a regional farmer's hub for the substantial strengthening of the local produce- and the establishment of the Business Support Center (KYE) of PSTE, which functions as liaison and coordination support body for every entrepreneur of Central Greece (small, large, candidate).

CVs of involved key researchers / staff members

Mr Konstantinos Meletis (male) (born 31/07/1968) is the Head of the General Directorate for Development Planning, Environment & Infrastructure, retains a deep experience in interventions environment protection and legislation compliance control, the design and enforcement of environment protection measures and the overall coordination of the spatial distribution regarding interventions and projects within the geographical boundaries of the Region. Regarding his education, Mr. Meletis holds a degree of Chemical Engineer specializing in Industrial Facilities from the Technical University of Athens. Also, he has made further studies on the following topics:

- “Planning and Implementation of Civil Protection Actions at Local Level”, Certified Postgraduate Training Program, Hellenic Institute for Training of Public Administration Executives MSc
- “Athens MBA, specializing in Finance”, Athens University of Economics
- “Food Chemistry and Microbiology specializing in Food Microorganisms”, National & Kapodistrian State University of Athens MSc
- “Environmental Design of Infrastructure Projects”, Hellenic Open University MSc

Regarding his experience on national and EU projects, he is a(n):

- Member of the Drafting Team of Large-Scale Technological Accident Response Plans of the General Secretariat for Civil Protection of the Greek Government
- Accredited Security Technician for Civil Protection of PSTE
- Project Manager of all the European Programs PSTE is Partner / Lead Partner

Mr. Meletis speaks Greek as mother tongue, and English fluently while he is a certified expert in IT (ECDL).

Ms. Roula Kechri (female) (born 21/8/1967) is Advisor to the Regional Governor on European Programs and International Relations.

She has a wide educational background, after university she has done further studies in education, political science and business administration as well as has received two scholarships for further training in the US and Germany from the State Dept and the German Ministry of Press & Defense. She was also selected to attend a special six-month course on “Political Crisis Management” organized by the Political Academy “K. Karamanlis Institute of Democracy” in cooperation with the Konrad Adenauer Stiftung, .

In addition, she has participated in a large number of conferences, seminars and workshops as a co-organizer or guest speaker in Greece and abroad; she has also made researches and publications on IT in education as well as on digital tools and evaluation. She speaks Greek as a mother tongue, English fluently and good German and Italian; she has a state certificate in IT.

Regarding her work experience, Ms. Kechri has worked at UNICEF, Mercedes-Benz, as an executive at the Ministry of Education of Greece and as an adult trainer in various subjects while she has also served as President at the Port Fund of Kymi and at the Public Central Library of Evia.

It should be mentioned that Ms. Kechri has extensive experience in managing international and European programs as a project manager but also in crisis management as an executive of public bodies.

Role in the project

PSTE will be acting as the main stakeholder in the Greek case study. Throughout the project, PSTE will provide its operational capacity and administrative power for the identification of current and forthcoming pressures and challenges for the relevant territory, the definition of all sectors and policies relevant to the territory, the documentation of key biophysical, social and economic features of these policies and finally their integration and interconnection into a cohesive and cross-sectoral intervention strategy. Moreover, the Region will mobilize its vast networking capabilities to engage local communities, support horizontally the case study and provide the connecting nodes for all stakeholders of the value chain to provide their contribution. In this context, PSTE will concentrate its contribution in WP9 - Large-scale demonstration activities of project outcomes, organizing a pilot case study in each region. Moreover, PSTE will also contribute into the participatory process and assessment framework specification in WP2, in the citizen engagement methodology for preventing wildfires in WP3, in the contribution to EU legal framework for climate-related risks in WP6, as well as in the policy recommendations produced in WP7. Last but not least, PSTE will perform extensive communication and dissemination activities for reaching out to the general public, local authorities and other policy makers.

Relevant publications, and/or products, services or other achievements

- General Secretary of Agricultural Policy and Management of European Funds, Ministry of Rural Development and Food (2017), Rural Development Program 2014-2020.
- Region of Sterea Ellada (2016), Strategic environmental assessment (SEA) of the regional waste management plan of Sterea Ellada.
- O.P Special Management Agency of the Region of Sterea Ellada (2015), Research and Innovation Strategy for Smart Specialisation of the Region of Sterea Ellada.
- O.P Special Management Agency of the Region of Sterea Ellada (2014), Ex-ante evaluation and strategic environmental assessment of the Regional Operational Programme of Sterea Ellada 2014-2020.
- Region of Sterea Ellada (2014), Regional Operational Programme of Sterea Ellada 2014-2020 under the “Investment for Growth and Jobs” goal.

List of relevant previous projects or activities, connected to the subject of this proposal

- **OPERNADUM** (OPEn-air laboRAtories for Nature baseD solUtions to Manage environmental risks), Horizon 2020 SC5-08-2017, Parnter. OPERANDUM intends to provide science-based evidence for the usability of Nature Based Solutions locally and at wider scale, and to propose best practices for their design, upscaling and replication in Europe and other territories; identify strategic path-ways for their acceptance and promotion in a multi-stakeholdership environment. The general objective of OPERANDUM is to develop a set of co-designed, co-developed, deployed, tested and demonstrated innovative green and blue/grey/hybrid NBS for the mitigation of the impact of extreme events, promoting their acceptance and facilitating the adoption of new policies for the reduction of hydro-meteorological risks in European rural and natural territories.
- **FEMINA** (Female participation in high-tech enterprises), INTERREG EUROPE, 2018-2023 - Partner. The gender gap is still visible in high-tech sectors across EU-28: women represented 29% of entrepreneurs in 2014 and 32.5% of employees in high-tech manufacturing and knowledge-intensive services in 2015. This is not a question of social inclusion. It is about economic growth: studies show that the women's specific skills can help to diversify and consolidate enterprises; that closing the gender gap could generate an EU GDP increase of 13%. In this context, FEMINA partners cooperate at interregional level to reach their overall aim: to ensure that selected policy instruments are integrated with measures to promote female engagement in their high-tech sectors, with a focus on sectors in their RIS3.
- **RCIA** (Regional Creative Industries Alliance), INTERREG EUROPE, 2016-2021 - Partner. Through inter-regional policy learning, RCIA aims to improve the Structural Funds policy instruments related to the SME competitiveness by focusing on supporting creative SMEs to set impulses for higher growth, by positioning CCI as “the missing link” throughout sectors and disciplines in regard to innovation and competitiveness, by increasing the attractiveness and innovative image of a city/region/country (attract talent, create & retain jobs in the territory) and by positioning CCI as a pillar of the competitiveness policy.
- **CHIMERA**, INTERREG MED, 2016-2018 - Partner. Cultural and creative industries (CCIs) represent highly innovative SMEs. For participating regions CCIs is a strategic sector of development as underlined in their RIS3s, but this potential is hampered by a gap of information on CCI local environment, innovation and

market barriers and a lack of tailored support to stimulate innovation, internationalization and cross fertilization. ChIMERA main objective is to improve innovation capacities of CCI public and private actors through strengthened cooperation among companies, research bodies, public authorities and civil society.

- **ForOpenForests**, LIFE11 2007-2013, 2012-2017 – Partner. The main objective of the project is to implement management in forests and forest openings for the conservation of biodiversity at species, habitat, and landscape level. Project area: Two mountainous Natura 2000 sites of Central Greece, in the Region of Sterea Ellada: "ETHNIKOS DRYMOS OITIS" (GR2440004) and "OROS KALLIDROMO" (GR2440006).

Individual exploitation plan

After proving the value and effectiveness of the proposed platform and services at local level, PSTE will seek to deploy them in additional geographic areas within its region. Moreover, through its Business Support Center (KYE), PSTE will provide support to entrepreneurs of Central Greece for contributing into the ecosystem of the project with more added-value products and services. Also, PSTE will exploit the policy recommendations reached through the project to enhance its environmental resilience strategy. Finally, PSTE will exploit the lessons learned in the pilots of the project for its future procurement actions and calls for tenders when it comes to forest management and environmental resilience.

Communication strategy for promoting project outcomes

PSTE will host publicity and dissemination events, steering meetings, workshops and conferences for the project. PSTE will also engage with the local press through press releases and conferences. As a public authority, it will also engage with the public in Central Greece through its web site and social media. Finally, it will also connect to other regions in Greece and abroad, as well as with other peers (policy makers) at local level (e.g., municipalities).

Description of significant infrastructure and major items of technical equipment relevant to the project

PSTE owns the necessary human, hardware and software resources to conduct research, development and innovation projects (such as tablets and smartphones available for testing applications into different devices, workstations, dedicated Servers allowing for the quick and reliable testing of the prototypes developed in the context of the project). Moreover, PSTE owns or has direct access to meeting venues and conference rooms to host publicity and dissemination events, steering meetings, workshops and conferences.

Pilot description

STUDY AREA

In this pilot, a regional unit of the prefecture of Sterea Ellada (Central Greece, partner: PSTE) will serve as a study area (Figure 20). In particular, the regional units of Evia and Fthiotida have been selected as suitable candidates, and one of the two regional units will be chosen in the implementation phase of the research project, depending on the level of detail of available data. The exact forest areas will be selected on the basis of their ecological value and fire risk. In the following, a description of the two alternative regional units is given.

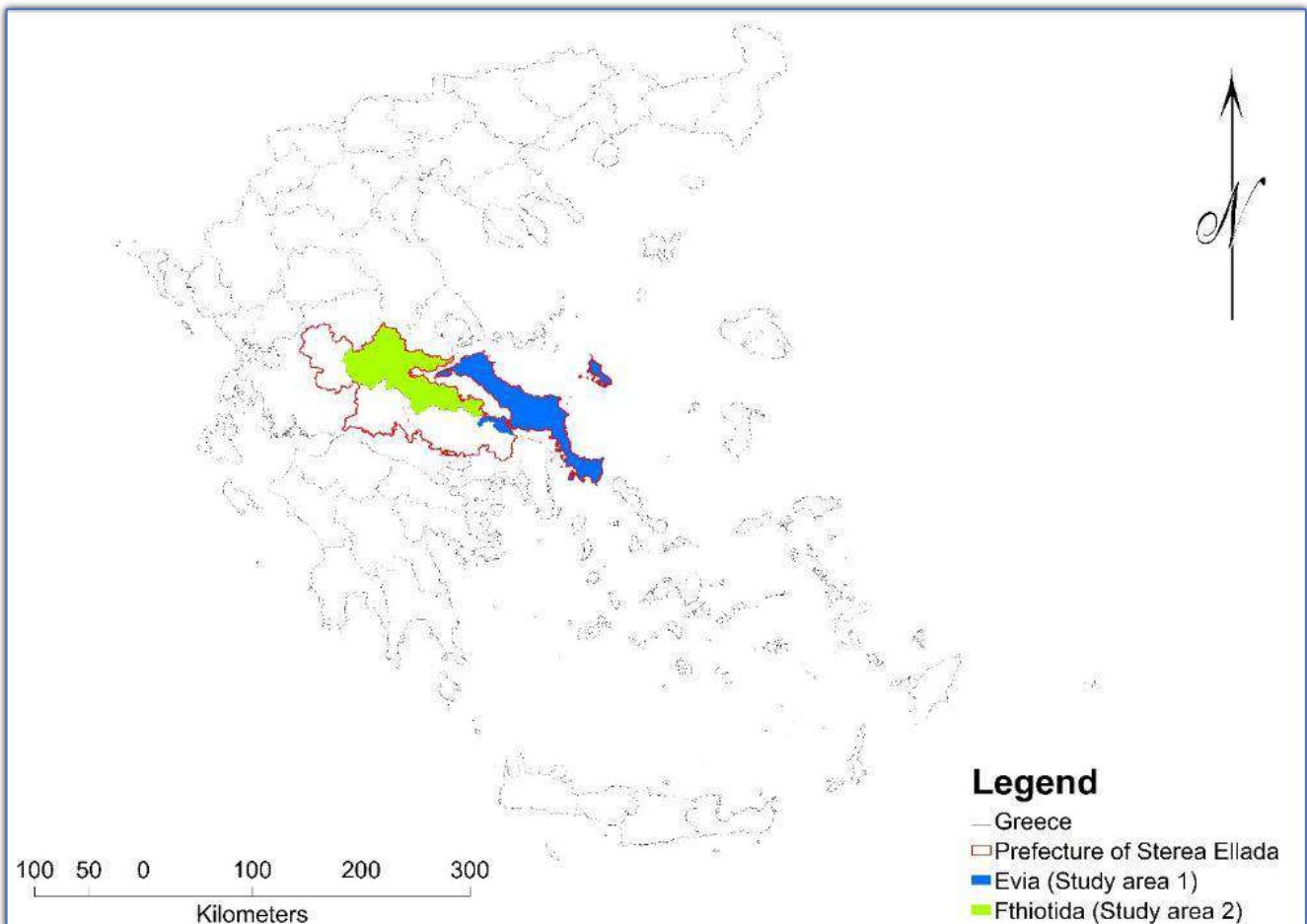


Figure 20. Map of alternative focus areas.

1. REGIONAL UNIT OF EVIA.

Evia is located in the eastern part of the geographical district of Sterea Ellada with longitude from 22 to 54° 34" (northern part) to 24 33' (the southern part) and with latitude from 38 to 49° 33" the northernmost end to the southernmost at 37 o 59' (Figure 1). Evia is the second largest island in Greece and its total area is 4,167 km². About 2,500 km² of Evia is covered by forests, while the rest of the island consists of agricultural land, residential areas and barren rocky areas of high mountains.

1.1. Geology

Evia belongs to the Pelagonian zone of non-metamorphic formations (Central and North Evia) and to the Atticocycladic zone (South Evia). Central and northern Evia consists of neo-Paleozoic, semi-metamorphic formations, igneous rocks, limestones and clastic formations of the lower - middle Triassic and non-metamorphic carbonate formations. Large masses of ophiolite rocks are deposited in the above formations. Limestones and Paleocene flysch are also found. Southern Evia consists of a base unit consisting of nerite Upper Cretaceous limestones and flysch (Paleogene), the unit of Chora consisting of multi-metamorphic rocks, such as gneiss and granitoid, the unit of glauconitic shists and ophiolithic formations.

1.2 Vegetation

The most significant forest species that make up the forests of Evia are Aleppo pine (*Pinus halepensis*), Firs (*Abies sp.*), Black pine (*Pinus Nigra*) and from the broadleaf, Chestnut (*Castanea sativa*), Oak (*Quercus sp*) and, sporadically, in small areas, other species, such as *Platanus orientalis* and *Accer sp*.

In more detail:

Pinus halepensis occupies a significant area, especially in the northern part of the Evia and forms pure clusters up to 500 m by altitude.

Abies sp. occupies areas above 500 m in altitude and is found either pure or mixed by person, groups and lochs with black Pine (*Pinus nigra*).

Pinus nigra occupies a small area, shows good growth and where there is a mix with Fir form dense clusters.

Platanus sp. develops on the banks of rivers and in the large streams that exist in the study area.

Pinus pinea is found sporadically in the low zone of the forest per tree and groups of trees.

The broadleaf leaves bushes form a particularly dense understory under *Pinus halepensis* forests where offer additional protection from soil erosion and provides shelter to the wild fauna.

In addition to the main forest species mentioned above, many secondary species are found, the most important of which are: *Arbutus Unedo*, *Arbutus Adrachnae*, *Erica Arborea*, *Erica Verticalata*, *Myrtus Communis*, *Quercus Coccifera*, *Spartium Junceum*, *Dactylis glomerata*, *Nerium Oleander*, *Paliurus Australis*, *Festuca sp.*, *Bromus Molis*, *Lolium Perene*, *Juniperus communis*, *Juniperus oxycedrus*.

1.3. Fauna

The birds that live in the wider area are the rock partridge (*Alectoris Graeca*), the blackbird and passing bird species, such as woodcock (*Scolopax rusticola*). Mammals, such as *Martes fiona*, *Meles meles*, *Lepus europaeus* and *Mus-mella nivallis* and arthropods, such as, ants are found in competent populations.

1.4 Climate

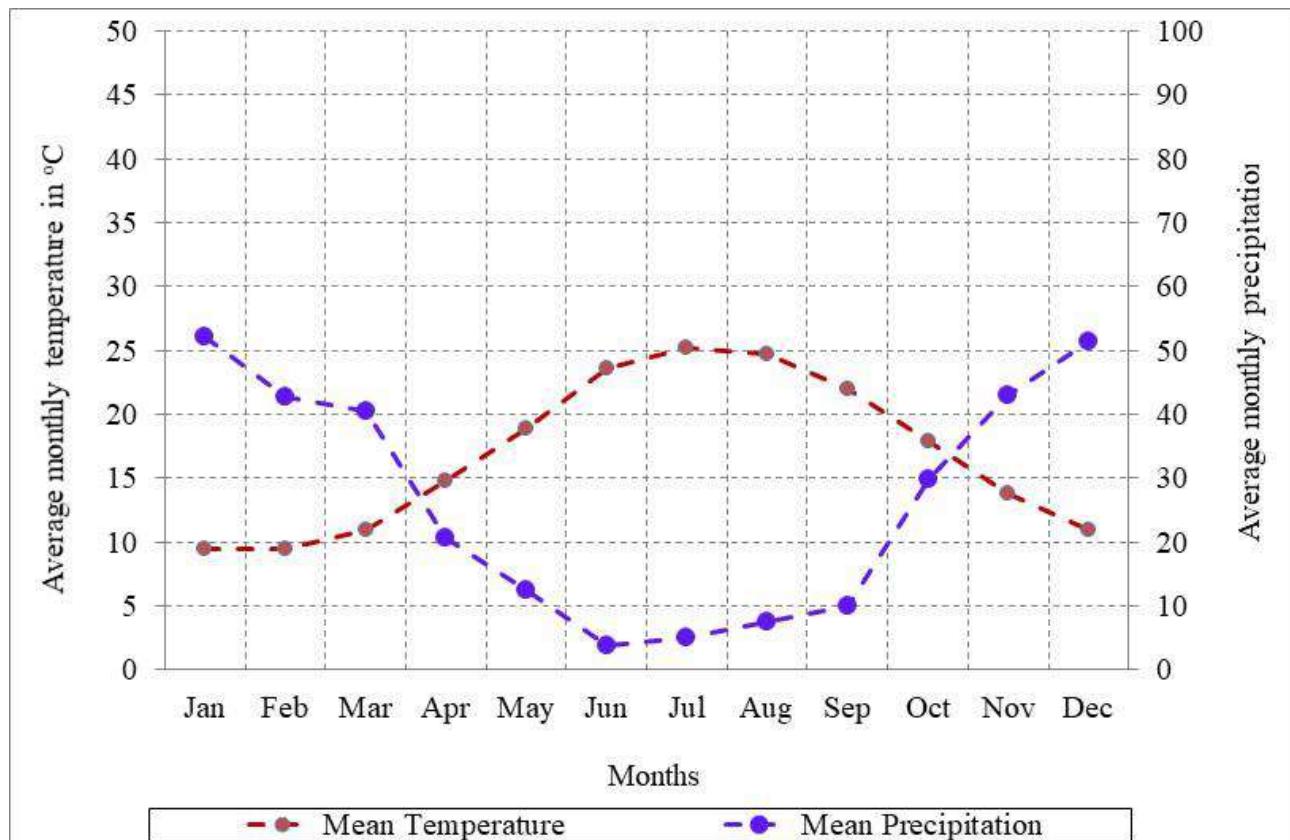


Figure 21. Ombothermic graph (Emberger) of Evia study area.

Evia has a wide climate variety which is due in particular to its geographical location and the diversity of its terrain. The climate of the area under consideration is Mediterranean type and its bioclimatic type is medium-Mediterranean. During the winter there are the most of the rains, while in the summer months there is drought with high temperatures (Figure 21). Winters are mild and the average minimum temperature of the coldest month is from 3°C to 7°C. The prevailing climate conditions, in the wider area, can be described as very favorable for the existing forest vegetation in the area with several rains falling mainly during most of the germination period.

1.5 History of forest fires in Evia

From a phytoecological point of view, the structures and combinations that make up the forest vegetation of the Evia are of great flexibility except for the oak and fir forests. The oak and fir forests, because of their small extent, have a minimal effect on the general fire behavior of the area. As a result, the region is one of the most fire damaged in Greece. Frequent fires are the most serious risk of degradation of the forests. According to statistics from a period of nine years, 322 fires occurred annually in Evia, destroying about 1% of the total area of the regional unit that is about the triple of country's average.

2. REGIONAL UNIT OF FTHIOTIDA

The regional unit of Fthiotida (Figure 20) belongs, geographically and administratively, to the prefecture of Sterea Ellada. Fthiotida consists partly of a productive plain and the mountainous part covered, primarily, by fir forests and oak forests.

2.1. Vegetation

In terms of vegetation, Fthiotida is dominated by forests of fir (*Abies cephalonica*), as well as by other important vegetation species, such as deciduous oak forests, high-altitude meadows and riverside vegetation, occupying small, concurring to fir, areas. In addition, *Pinus nigra* is found in the mountains of the study area, to a relatively small extent.

The forests of fir grow from the altitude of 600 m up to about 1800 m. A relatively small, but not insignificant, area is occupied by forests of deciduous oak (*Quercus sp.*), as well as mixed oak and fir forests in the southern and western parts of the mountains volume.

Thermophilic broadleaf species, such as *Quercus ilex*, *Arbutus sp.*, *Pistacia lentiscus*, are found mainly at low altitudes of the mountains and the *Quercus coccifera*, which has a wider elevation spread.

A relatively large proportion of mountain areas are covered by meadows of the highest altitudes (subalpine). These meadows as well as the rocky slopes are considered the richest areas in chlorophyll diversity and are home to the rarest and most interesting plant species.

The riparian vegetation follows the streams and rivers and consists, mainly, of *Platanus orientalis*, *Salix spp.* and *Alnus glutinosa*.

2.2. Fauna

The species that make up the fauna of the region are mostly related to the extensive forests of fir. These forests are home to a variety of mammals and birds, many of which are rather common and widespread species in the Greek mountains such as deer, wild boar, wildcat, fox and hare. Other habitats of more limited extent, such as, steep cliffs, meadows and water formations, host a variety of species of great interest, of mammals, birds, amphibians, fish, but also invertebrates.

The region of Fthiotida is a refuge for several rare and/or endangered species, according to the Red Book of Endangered Animals of Greece.

Another mammal found is *Canis lupus*. The re-emergence of lupus is initially related to the improvement of the legal protection status of the species, since 1981 its bounty as a harmful species has ceased, whereas since 1992 it has now been included in the species of Directive 92/43/EE.

The presence of the brown bear (*Ursus arctos*) in Fthiotida, which is considered an endangered species in Greece, is also particularly important, as it is the south-easternmost distribution end of the species in Greece, but also in Europe. As far as birdlife is concerned, this is typical of mountain ecosystems and includes mostly forest species and nesting species of subalpine meadows. Typical is the presence of many, such as, *Picus canus*, *Dendrocopos eucotos*, *Dryocopus martius* and *Dendrocopos syriacus*. The *Alectoris graeca*, is an endemic species of Europe, included in the "Vulnerable" species in the Red Book of Greece, lives at high altitudes and on steep rocky slopes with sparse bushy vegetation. Its main threat is hunting because, although endangered, it is a predatory species. There are also many species of birds that live in the mountain meadows, such as, *Emberiza hortulana*, *Eremophila alpestris*, *Alauda arvensis* and *Anthus campestris*. Between the nocturnal predators, particularly important is the presence of *Aegolius funereus*, a small, forest bird, which has been spotted in very few areas throughout Greece. Moreover, the nesting record of *alpic* at the foot of mount Oiti, is remarkable, as this species is considered a rare and local visitor to Greece and to date has been recorded nesting mainly in Northern Greece up to Thessaly.

2.3. Climate

In Fthiotida, there are two main meteorological stations located at low altitudes near Lamia and Lidoriki cities. There are also two rainfall measuring stations in the villages of Athanasios Diakos and Pyra. The above main stations cannot provide representative data for the high-altitude areas. Annual precipitations data of 627.6 mm and 850.10 mm of the Lamia and Lidoriki stations, respectively, differ greatly from that of the station of Athanasios Diakos with 1579.30 mm and from the station of Pyra 1273.50 mm, annual precipitation respectively, since they are located at higher altitudes, approx. 1100 m (Figure 22).

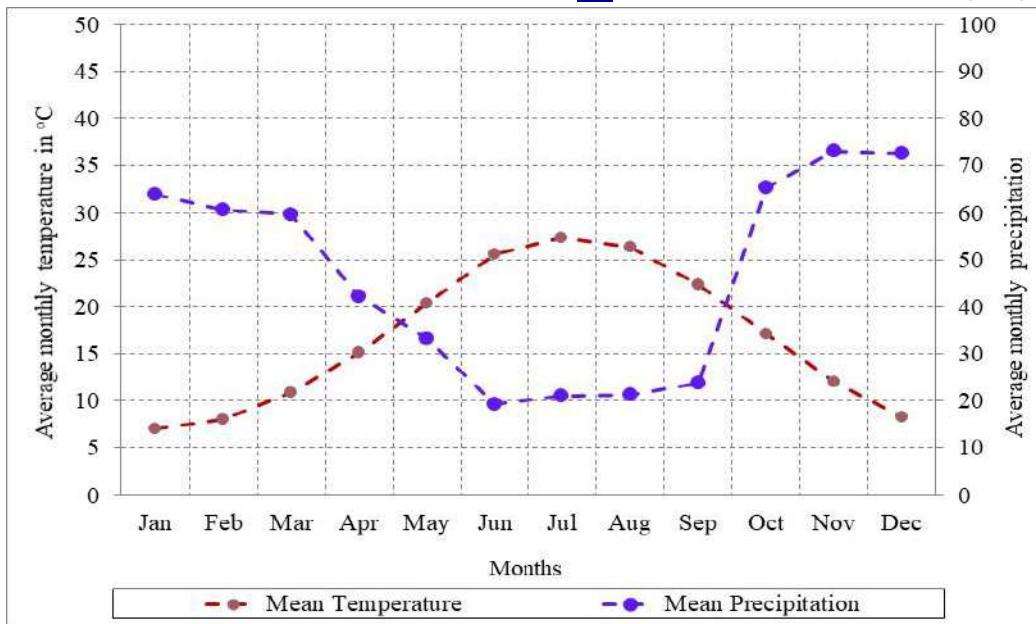


Figure 22. Ombothermic graph of Fthiotida study area.

2.4. Geology

Fthiotida belongs to the Sub-pelagonic zone, the zone of Pindos and the zone Parnassos - Gionas. In the sub-pelagonic zone (northeastern and southeastern part), the presence of flint formation is important, on which ophiolite masses as well as pelagic or neritic limestones are deposited. Lateral iron-nickel deposits as well as bauxite horizons also appear. In the zone of Pindos (in the western part), the limestones and the flysch of Pindos are found, while in the zone of Parnassos - Gionas (southern, southeastern part) dolomites, limestones and flysch exist. Important is the presence in the catchment area of Sperchios of the newer deposits (postalpine sediments), such as conglomerates, lake deposits, debris, alluvial formations, etc.

2.5. Special protection areas

In the mountainous Fthiotida, there is the Oiti's national park which is a protected natural area. The area was declared protected in 1966, in accordance with the provisions of Law 856/1937 "on National Parks", with the aim of preserving and protecting the rich fauna and flora, as well as the particular geomorphological characteristics of the mountain.

According to the existing institutional framework of the National Parks, the core is in full protection to keep the flora and fauna of the area intact. Consequently, within the core a number of activities are prohibited, such as, excavations, installation of advertising signs, industrial activities, the construction of buildings, agricultural and forestry exploitation, grazing, hunting, as well as the operation of mines and quarries.

2.6. Natura 2000

The Natura 2000 Network is a European Network of Protected Areas, which host natural habitat types and species (plants and animals) that are important at European level. In Fthiotida, there are a total of four areas of the Natura Network, namely:

- A Special Protection Zone for the Conservation of Wild Bird life, under Directive 2009/147/EC (formerly Directive 79/409/EEC).
- The "Oiti National Park - Asopos Valley" (GR2440007).

Two Special Conservation Areas for the Conservation of Natural Habitats and Wild Fauna and Flora, pursuant to Directive 92/43/EEC:

- The "Oiti National Park" (GR2440004).
- The "Gorgopotamos Gorge" (GR2440003).

1.5 History of forest fires in Fthiotida

From the phytoecological point of view, the structures of vegetation that make up the forest vegetation of Fthiotida are less flammable than that of Evia's ecosystems, because the main vegetation species are oak and fir. According to statistics, over a period of nine years, 263 fires occur annually in Fthiotida, destroying about 0.6% of the total area of the regional unit, which corresponds to the double of the average of the whole county.

4.1.43 FIRE RESCUE BRIGADE OF MORAVIAN SILESIAN REGION

Partner Name: Fire Rescue Brigade of Moravian-Silesian Region (Hasičský záchranný sbor Moravskoslezského kraje)	
Company website: www.hzsmsk.cz	
Type: End-user	

Partner profile

FRB-MSR acts as regional fire prevention authority and regional crisis management and civil protection authority. It is based on a professional basis and belongs to public emergency services.

The FRB-MSR:

- Provides services for all kinds of emergencies, with the exception of Emergency Medical Services and Security Emergencies. The main fields of intervention are: traffic accidents, various kinds of technical accidents, search and rescue, dangerous materials leaks, CBRN (chemical, biological, radiological and nuclear) danger, water rescue, rescue from heights and depths. Other field of activity is fire prevention and education.
- Coordinates emergency response of all emergency services involved in Integrated Rescue System.
- Operates regional Public Safety Answering Point for handling of 112 emergency calls.
- Is an indispensable part of the crisis management, the public warning and the civil protection system in the Czech Republic and acts as regional authority at the field of crisis management.
- Operates public warning system, coordinates local authorities in the field of crisis management and civil protection.
- Is in charge of elaborating Crisis Plan and Emergency Plans.
- At the field of fire prevention the FRB-MSR acts like is regional authority at state fire supervision, executes fire-prevention inspections, assesses and verifies building documentation and carries out fire investigation.

CVs of involved key researchers / staff members

Vladimír Vlček (M) achieved his Ph.D. at the Technical University of Ostrava in 2006. He is Chief Fire Officer of FRS-CR, the national organisation of FRB-MSR, since December 2016. Before that, he was Deputy Chief Fire Officer, in full-time at the Fire Service from 1984. His main activities are referred to the fields of the Operational Management of Fire Service and the Integrated Rescue system and Crisis Management. Among his previous work experience, he has been a Special Expert of the Ministry of Interior. He has been trained by EU Civil Protection Mechanism (Seminar for Mechanism Experts, High Level Coordination Course, Operation Management Course, Assessment Mission Course). He is leader of WASAR (Water Search and Rescue), USAR (Urban Search and Rescue) and HCP (High Capacity Pumping) teams. Vladimír has also taken part in several missions with UN-DAC (The United Nations Disaster Assessment and Coordination) team and EU Civil Protection Team. Currently, he is the President of the Czech Association of Fire Officers (CAFO, <http://www.cahd.cz/>) and the Representative of CAFO in FEU (Federation of the European Union Fire Officer Associations).

Marek Gašparín (M) achieved his Ph.D. at the Technical University of Ostrava in 2016. In full-time at the Fire Service since 2001, Marek is working at the department of Integrated Rescue System and his main activities are focused on Operational Management, Foreign Cooperation and European Funds Projects. Previously, he has gained experience in the following operational fields: Public Safety Answering Point, Command and Control Room, Crisis Management, Integrated Rescue System, Fire Prevention, Information Systems. He is a member of the Czech Association of Fire Officers (CAFO, <http://www.cahd.cz/>).

Role in the project

FRB-MSR will act from the position of End User / Emergency Response Organization / First Responder. Fighting with forest fires is one of the core activities of FRB-MSR and for that task it disposes well trained and educated personnel, proper appliances and facilities.

Relevant publications, and/or products, services or other achievements

CHEMON (<http://chemon.hzsmsk.cz/>) – Realizing and operating system of chemical monitoring in areas endangered by chemical materials leak with possible affecting of heavy populated areas.

Emergency Cards – Development of Emergency Cards and participation at preparedness of national methodology for creation of Emergency Cards (operational manual for emergency services and authorities in case of emergency related with dangerous materials leak).

Risk Assessment – Participation at national project focused on assessment of threads in the Czech Republic. The assessment was realized on national, regional and district level and outputs are being used at emergency planning and crisis planning nowadays.

“Risk Mapping” (2010) (<http://www.spbi.cz/eshop/shop.php?param1=RE-VUQUIMLDk3OC04MC03Mzg1LTA4Ni05>) – Publication describing risk mapping process methodology, which was developed by FRB-MSR, ISBN 978-80-7385-086-9, 126 pages.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
IPA II	first responder / end user	improve preparedness, capacity building and internal cooperation Balkan countries to treat forest fires and flood emergencies.
EASeR	first responder / end user	project targeted at search and rescue assessment called “barrier effect” during emergency interventions in response to various catastrophes
LOT5 – EU CPM Exercises	first responder	international training courses for WASAR, Forest Fires and CBRN modules
TOXI-triage	first responder / end user	research project for development of new technologies to treat serious emergencies
DIRECT	first responder / end user	the general objective of the project is to improve preparedness of civil protection systems through capacity building, raising awareness of population and international cooperation

Individual exploitation plan

Expected project outcomes will help to better understand the wild forest fires events and provide new ways and possibilities to treat this kind of emergencies at regional, national and international level. The project outcomes are expected to be integrated into FRB-MSR activities to enhance effectiveness of treating with wild fires at various levels of emergency management (tactical, operational and strategic level).

Communication strategy for promoting project outcomes

FRB-MSR is ready to prepare to promote the project and its outcomes by:

- holding the project workshops/conference/training with promotion of this activities through regional and national media,
- promoting the project and its outcomes at national level – national workshops and trainings of Fire Rescue Service of the Czech Republic, meetings of Czech Association of Fire Officers, regional workshops and trainings of emergency services of Integrated Rescue System.
- promoting the project and its outcomes at international level – regular meetings of F.E.U. (European Federation of National Fire Officer Associations), ongoing FRB-MSR’s participation at the project IPA II activities (see above the list of project activities)
- publishing of an article at national firefighting magazine “112”.

Description of significant infrastructure and major items of technical equipment relevant to the project

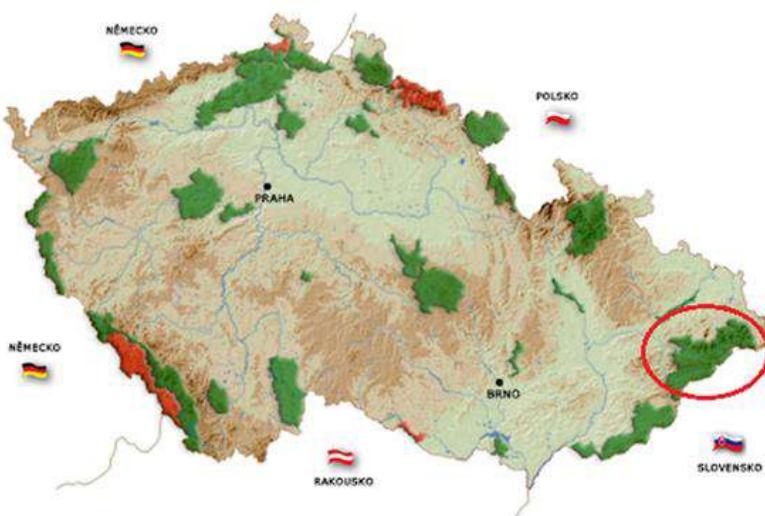
The FRB-MSR:

- Disposes of well trained personnel, appliances, facilities and is fully equipped to provide service in all scales of emergencies. FRB-MSR manages with 22 full time fire stations and operationally controls approximately 356 part-time and volunteer stations.
- Disposes of INSARAG (International Search and Rescue Advisory Group) and UCPM (EU Union Civil Protection Mechanism) certified WASAR (Water Search and Rescue) and USAR (Urban Search and Rescue) modules, which can attend national and international rescue humanitarian assistance.

- Operates a public warning system at the territory of Moravian-Silesian Region, operates and distributes the warnings and notifications for crisis authorities and local authorities of Moravian-Silesian Region.
- Is responsible for managing of the Integrated Security Centre of Moravian-Silesian Region, the facility which provides environment and infrastructure for operation of crisis authorities of Moravian-Silesian Region and Municipality of Ostrava and infrastructure and environment for regional emergency number call centres, including 112 emergency number public answering point.
- Is able and well experienced in carrying out:
 - Case Studies,
 - In-Field or Table-Top Exercises
 - Dissemination and Education workshop/meetings/trainings

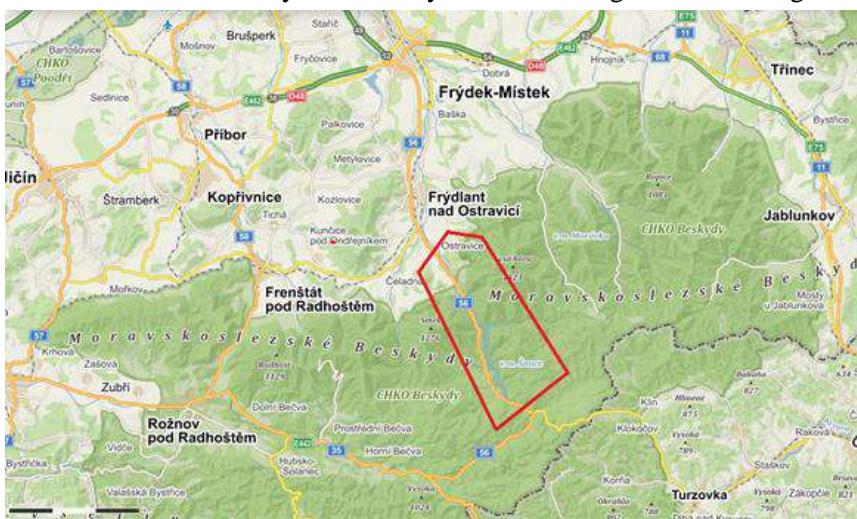
Pilot description

Pilot site description:



The pilot area will be set in the north-east part of the Czech Republic and east part of Moravian-Silesian Region, at the territory of Moravian-Silesian Beskydy Mountains. Beskydy mountains are the northern territory of Protected Landscape Area Beskydy (PLAB). East border of the PLAB is located at national border with Slovak Republic. The territory of PNRB belongs to most visited tourist resorts in the Czech Republic. The overall area of the Protected Landscape Area Beskydy is 1.160 km². with the highest mountain, Lysá Hora, with an altitude of 1.323 meters. Lowest areas of PNRB have got the altitude approximately 400 metres. The pilot area will be placed nearby the municipality Ostravice (GPS 49.5513297N, 18.3789831E), municipality Staré Hamry (49.4682900N 18.4321981E) and water dam Šance (GPS 49.5112764N, 18.4161478E).

18.3789831E), municipality Staré Hamry (49.4682900N 18.4321981E) and water dam Šance (GPS 49.5112764N, 18.4161478E). This territory is frequently affected by weather related emergencies (strong winds, floods, flash floods, landslides), thus there are installed systems for hydro-meteorological monitoring of the territory.



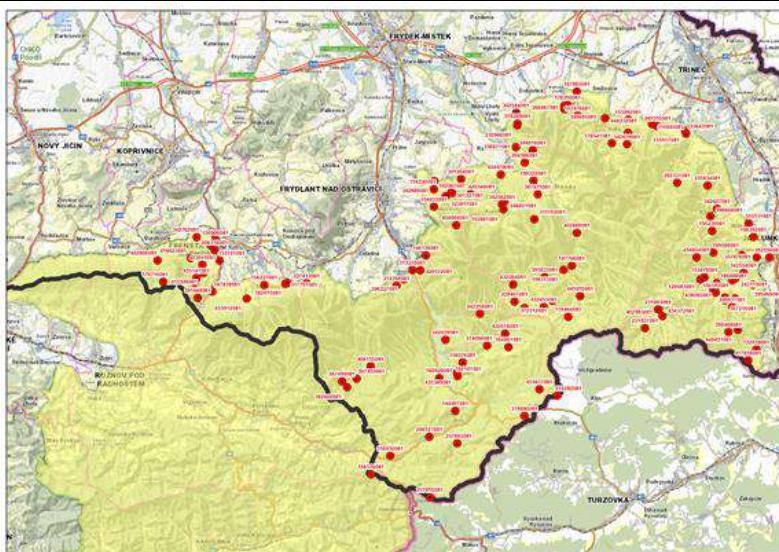
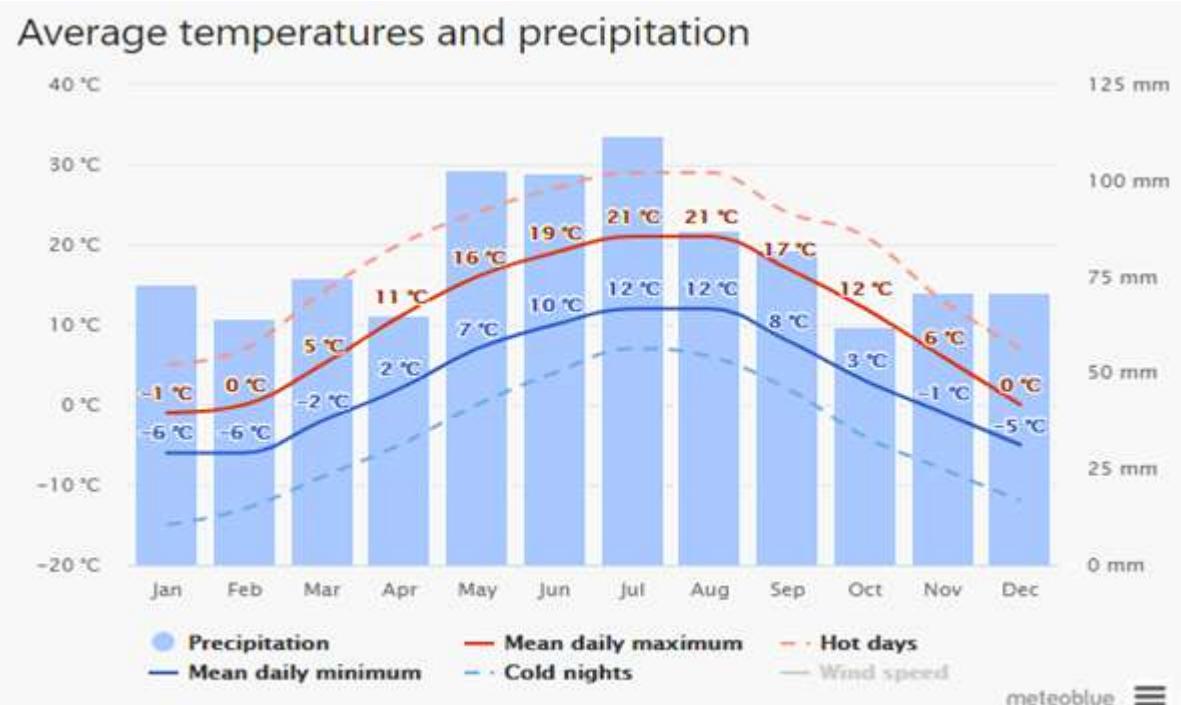
Ecological and biodiversity description:

Approximately 2/3 of the PLAB are covered by forests, and a significant part presents old growth deciduous and coniferous forests. The reason for declaring the Beskydy Protected Landscape Area was its exceptional natural values, especially the remnants of the original primeval forests with the occurrence of rare Carpathian animals and plants. The Beskydy Mountains are famous for their highland meadows and occurrence of rare Carpathians plants and animals. Also noteworthy are the species-diverse meadows and pastures, unique surface and underground

pseudo-karst phenomena. The Beskydy landscape still has an extraordinary aesthetic value, which was created by the historical coexistence of man with the mountains

Annual weather pattern:

The climate of the Beskydy Mountains is influenced by their location in the central part of Europe. The influences of the oceanic and continental climate meet here. The oceanic air masses bring weather with mild winters, colder summers, heavy clouds and heavy rainfall. Continental air is characterized by daily and annual temperature fluctuations, less precipitation and clouds. The fragmentation of the relief also has a great influence on the climate. As the altitude rises, the temperature and atmospheric pressure decrease and other climatic factors are also influenced. According to the climatic division of the Czech Republic, the Beskydy region belongs to the category of cold areas.



Historical report on Wildfires:

FRB MSR records overall 146 nature fires in Moravian-Silesian Beskydy Mountain from 2010. These fires caused the direct losses approximately 200K € and affected territory 326 hectares.

Available infrastructure [KPIs]:

Territory of Moravian-Silesian Beskyds Mountains (MSBM) belongs to 26 municipalities, which dispose its own Volunteer Fire Brigade. This fire brigades are situated directly at the territory of MSBM or close to its borders. The Volunteer Fire Brigades provides the basic resources for forest firefighting. Area of MSBM is also covered by four professional fire stations of FRB-MSR. FRB-MSR provides well-trained personnel, appliances, facilities and is fully equipped to provide service in all scales of emergencies. FRB-MSR manages with 22 full time fire

stations and operationally controls approximately 356 part-time and volunteer stations. Airborne firefighting vehicles (helicopters) to treat forest fires are at the disposal too.

Demonstration scenario:

- Emulation of accidental fires resulting from weather conditions
- Effectiveness in response coordination between regional command centre
- Total area of coverage

Phase A: Evaluation assessment

- Training activities to enhance preparedness

Phase B: Evaluation assessment

- Response coordination and evaluation of wireless communication infrastructure

Contribution to national priorities:

Include reference to national policies

4.1.44 Hrvatska vatrogasna zajednica

Partner Name: Hrvatska vatrogasna zajednica

Company website: <https://hvz.gov.hr>

Type: End-user



REPUBLIKA HRVATSKA

Hrvatska vatrogasna
zajednica

The Croatian Firefighting Association/Hrvatska vatrogasna zajednica (in the following text: CFA) is the responsible organization for fire-fighting in Croatia, in which are associated 97 professional fire-fighting units and 1.793 volunteer firefighting units with altogether about 60.500 firefighters, of which 3.500 are professional fire-fighters and 57.000 are volunteer fire-fighters, owning in total 4.174 specialized fire-fighting vehicles.

At this moment, the CFA has 128 employees, working in the fire-fighting headquarter, fire-fighting school, fire-fighting inspection and 4 intervention units.

The CFA conducts and coordinates organizational, operational and preventive measures to achieve readiness and preparedness of fire-fighting units through education and training of fire-fighters, technical equipping, proposing regulations in the field of fire-fighting, publishing literature, promoting fire-prevention activities, work with cadet-fire-fighters and taking care of fire-fighting heritage.

CVs of involved key researchers / staff members

1. Slavko Tucaković, univ. spec. oec., main fire chief, since 2012. leading all fire-fighting measures on national level in Croatia. Decision making and strategic planning.
2. Mario Starčević, dipl. Ing. since 2004. Head of the technical and operative department, responsible for EU-projects and international affairs in the CFA. Monitoring of work and coordination of activities.

Role in the project

- End-user
- Pilot demonstration

Relevant publications, and/or products, services or other achievements

- CFA operates the national fire-fighting call center
- CFA is responsible for fire-inspection of fire-fighting units
- CFA coordinates the National program of special measures of fire-prevention and suppression
- CFA develops ICT solutions for fire-fighting organizations in Croatia (management of fire-fighting incidents and data base of incidents, man – power, equipment, activities, alarm system, tracking system, GEO-information system, interactive data base of dangerous goods)
- CFA supervises a video-surveillance system for coastal area of Croatia, including video system in fire-fighting air-crafts through the integrated command center of fire-fighters, police and army

- CFA develops and maintains the central web-portal of fire-fighting organizations (every fire-fighting organization has a standardized web-site)
- CFA develops the “fire-fighting net” (interactive tool of risk management according to territorial risks)
- CFA educates approximately 1.500 fire-fighters each year for use of CFA ICT solutions

List of relevant previous projects or activities, connected to the subject of this proposal

Adriatic Holistic Forest Fire Protection, 1°str./0001/0 (acronym HOLISTC)– IPA Adriatic CBC Programme 2007-2013, fulfilled from 2014.-2016., CFA was partner in Adriatic consortium of 20 partners, CFA developed ICT application for all fire-fighting units. This project applied a set of measures for wildfire prevention and implemented an efficient (video) wildfire monitoring system in Croatia, that is now governed by CFA.

Strengthening the knowledge and skills of members of fire organizations in the Republic of Croatia, UP.04.1.1.0001 (acronym eHVZ)– European Social Fund, Effective Human Resources Operational Program; being fulfilled by CFA from 2018.-2023. This project ensures education for ICT applications of CFA of fire fighting operators in whole Croatia; plans the purchase of ICT equipment for fire-fighting call-centers and purchase of fire-simulator

Multi-hazard cooperative management tool for data exchange, response planning and scenario building No 740689 (acronym Heimdall) – Horizon 2020 EU.3.7.5.; being fulfilled from 2017.-2020., CFA associate member, CFA gives members of specific working groups. This project aims at improving preparedness of societies to cope with complex crisis situations by means of providing integrated tools to support efficient response planning and the building of realistic multidisciplinary scenarios.

European Fire and Rescue Innovation Network No 740575 (acronym Fire-IN) – Horizon 2020; being fulfilled from 2017.-2022., CFA associate member, CFA gives members of specific working groups. This project aims to give access to the state of the art Fire and Rescue technologies for whole Europe

Individual exploitation plan

- Vendor integration

Communication strategy for promoting project outcomes

- Promotion of project outcomes to stakeholders
- Contribution to dissemination and communication activities

Description of infrastructure to be made available to the project

The Primorsko-goranska county counts around 20.000 hydrants, 6 professional fire-brigades with 328 profesional fire-fighters and 60 volunteer fire-brigades with 20 professional and 1.867 volunteer fire-fighters, counting around 3.000 fire-fighting incidents/year within average 450 wildland fires/year.

Pilot description

Pilot site description:

Fire-fighting exercise ground and training center Šapjane and wider terirotry of Učka Nature Park

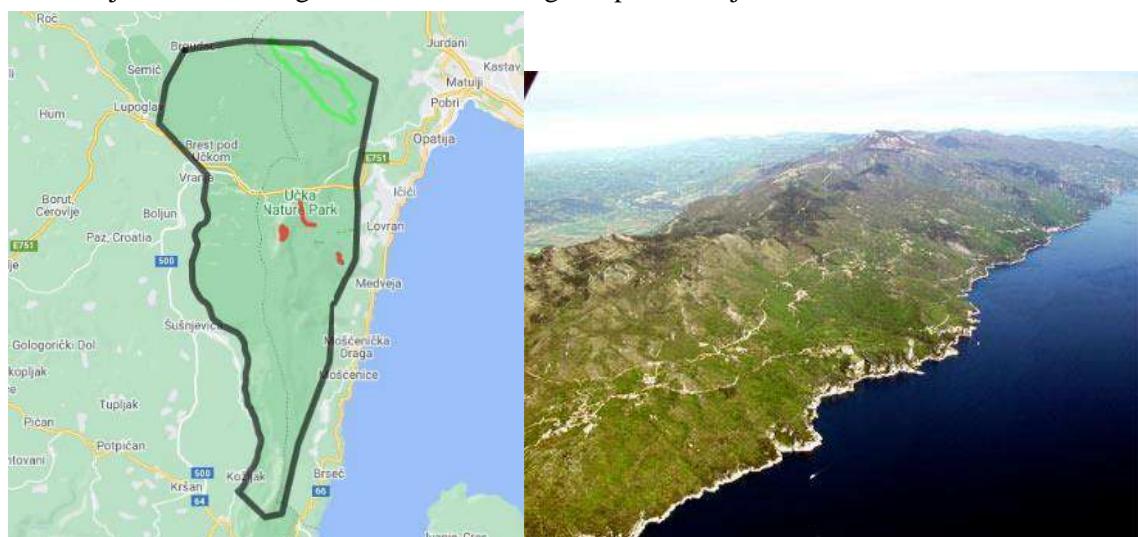
In order to provide conditions for training firefighters and other participants in the process of protection and rescue of people, animals and material goods, the firefighter association of Primorje-Gorski Kotar County addressed the Government of the Republic of Croatia with a request to manage the former barracks "Boršt" in Šapjane, near the city of Rijeka, with the corresponding area. Since 2010, the former barracks has been entrusted to the management of the firefighter association of Primorje-Gorski Kotar County. All training grounds are primarily intended for the training of firefighters, but they fully meet the needs for the training of civil protection operational forces.



Picture: Fire-fighting exercise ground and training center Šapjane

Source: Vatrogasna zajednica Primorsko - goranske županije

Učka Nature Park encompasses Mount Učka and a part of the Ćićarija mountain range. It is located along the northern Adriatic coast at one of the most northerly points of the Mediterranean, right where Istria meets the continental part of Croatia. The distinctive features for which this area was proclaimed a nature park have been known about for long time. Due to its relief and proximity to the sea, the area is characterised by a particular climate and lush forest vegetation. Also important are its rich meadows and other anthropogenic habitats that are home to numerous endemic, threatened and protected plant and animal species. Encompasses: mount Učka and part of the Ćićarija mountain range; area: 160 km²; highest peaks: Vojak 1,401 m, Veli Planik 1,272 m.



Picture: Učka Nature Park

Source: Google Maps; VIKENDPLANER.info

Ecological and biodiversity description:

Forest ecosystems in Croatia cover 44% of the land area. The geographical position of Croatia in three biogeographical regions, continental, alpine and Mediterranean, has conditioned the exceptional diversity of habitats with as many as 105 types of forest communities. 36% of Natura 2000 network in Croatia are forests and forest land (broadleaves 25.58%, coniferous 2.57% and mixed 7.65%). Forests boast have about 4.500 plant species. Preservation of forests and their large complexes in Croatia (especially the areas of Gorski kotar, Velebit, Lonjsko polje and Spačva) is extremely high. According to the Nature Report for the period 2013-2017. as many as 38% of forests are in excellent condition, and 61% of forests are in good condition. Forest ecosystems are often interspersed with various habitats which significantly increases their biodiversity (running water, springs, etc.) or specific microhabitats (old trees, droughts, rotten wood, etc.), and the presence of a large number of strictly protected and / or endangered plant, animal and the type of fungus confirms the exceptional contribution of forests to the overall biodiversity of Croatia. Furthermore, in the Dinaric part of Croatia, forest localities with preserved characteristics of original (primary) rainforests have been defined, since they developed exclusively under the influence

of natural factors, without organized human influence. Thus, an area of 3320.89 ha is included on the UNESCO World Heritage List within the area "Beech rainforests and original beech forests of the Carpathians and other regions of Europe." The uniqueness of these areas was first recognized at the national level, as evidenced by the fact that they are located in previously protected areas, in the Northern Velebit National Park, or in the Strict Reserve Hajdučki and Rožanski kukovi and in the Paklenica National Park. The preservation of the integrity and function of forest ecosystems in Croatia is significantly contributed by the ecological network that is part of the European ecological network Natura 2000. Most forest habitats belong to one of the target habitat types of Natura 2000 area and are important for many species and habitat types endangered nationally and / or internationally. Forests provide a whole range of ecosystem services that are recognized in Croatia as common forest functions. Some of the services are protection against erosion, torrents and floods; impact on water regime and water quality, impact on soil fertility, climate impact and climate change mitigation, protection and improvement of the human environment, oxygen generation, carbon sequestration and purification of the atmosphere, recreational, tourist and health function, creating favorable conditions for fauna, contribution of protective forests and special purpose forests (especially in protected areas) in the conservation of biodiversity.

Učka Nature Park is characterised by an exceptional variety of features in a comparatively small area. Učka is probably the only place in the world where one can take a photograph of the endemic Učka or Tommasini bell-flower (*Campanula tommasiniana*) and one of the last European locations where patient bird watchers will be rewarded with impressive glimpses of the Eurasian griffon vulture (*Gyps fulvus*) or golden eagle (*Aquila chrysaetos*). These species are two outstanding representatives of the ornithological life to be found on Učka, which includes ca. 100 nesting birds and many other birds that occasionally visit this mountain. A distinctive characteristic of Učka Nature Park's flora is that it is an area which, with regard to its geographical location and climate, abounds in both continental and Mediterranean species. According to the existing literature, the flora of Učka Nature Park encompasses approximately 1300 different species, which is an extraordinarily large number, considering the relatively small size of the protected area. Such a richness is a result of the previously described environmental factors, predominantly climate, geology and relief. Učka has a long tradition of botanical, especially floristic research. The first scientists to visit Učka were botanists. The list of prominent researchers is quite long, and most of the floristic papers that were published in the 20th century have widened our knowledge of the richness of the local flora. In addition, it must be emphasised that despite the centuries-long floristic research, new discoveries can still be made here. With regards to the diversity of habitats and the plant and animal species living there, Mount Učka is an important point of biological diversity on the European continent. The data about local fauna in the literature from the first half of the 20th century reveal the existence of a great number of endemic and protected species in the park, which require active care. It is estimated that we are familiar with only 40% of the total number of species that inhabit the park.

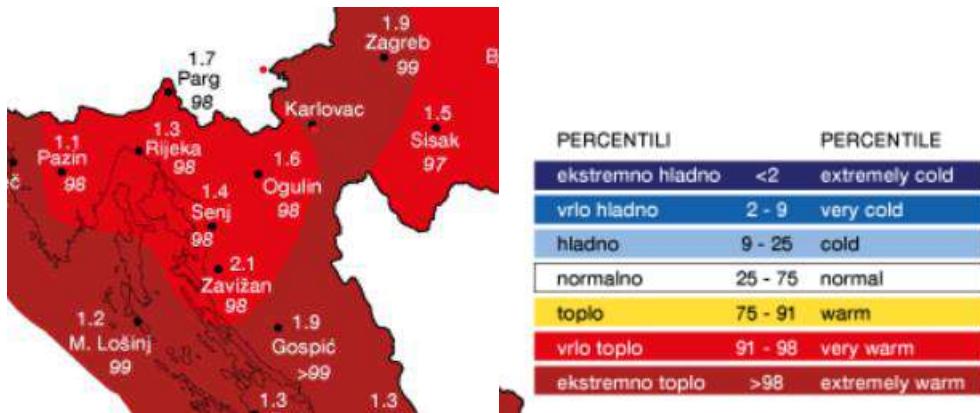
The activities of the project will:

- Implement new technologies and procedures that will contribute to the effectiveness of the fire-fighting and civil protection system in the field of management of wildland and forest fires
- Ensure interoperability of existing procedures and plans that will lower bureaucracy and raise effectiveness of the fire-fighting and civil protection system in the field of management of wildland and forest fires
- Develop new training system for forest and wildland fires (VR system) adopted to risks and fire-fighting and civil protection structure in the Mediterranean region
- These activities will contribute to better organized and more effective suppression of wildland fires adopted to the Mediterranean, lowering the ecological impact and threats to biodiversity of forest and wildland fires

Annual weather pattern:

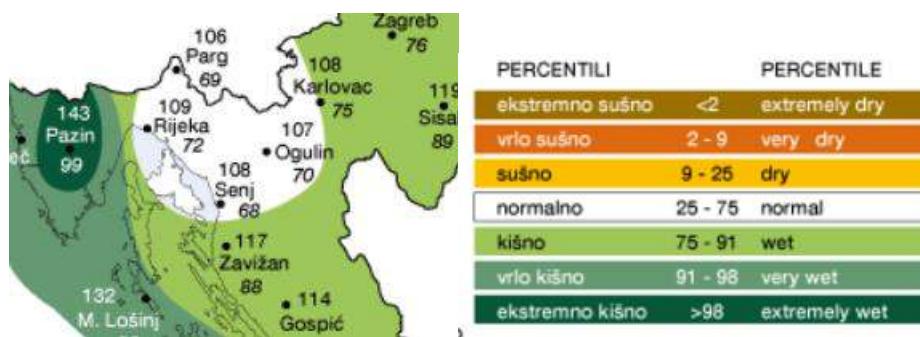
Croatia's climate is determined by its position in the northern mid-latitudes and the corresponding weather processes on a large and medium scale. The most important climate modifiers over Croatia are the Adriatic and the Mediterranean, the Dinarides' orography with their form, altitude and position relative to the prevailing air flow, the openness of the north-eastern parts to the Pannonian plain, and the diversity of vegetation. Therefore, the following three main types of regions - with continental, mountain and maritime climate, prevail in Croatia. Average temperature inland: January 0 to 2 ° C, August 19 to 23 ° C while average temperature in the coast: January

6 to 11 ° C, August 21 to 27 ° C. With an average of 2,600 hours of sunshine a year, the Adriatic coast is one of the sunniest in the Mediterranean, and the average sea temperature in summer is from 25 ° C to 27 ° C. Average rainfall during the year is in the coastal zone between 700 and 1000 mm, in the immediate hinterland between 1000 and 1500 mm, in Lika and Gorski Kotar up to 2000 mm, and in the higher mountains more than 2000 mm, in the mountains and more than 3000 mm. The continental parts of Croatia in the north and east receive an average of 700 to 1200 mm of rainfall.



Air temperature anomalies for Croatia

Source: Croatian Meteorological and Hydrological Service



Precipitation amounts for Croatia

Source: Croatian Meteorological and Hydrological Service

Meteorological data will be integrated in procedures and training activities.

Historical report on Wildfires:

In the last 40 years the number of wildlanad fires exponentially growes from average 1.000/year up to 10.000/year. The number of fires deaths in wildland fires is also very high and counts in average 30 civil deaths/year, with up to 50 injured fire-fighters/year. The burnt area counts from 30.000 ha/year up to 120.000 ha/year (0,5 up to 2,5 % of state area) and is one of the highest in the world, with damages from 100 to 200 million EUR/year.

Available infrastructure [KPIs]:

The Primorsko-goranska county counts around 20.000 hydrants, 6 professional fire-brigades with 328 profesional fire-fighters and 60 volunteer fire-brigades with 20 professional and 1.867 volunteer fire-fighters, counting around 3.000 fire-fighting incidents/year with in average 200 wildland fires/year.

Demonstration scenario:

AD 1)

- Overview of types and kinds of unmanned systems (multi-rotor helicopters, aircraft) and cost benefit analysis of the optimal system, system purchase
- Sensors (video cameras, thermal imaging cameras), transmission of video signals to command posts

- Mapping of the terrain and monitoring of the fire line for purpose of forest fire management and methods of measuring of burned area and display in GIS
- Practical demonstrations of working with unmanned systems

AD 2)

- Interaction and data exchange of existing intervention management systems (Ministry of the interior-NICS NextGeneration Incident Command System and Croatian Firefighting Association - fire incident management)
- Development of training programs and creation of instructors for intervention leaders in the use of new technologies
- Determination of symbols regarding the display of critical infrastructure and incidents on a topographic map (creation and reading of a situation report - SITREP, Fire Network)
- Connecting applications with real-time image transmission from the air

AD 3)

- Cost-benefit analyses for choosing virtual reality (VR) simulators with integrated fire-propagation systems
- Determining the location of the VR simulator
- Development of training programs
- Training of instructors for work on VR simulator
- Development of a proposal for a rulebook of training of fire-fighting commanders for forest fires
- Training of experts to maintain and update training for forest fires.

AD 4)

- Determination of focus groups according to available data of fire danger and forest fires (e.g. local municipalities with estimated highest fire danger risk and repeating big forest fires) among population for raising awareness and acquiring additional data from first-hand experiences
- Defining the curriculum to be implemented for focus groups
- Definition of focus groups per geographical location, profession (agriculture, tourism, administrative sector.) and experience

AD 5)

- Update the methodology for drafting fire protection and fire-fighting plans in online formats
- Establish web platform for fire protection and fire-fighting plans
- Integrate and insert fire protection plan and fire-fighting plan data (e.g. Copernicus - EU Earth Observation Programme, Fire-fighting net)
- Training of experts to use new methodology in forest fire management and command
- Making available reports of fire protection and fire-fighting plan on web platform for interested population

Phase A: Evaluation assessment

- Communication toolkit for citizen engagement
- Environmental assessment of fire danger index
- Training activities to enhance preparedness

Phase B: Detection and response coordination of fire fighters

- Efficiency and effectiveness of fire detection system
- Evaluation of SILVANUS intelligence toolkit
- Response planning and coordination of fire fighters

Contribution to national priorities:

National priority: improve annually Program of activities in the implementation of special fire protection measures of interest to the Republic of Croatia.

4.1.45 Civic Association Plamen Badin (Občianske združenie Plameň Badín) - PLAMEN

Partner Name: Civic Association Plamen Badin (Občianske združenie Plameň Badín) - PLAMEN	
Company website:	
Type: Civic Association	

Plamen Badin is a civic association focusing the cooperation with local government, legal and natural persons, and other civic associations in the field of fire protection, especially in connection with the implementation of rescue, localization and liquidation work beyond the tasks arising from generally binding legislation to fire brigades of Fire and Rescue Service and Municipality Voluntary Fire Brigades, respectively other IRS components. It meets all personnel and technical conditions in the scope of requirements for Municipality Voluntary Fire Brigade category B, which are extended by specific expertise especially in the field of gas service, flood rescue service, logistical support of long-term large-scale interventions and support of intervention management in the form of UAV multispectral data collection and processing.

CVs of involved key researchers / staff members

- **Ing. Robert Sopko:** he studied at the Technical University in Zvolen, in the study field Rescue Services. Since 2018, he is a member of a Module administrated under the Fire and Rescue Service which operates also abroad and which is specialized in the application of data obtained through the UAV to a comprehensive intervention management database, experimentally focuses on the use of multispectral cameras installed on UAV. He holds a licence to operate with the UAV.
- **Bc. Peter Droba:** he studied Forestry and Forest Management at the Vocational Forestry High School in Banská Štiavnica. Then he studied at the Technical University in Zvolen, Faculty of Ecology and Environmental Sciences. He also participated in the EU Erasmus programme – student mobility at the Inland Norway University of Applied Sciences, where he studied "Nordic forestry and wildlife management". During his studies, he also worked on school projects focused on the specialty he studied for 3 months in Norway. After completing his bachelor's degree, he moved directly under INN to Norway as a full-fledged master's degree student. He also practiced during his studies in Denmark, Sweden, Finland, Lithuania, and Greenland. Since 1997, he has been a member of the Nature Guard of the Slovak Republic in the BR Pol'ana Protected Landscape Area. NP Low Tatras and NP Veľká Fatra. He knows the territory of Pol'ana as well as natural conditions and conditions very well. An extended GIS course at Skovskolen, Institut for Geovidenskab og Naturforvaltningv Nodebo, Denmark, where he also worked on mapping areas with a drone, can also be included in the practice. In 2017, he started working at Plamen Badin association where he still works until present time.
- **Bc. Jakub Mikuláš:** he graduated at the Technical University in Zvolen, in the study field Rescue Services. Since 2018, he is a member of the VPlamen Badin association. He specializes in supporting intervention management in terms of analysis of ground access and access roads determined by technical and tactical parameters of available firefighting equipment and coordination of deployed forces and resources of fire brigades at the scene with absent local knowledge using coordinated GPS guidance.

Role in the project

- **WP1: Task 1.1, 1.2** – PLAM will participate in general project management activities.
- **WP2: Task 2.2, 2.4, 2.5** – PLAM will provide inputs to forest models used for threat assessment and historical case studies in Slovak Republic. PLAM will also participate in defining a systematic methodology for participatory processes.
- **WP6: Task 6.1, 6.2, 6.5, 6.6** – PLAM will contribute twofold: in resilience related activities (both ecological and forest restoration) and in impact assessment and EU climate-risk framework for forest resilience from the central-European perspective.

- **WP7: Task 7.1-7.4** – PLAM will contribute and bring rich experiences of its senior firefighters in the domain of policy recommendations on environmentally sustainability and forest restoration in context of Slovak forests.
- **WP9: Task 9.1-9.6** – PLAM will participate as a practitioner in the Slovak pilot in collaboration with TUZVO (pilot lead partner), with 3MON as the technology provider and UISAV as the scientific and large-scale computing expert. PLAM will be participating in all 3 phases (A/B/C) of the Slovak trial.
- **WP10: Task 10.1-10.5** – PLAM will collaborate in exploitation and dissemination of project results among practitioners. PLAM will also contribute to standards and compliance for interoperability of the resulting platform and existing infrastructure in place in Slovak context.

Relevant publications, and/or products, services or other achievements

- implementation of rescue, localization and liquidation work beyond the tasks arising from generally binding legislation for fire brigades of the Fire and Rescue Service and Municipality Voluntary Fire Brigades, respectively other Integrated Rescue System emergency services.

Individual exploitation plan

- Plamen Badin staff operates in the of fire and rescue services on daily bases. The solutions developed in the framework of the project present valuable contribution for the fire protection practice that is represented by the VFBZV.
- Plamen Badin is going to be involved in preparation of training guidelines for firefighters, development of new fire tactics procedures based on application operational analysis methods and including the progressive ICT decision supporting technologies. Obtained experience will be transferred to other fire and rescue services, including Fire and Rescue Service (professional forces)
- Plamen Badin will be directly involved in preparation, testing and demonstration of innovative tactical procedures when fighting wildfire, using the progressive ICT based analytical, modelling, and remote sensing technologies to support the decision-making process of incident commander on the intervention site and in real time.

Communication strategy for promoting project outcomes

- Plamen Badin cooperates with other fire brigades and emergency services when intervening. Using the outputs of the project, knowledge, expertise, or ICT tools will propagate among other emergency services that will lead to wider informatisation of emergency services and crisis management procedures at all. Many firefighters involved in the Plamen Badin is employed in the Fire and Rescue service (professional firefighters). That is also way how to transfer the knowledge, experience to the fire and rescue practise.
- Plamen Badin also communicates with other stakeholders, prepares fire prevention measures, organizes workshops, which is another way to disseminate the projects outputs

Description of significant infrastructure and major items of technical equipment relevant to the project

Plamen Badin meets all personnel and technical conditions in the scope of requirements for Municipality Voluntary Fire Brigade category B:

- **Personal capacities:** 10 firefighters available on daily basis
- **Equipment:** tanker car syringe, fire, and rescue material resources (hoses, ladder, axes, personal protective equipment including protective cloths), self-contained breathing apparatuses.

It also provides specific expertise especially in the field of gas service, flood rescue service, logistical support of long-term large-scale interventions and support of intervention management in the form of UAV multispectral data collection and processing.

Pilot description

Pilot site description:

Name of landscape: **Podpol'anie**

Approximate location of the case study area is Podpol'anie located in the central part of Slovakia (Figure 1), particularly within region of Banská Bystrica and its district Detva. Within case study area are situated two towns (Detva and Hriňová) and 13 municipalities. In 2011 the population of Detva district was almost 33 000 residents and population density 73 persons per km². The area belonged to the regions with the highest unemployment rate in Slovakia, when in 2011 its rate was 16,68 %.

The location of the Podpol'anie case study area within NUTS classification is as follows:

- NUTS1 SK0 - The Slovak Republic
- NUTS2 SK03 - Central Slovakia
- NUTS3 SK032 - Banská Bystrica Region
- LAU 1 604 - Detva District

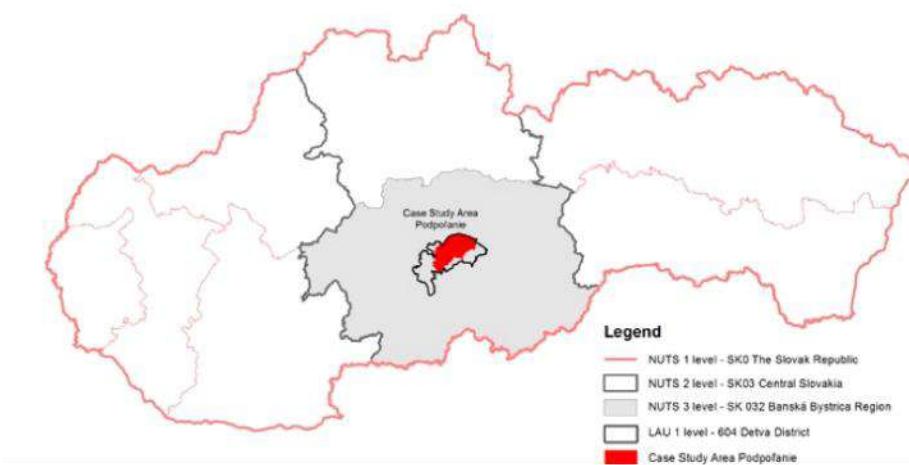


Figure 1: Case study area Podpolanie within NUTS classification in Slovakia

Slovakian Forests Description

In 2018, the area of forest holdings in Slovakia reached 2.02 million ha, of which forest crop land (forest stands) accounted for 1.948 million ha (Compendium of Slovak Forestry Statistics). The long-term trend of increasing the area of forest holdings (FH) and forest crop land (FCL) continues.

Since 2001 the area of forest stands has increased by almost 19,000 ha. The annual growth is mainly due to a change in the category of land use. Forest cover, calculated as a percentage of forest holdings in the total area of Slovakia (4.903 million ha including water areas), reached 41.2% in 2018.

In addition to forests on forest land, in Slovakia there is also a certain percentage of farming and other land covered by forest vegetation (so-called „white plots“). Based on the results of the second cycle of the National Forest Inventory and Monitoring 2015-2016 (NFIM 2), the area of white plots is $288,000 \pm 39,000$ ha, or almost 15% of forest land.

In 2018, the total supply of raw timber without bark reached a volume of 481.8 million m³. The stock of coniferous timber (198.63 million m³) declined due to frequent damage, especially to spruce forests. The trend of increasing the stock of hardwood (283.17 million m³) continued. The average timber supply per hectare was of 248 m³. At present, due to the current age structure of forests in the Slovak Republic, the highest timber stocks are historically the highest. However, their volume is already culminating; timber stocks are expected to decline in the upcoming years and decades due to a gradual change in the age structure.

Ecological and biodiversity description:

The case study area is agricultural – forest land with forests in the north and agricultural land in the south. For an upper part of the forest area are typical beech and fir-beech forests, in contrast to lower part where do prevail the Carpathian oak-hornbeam forests. Agricultural land is characterized by middle to low productive. The region is considered rather as region with specific cultural landscape development. In particular, the surrounding of Hriňová town is characterized by dispersed rural settlements and by traditional land use (e.g., small private owners). The region has never undergone collectivization in the 20th century; therefore, it represents a unique opportunity to

study relations between the man and the landscape. Moreover, region could be characterized as highland territory with different land-use patterns. There are grown commercial deciduous and mixed coniferous-deciduous forests, meadows, pastures, arable land, and areas with non-forest woody vegetation. Some parts of the mountain pastures and meadows are abandoned and overgrown.

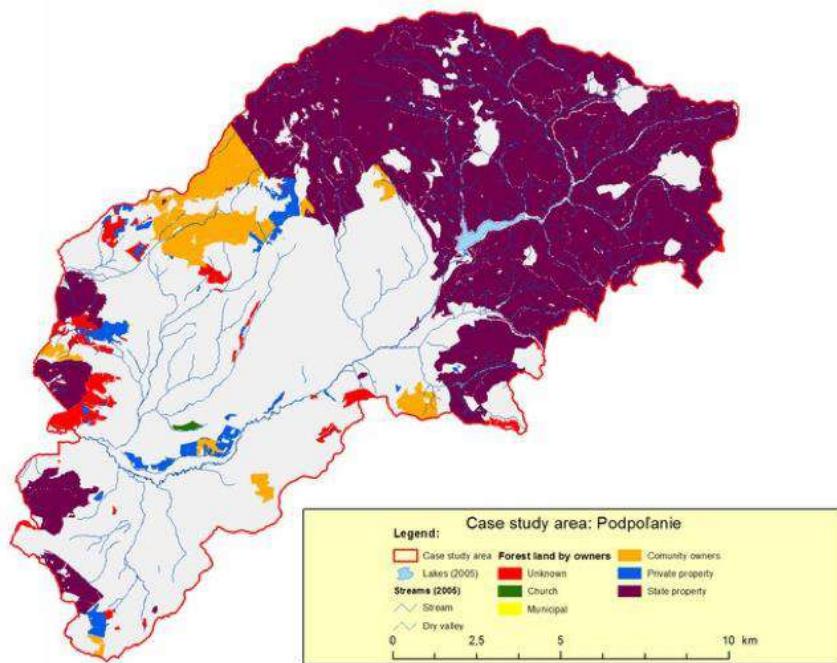


Figure 2: Ownership structure in case study area Podpol'anie

In terms of forest land ownership in Podpol'anie case study area (Figure 2), the state forest proportion is 84,7 %. This area is administered by the State Enterprise Forest's branch plant Kriváň, which is the largest forest subject in the region. Forest land whose owners are unknown (3,7 %) is also managed by this forest holding. From non-state owners the biggest share is in communal ownership (8,3 %). Private owners own 3,2 % and church only 0,1 % of forest land. Very small part of forest land is in municipal and agricultural cooperatives ownership.

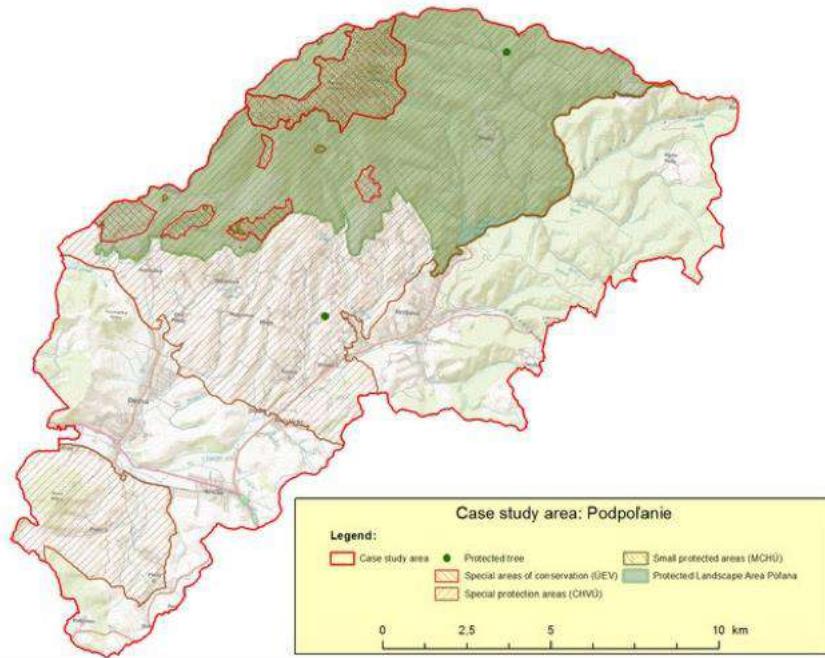


Figure 3: Protected areas within Podpol'anie case study area

North part of the case study area (almost forest) is under nature protection (table 1), particularly it belongs to Protected Landscape Area Polana - the Polana Biosphere Reserve (Figure 3). Protected Landscape Area (PLA) Polana was launched in 1981 for the protection of inanimate nature, plant, and animal communities as well as a special landscape character. Agricultural land as the mountain meadows and pastures is either mowed or grazed

by cattle and sheep. Re-cultivation in recent past, to some degree has changed the original floristic composition of the grasslands. Despite this, enough natural plant and animal communities is still present. The area is dominated by the massif of Pol'ana Mountain that is the highest extinct volcano in Central Europe with its altitude of 1458 m. Elevation range is about 1000 m (the lowest point of 460 m. a.s.l. and the highest of 1458 m. a.s.l.). The whole mountain is part of the Carpathian arc. In a relatively small area exists a presence of mountain thermophile species of plants and animals.

Table 1: Proportion of protected areas in Podpol'anie case study area

Protected areas within Podpol'anie case study area	Area (ha)	%-share
Protected Landscape Area (CHKO)	6,795	32
Special areas of conservation (ÚEV)	12,085	57
Small protected areas (MCHÚ)	749	3.5

The forest land in the area has important protection functions concerning the water, soil, and biodiversity. Within the territory is located a water reservoir Hriňová, which is an important source of drinking water for the surrounding region. Moreover, the recreational function of the area is also significant. Due to Protected game area of Pol'ana is Podpol'anie case study area well known for its hunting. On the area of more than 20 000 hectares is provided a coordinated ecological and large-scale management of game, especially of red deer population of Carpathian deer. Additionally, the forest is also intensively used for mushrooms, forests' fruits and nuts picking. To the outdoor activities mainly belong summer activities as tourism, ecotourism, and various sports.

Slovak Forests Damage

Due to a great diversity of natural conditions and habitats, Slovak forests have a very rich tree species composition, varied age structure and spatial arrangements. The most abundant tree species are European beech (33.9%), Norway spruce (22.5%) and English/sessile oak (10.5%) and Scotch pine (10.5%). Broadleaved species are at 63.1% more common than conifer species, which has a positive impact on the biological diversity of forest ecosystems and their stability. The area of coniferous species has been decreasing; since 2005 from its original 41% down to 36.9% in 2018 mostly due to the harmful factor's activity in the forests.

In the period of the last 15 to 20 years, forests in the Slovak Republic, to a large extent also due to climate change, have been exposed to an unprecedented frequency and intensity of harmful factors activity. Abiotic harmful factors in forests in 2018 damaged forest trees in the volume of 1.45 mil. m³ of timber. Biotic harmful factors damaged forest stands in the volume of 4.0 mil. m³ of timber, while the spruce bark beetle damaged 3.4 mil. m³ of this volume. The main measures for forest protection were the processing of damaged timber and its logging from forest stands, supplemented using pesticides and auxiliary products (pheromones, repellents).

Despite the implementation of these measures, the incidence of secondary harmful agents and the damage caused by them is increasing. The adoption and implementation of vigorous protection and defence measures are essential when looking at the current and projected state of forest damage.

Annual weather pattern: specified for the pilot study area

Climate: moderately warm, humid

Mean annual temperature: 8°C - 9°C

Annual precipitation: 700 – 800 mm

Historical report on Wildfires:

According to the statistics of the Fire Research Institute of the Ministry of the Interior of the Slovak Republic, 262 forest fires were registered in 2018 with a total damaged area of 243.38 ha and € 436,140 in damage. Two people were injured in the forest fires and one person was killed. The largest forest fire was recorded on May 3, 2018 in the vicinity of the town of Vysoké Tatry on the forest lands of the company Lesy Mesta Kežmarok. The fire hit 10 hectares of coniferous forest and caused damage of almost € 17,300. The cause of the fire was negligence and carelessness of adults.

Most fires were recorded in the districts of Čadca (30 fires), Martin (19 fires) Žilina (19 fires). The largest area damaged by forest fires was in the districts of Martin (32.92 ha), Kežmarok (30.63 ha), Nové Mesto nad Váhom (30.28 ha). The biggest damage was caused by forest fires in the districts of Snina (€ 100,000), Martin (€ 47,200)

and Dolný Kubín (€ 40,200). The most common cause of forest fires was an unidentified cause (55), setting fires in nature (43), incineration of waste outside landfills (37). The most frequent burns in the forests were in April (55), May (44), October (39).

Timber is the most important source of income for the preservation of forest functions and employment in the forestry sector in Slovakia. It is also a basic raw material for the wood processing industry, which ensures employment, sales, and revenues in this sector of the Slovak economy as well.

The area of Podpol'anie region can be characterised by the mixture of forest and farm land. Mostly the farm land is affected by the controlled burning of grassland and agricultural land in spring and autumn season, which is connected with fire transition to forest. In the previous 6 years, there occurred 7 such fires which ended in forest fires. For this purpose, the CCTV smoke detection system ForestWatch was installed in this area.

Available infrastructure [KPIs]:

In the pilot study area, there are available the following firefighting coping capacities:

Fire and Rescue Service (professional firefighters) administrated by the District Directory of the Fire and Rescue Service in Zvolen and in Detva:

Personal capacities: 13 firefighters-rescuers on daily basis available. For fighting the wildfire: there is also established Ground Forest Firefighting and Aerial Forest Firefighting Modules in Slovakia. Those are divided to 3 groups located in western part, central part and eastern part of the country. The central part group is located at the District Directory of the Fire and Rescue Service in Banská Bystrica and the Podpol'anie region belongs to its intervention area. This central part module is composed of firefighters coming from the District Directorate of the Fire and Rescue Service in Banská Bystrica (26 persons) and in Zvolen (12 persons).

Equipment: For fighting the wildfire in the study area, there are available: 21 firefighting and rescue vehicles, including 6 vehicles of tank car syringe type (CAS 30 Iveco Trakker and CAS 30 T815-7) and 4 terrain vehicles (Polaris IPS Ranger XP900). Except it 49 self-contained breathing apparatuses, 1 thermo-vision camera.

In the area also voluntary fire brigades operate. Totally 50 voluntary fire brigades, which 23 brigades are involved in territorial fire alarming plan to cope with the professional fire forces when fighting the fire. Those equipment include following tank car syringes: 6 pcs CAS 32 T815, 5 pcs CAS 32 T148, 4 pcs CAS 25 Š706, 3 pcs CAS K25 L101 and 24 pcs CAS 10 Iveco Daily.

To convene the fire brigades, there is a fire alarming plan and first, the site relevant fire brigades are involved in intervention. When situation gets worse, other fire brigades are involved. The Ground or Aerial Firefighting Module is involved when there is an extensive forest fire and available firefighting sources and resources need another, mostly aerial, support. The incident commander from the Fire and Rescue Service decides to deploy it and is also possible to request its intervention at the Operational Centre of the Presidium of The Fire and Rescue Service.

Demonstration scenario:

- The demonstration scenario includes all the phases of fire risk management – prevention and preparedness, response and restoration and adaptation. It results in implementation of joint tactical training, based on using the information on actual wildfire fire danger index rate and forest susceptibility to fire to select fire prone area, in which a virtual fire will be set. The EmerPoll platform will be used for fire announcement. This fire will be simulated by smoke to test also the sensibility of CCTV fire detection system installed in the pilot area to detect the fire and to inform the relevant fire and rescue service about fire occurrence. This data information contains also information on fire location. There will be simulated extensive fire, remote sensing technology will be requested to be deployed to have information on current fire situation a position of firefighters in the field. For choosing the appropriate fire tactics, modelling of fire behaviour (previous field surveys and laboratory test will be realised in the pilot study area) will be applied. To support the management and coordination activities of the incident commander GINA technology will be used. The tactical training will be evaluated by the relevant stakeholder who will participate in the training as the observers. After the training a workshop will be organised where all the aspects of the training will be discussed and evaluated as by the experts in the field, firefighters as by the stakeholders involved in the training like observers. Economical aspects of innovative ways of fighting with wildfire using the progressive ICT tools will be discussed, too.

Phase A/B/C: Policy recommendations on ecological restoration process

Phase A

- A1) Building knowledge base on wildfires and pilot study area (including forest models, environmental biodiversity profile for the pilot study area)
- A2) Implementation of field surveys focusing fuel mapping and quantification. Fuel sampling.
- A3) Implementation of laboratory fire tests to study the fuel moisture of extinction – required to specify the fire danger index
- A4) Development of algorithm to assess the wildfire risk: multicriteria analysis of existing systems (social, economic, environmental) in the pilot study area according to their susceptibility and vulnerability to fire, including fire behaviour modelling in FARSITE. Geostatistical analyses will be provided.
- A5) Using the spatial decision support system tools an automatized system for wildfire danger assessment, i.e., GIS-based “Wildfire early warning system (WFEWS)” prototype for the pilot study area will be developed. This will use the data coming from the ForestWatch CCTV-based smoke detection system, which has been used for monitoring of this region for several years. Wildfire danger index is assessed based on actual meteorological, microclimate data, actual live fine fuel moisture content value. Field measurements to obtain the microclimate data and live fine fuel and duff moisture content values are required. To provide laboratory experiments to find the fine fuel moisture content critical (moisture of extinction) values is also required.
- A6) For wildfires monitoring in shadowed areas (because of terrain, stand height) the UAVs deployment will be tested.
- A7) Remote sensing data (e.g., Sentinel) progressive digital image analyses will be applied for monitoring the fire spreading and consequences as well as for deriving the parameters of fire site and fire itself. This information is necessary for fire investigation purposes as well for planning fire prevention measures.
- A8) Development of algorithm to model impacts of wildfires on human, economy, and environment, including global climate. There will also be calculated volumes of combustion products released from wildfire, i.e., burning the lignocellulose material. Those will be assessed based on the carbon stock in the wildland fuel. The consequences of wildfire on human, economy and natural environment will be assessed using mathematical modelling procedures.
- A9) Citizen engagement toolkit for generating awareness of accidental fires and mitigation strategies will be developed (mobile application) – partly the EmerPoll platform (UISAV) will be used for these purposes.
- A10) Field training focusing testing developed fire prevention, monitoring and response tools will be realised and evaluated by stakeholders, end-users
- A11) Training handbook for fire fighters on the safety regulations for the deployment of technologies will be elaborated

Phase B – Response

- B1 GINA applications – the GINA Central application will be used as the core information exchange hub, with the high standard (SSL 8 a ISO 27001), to coordinate and dispatch resources during the individual incidents. The application includes dispatch, live GPS location of resources, statuses, navigation and route search, messages, live sharing of data and information, time history of events as well as other geographical and analytical functions. GINA also provides open interfaces to be integrated with other systems of the SILVANUS platform.
- B2 UAVs and UGVs involvement – swarm of UAVs and UGVs will be used to monitor and map the incident site in real-time using the integration capabilities of the GINA toolkit (3MON) combined with the software with multi-coverage approach for multiple robots coordination and dispatch provided by UISAV.
- B3 Crowdsourcing and situational awareness module – stakeholders will use the EmerPoll platform by UISAV for coordination, adaptation and mitigation of actions as well as to reach (inform or warn) fire fighters in the field, public or other end users.
- B4 Knowledge-base Integration – The knowledge base build around the SILVANUS ontology will be used to store, process and provide relevant geographical, forest inventory specific and fire-fighter's data scientific knowledge relevant to the current incident.
- Demonstration of joint tactical training of professional and voluntary fire brigades connected with deployment of helicopters, UAVs and other progressive ICT tools as well as output of the existing CCTV smoke detection system installed in the area. There will be introduced and demonstrated new tactical procedures for fighting the wildfire, developed in the framework of this project and based on application of progressive remote sensing

ICT tools. It will be followed by Workshop for stakeholders to disseminate the tactical training findings as well as the project outputs.

Phase C - Restoration and adaptation

- C1) Forest models and management strategies for fire destroyed/damaged stands/soil/biota will be developed – stakeholders' involvement; consensus of stakeholders will be required (participatory processes)
- C2) DSS and algorithm for biodiversity index and ecological site classification decision will be developed
- C3) Socio-economic analysis will be provided – stakeholders' involvement
- C4) Restoration roadmap of natural resources will be elaborated – stakeholders' involvement
- C5) Fire prevention (including fuel and forest management) and firefighting strategies for natural resources (forest and country) will be developed – stakeholders' and firefighters' involvement.

Contribution to national priorities:

Action plan of the National Forestry Program of the Slovak Republic for the period 2015-2020:

STRATEGIC OBJECTIVE 1 - PROMOTION OF ECOLOGICAL MANAGEMENT OF FORESTS

Priority 3 - Promote the conservation, and enhancement of biodiversity

Framework objective 1.5 Preservation and improvement of forest biodiversity by appropriate differentiation of forest management methods and other measures regarding to the category and function of forests

Framework objective 1.7 Creation of legal, economic, and technical conditions for active care of forest ecosystems in protected areas to preserve and restore their biodiversity in accordance with the objectives of nature preservation

STRATEGIC OBJECTIVE 2 - IMPROVING AND PROTECTING THE ENVIRONMENT

Framework objective 2.9 Adaptation of the species and spatial structure of forests by the expected impact of climate change in the form of forest adaptation measures

Framework objective 2.11 Establishment and financial provision of an effective system of forecasting, prevention, and monitoring of forest fires

4.1.46 TECHNICAL UNIVERSITY IN ZVOLEN (Technická univerzita vo Zvolene)

Partner Name: Technical University in Zvolen (Technická univerzita vo Zvolene)

Company website: <https://www.tuzvo.sk/>

Type: International collaborator (Academic)



Partner profile

The Technical University in Zvolen (also known as TUZVO) is a modern higher education institution providing education in all three levels of studies within the European Higher Education and Research Area. In the higher education system in Slovakia, the TUZVO has a unique specialisation within a focus on the spheres of forest – wood – ecology – environment with an appropriate expansion in other technical, natural, security, economics as well as design spheres.

TUZVO fulfils its mission also by solving research projects and programmes of national and international character in seven research areas: agricultural and forestry sciences, construction engineering and technologies, ecology and environmental sciences, manufacturing sciences, economics and management, safety/security sciences, design; as well as in other related and applied areas.

The Technical University in Zvolen with its research activities covers the whole complex of forest - wood - product - the environment in all its diversity, including the disposal of products after the time of their serviceability. At the same time, it pays attention to ecological impacts upon the nature and landscape protection as well as the technical provision of these spheres.

Faculties orientate their research and development towards the following:

Faculty of Forestry: Silviculture, forest management, forest economics, timber harvesting and logging, forest ecology, forest constructions and ameliorations, forest protection and game management, forest phytology.

Faculty of Wood Sciences and Technology: Structure and properties of wood and wood-based materials, products of native wood, modification of wood properties, wood constructions, interaction of wood - water, rationalisation of energy consumption when processing wood, fire protection and safety/security.

Faculty of Ecology and Environmental Sciences: Biota, biodiversity and their monitoring, ecological principles of creating and protection of nature and using landscape, monitoring quality of the environment, ecologisation of processes and production, economical use of wastes, philosophical and social aspects of relations of human being - nature - society.

Faculty of Environmental and Manufacturing Technology: Development of machinery for forestry and processing wood, assessing quality of forestry and wood-processing machines, making use of new energy sources, biomass.

TUZVO participated in a role of partner of the WARM project (5th Framework programme of the EU. Since 2019, TUZVO has been involved in implementation of international COST Action titled FIRELinks (2019-2023), which objective is to synthesise the existing knowledge and expertise, to define a concerted research agenda which promotes an integrated approach to create fire-resilient landscapes, considering biological, biochemical, and physical, and socio-economic, historical, geographical, sociological, perception and policy constraints. In the past, TUZVO was involved in several COST Actions dealing with the issue of development of decision support tools to enhance the forest management strategies (e.g. FP0804 - Forest Management Decision Support Systems (FORSYS).

Since 2020, TUZVO is involved in implementation of research project with acronym FDAAS funded by the ERDF. The project is focusing research and design of a complex automated system for wildland fire danger assessment based on the data on atmospheric and micro-climatic conditions (and fuel parameters) obtained through IoT sensor network.

Totally **3 faculties** are involved in project implementation: Faculty of Wood Sciences and Technology, Faculty of Forestry and Faculty of Ecology and Environmental Sciences.

CVs of involved key researchers / staff members

- **Prof. Danica Kačíková, PhD., MSc.** – professor at the Technical University in Zvolen, Faculty of Wood Sciences and Technology, Department of Fire Protection. She is an expert in the field of testing chemical and fire properties of materials and fire dynamics. She has profiled from the development, modification, and application of chemical analytical methods, through the study of wood and wood-based materials to the evaluation of materials in general, with emphasis on the physical, physicochemical, and chemical properties related to the flammability and thermal stability of the materials, the course, and products of thermal degradation. The material characteristics obtained by the progressive laboratory analytical methods she uses in the calculations of values of selected parameters of internal fire dynamics and smoke control in internal and external fires. In the project she will be responsible for field surveys aimed in mapping fuel quantity and structure and sampling, and laboratory testing the fuel samples (physical, chemical and fire properties investigation. Number of papers and citations in WOS/Core Collection: 40/379, H-index 11.

- **prof. Dr. Jaroslav Šálka** – professor at the Technical University in Zvolen, Faculty of Forestry, Department of Forest Economics and Management. He is an expert in the field of forestry policy, governance and participatory processes. Number of papers and citations in WOS/Core Collection: 24/152, H-index 8. In the proposed project he will be responsible for designing and implementing of participatory processes with the goal to involve stakeholders in decision making in the Slovakian pilot study regarding the fire and forest management.

- **doc. Ing. Andrea Majlingová, PhD. et PhD.** – associated professor at the Technical University in Zvolen, Faculty of Wood Sciences and Technology, Department of Fire Protection. She studied Forestry at the Technical University in Zvolen and then graduated with 2 PhD. degrees in Forest Management (Technical University in Zvolen) and Rescue Services (Faculty of Security Engineering, University of Zilina). Number of papers and citations in WOS/Core Collection: 21/90, H-index 5. She is an expert in the field of risk management, crisis management, application of decision support tools (GIS, remote sensing, computer aided modelling of fire behaviour) in the safety/security practice. In the project, she will be responsible for the development of forest and fuel models, forest and fuel management strategies, and will participate at modelling of wildland fire behaviour and wildland fire risk management activities. She will be responsible for the application of the material analyses results into the fire modelling, too.

Role in the project

- **WP1: Task 1.1, 1.2** – TUZVO will participate in general project management activities.

- **WP2: Task 2.1-2.5** – TUZVO will be the WP2 leader as well as the leader of two tasks within this WP. Specifically, in tasks 2.1 it will lead the review of existing sustainable forest management services across countries and stakeholders. In further tasks TUZVO will provide inputs for forest models used for threat assessment, climate sensitive forest models and historical case studies from Slovak Republic. TUZVO will also lead the task 2.5 dealing with defining a systematic methodology for participatory processes.
- **WP5: Task 5.1** – In task 5.1 TUZVO will provide requirements and inputs for implementing a Big-data analytics framework for institutional awareness on fire danger index.
- **WP6: Task 6.1, 6.5, 6.6** – In this WP TUZVO will contribute to ecological resilience related activities, privacy and societal impact assessment and in impact assessment and EU climate-risk framework for forest resilience from the central-European perspective.
- **WP7: Task 7.1-7.4** – TUZVO will contribute and bring rich experiences of its senior researchers, scientists and educators from the forest management domain for policy recommendations on environmentally sustainability and forest restoration in context of Slovak forests.
- **WP9: Task 9.1-9.6** – TUZVO will lead the Slovak pilot in collaboration with the fire brigades, represented by the PLAMEN civic organization, with 3MON as the technology provider and UISAV as the scientific and large-scale computing expert. TUZVO will be participating in all 3 phases (A/B/C) of the Slovak trial.
- **WP10: Task 10.1-10.5** – as a educational and scientific partner TUZVO will participate mainly in dissemination of project results. TUZVO will also contribute to standards and compliance for interoperability of the resulting platform and existing infrastructure in place in Slovak context.

Relevant publications, and/or products, services or other achievements

- Integrating innovation in forest and development policies: comparative analysis of national policies across Europe. Gerhard Weiss, Jaroslav Šálka ... [et al.]. In Policy integration and coordination: the case of innovation and the forest sector in Europe: COST Action E51 / Ewald Rametsteiner ... [et al.]. - Luxembourg : Publications Office of the European Union, 2010. - ISBN 978-92-898-0049-5. - P. 41-85.
- Mechanism of cross-sectoral coordination between nature protection and forestry in the Natura 2000 formulation process in Slovakia. Zuzana Sarvašová, Jaroslav Šálka, Zuzana Dobšinská. In Journal of environmental management. Integrated land-use and regional resource management – A cross-disciplinary dialogue on future perspectives for a sustainable development of regional resources. - ISSN 0301-4797. - Vol. 127, suppl. (2013), p. S65-S72.
- Analysis of stakeholders' involvement in the implementation of the Natura 2000 network in Slovakia. Flavia Brescancin ... [et al.]. - COST Action FP 1207 ; ITMS 26220120006 ; ITMS 26220120049 ; KEGA 017TU Z-4/2015. In Forest policy and economics. - ISSN 1389-9341. - Vol. 78 (2017), p. 107-115.
- From command-and-control to good forest governance: a critical interpretive analysis of Lithuania and Slovakia / Ekaterina Makrickiene ... [et al.]. In Forest policy and economics. - ISSN 1389-9341. - Vol. 109 (2019), art. no. 102024 [13 p.]. (3.139 - IF2019).
- Forest fire vulnerability analysis. Ján Tuček, Andrea Majlingová. In Bioclimatology and natural hazards / eds. Katarína Strelcová...[et al.] ; revs. Jan Bednář...[et al.]. - Dordrecht : Springer Science+Business Media B.V., 2009. - ISBN 978-1-4020-8875-9. - P. 219-230.
- Spatial distribution of surface forest fuel in the Slovak Republic. Andrea Majlingová, Maroš Sedliak, Róbert Smreček. In Journal of maps. - ISSN 1744-5647. - Vol. 14, no. 2 (2018), p. 368-372. Opening-up of forests for fire extinguishing purposes / Andrea Majlingová. In Croatian journal of forest engineering. - ISSN 1845-5719. - Vol. 33, issue 1 (2012), p. 159-168.
- Multicriterial forest fire risk assessment applicable in Central Europe - case study / Andrea Majlingová. In International journal of engineering and applied sciences- ISSN 2394-3661. - Vol. 2, issue 2 (2015), p. 45-50.
- Manažment rizík hospodárenia na lesnej pôde s dôrazom na lesné požiare / Risk management on forest land with emphasis on forest fires. Maroš Sedliak, Andrea Majlingová ... [et al.]; rev. Ján Holécy, Milan Oravec. - 1st ed. - Zvolen: Technical university in Zvolen, 2015. - 180 p. - ISBN 978-80-228-2762-1. (In Slovak)
- Štúdium vplyvu zmeny parametrov lesného prostredia a paliva na správanie lesného požiaru / Study of the effect of changing parameters of the forest environment and fuel on forest fire behaviour. Danica Kačíková, Andrea Majlingová ... [et al.]; rev. Linda Makovická Osvaldová, Jaroslav Kapusniak. - 1st ed. - Zvolen: Technical University in Zvolen, 2020. - 112 p. (In Slovak)
- Decision support tools and strategies to simulate forest landscape evolutions integrating forest owner behaviour: a review from the case studies of the European project, INTEGRAL. Christophe Orazio ... [et al.]. In Sustainability. - ISSN 2071-1050. - Vol. 9, issue 4 (2017), art. no. 599 [31 p.] [online].

- Forest decision support systems for the analysis of ecosystem services provisioning at the landscape scale under global climate and market change scenarios. Eva-Maria Nordström ... [et al.]. In European journal of forest research. - ISSN 1612-4669. - Vol. 138, no. 4 (2019), p. 561-581.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
WARM - Wildland Urban Area Risk Management, 5th Framework programme of the EU	In the frame of WARM project (Wildland-Urban Area Fire Risk Management), a research activity of the 5th Framework Programme of the European Commission, the scales of the problem and factors identified are presented. According to the experience of past years, a consistent and comprehensive framework is explained in which several research activities are presented. Among them, the characterization of different house vegetation patterns, the description of interface fuels, the modeling of fire behavior and the participation of water runoff and landslides are considered in the computing of settlement risk and vulnerability.	Methodologies to be used for wildland fire risk assessment in the SILVANUS project.
ALTERFOR, (2016-2020), H2020 programme project funded by EC	ALTERFOR explores the potential to optimize forest management models currently in use in different forested areas in European countries. The international consortium of scientists and forestry practitioners will examine alternative forest management models in ten case study areas. Each area represents different forest management practices and socio-ecological conditions across Europe.	Transfer of knowledge and experience in developing forest management models to be used in different forested areas in European countries
FDAAS (2020-2021), funded by ERDF	Research and design of a complex automated system for wildland fire danger assessment based on the data on atmospheric and micro-climatic conditions (and fuel parameters) obtained through IoT sensor networks	Methodology to be used for wildland fire danger index assessment – suitable for the central Europe conditions / forests
COST Action CA18135 Fire in the Earth System: Science & Society (Fire-Links), (2019-2023)	The objective is to synthesise the existing knowledge and expertise, to define a concerted research agenda which promotes an integrated approach to create fire-resilient landscapes, considering biological, biochemical and physical, and socio-economic, historical, geographical, sociological, perception and policy constraints.	Transfer of knowledge, dissemination of SILVANUS project outputs
COST Action FP0804 Forest Management Decision Support System (FOR-SYS), (2009 –2013), EU-funded	This Action defined a European-wide framework with core processes and information standards for decision making in a sustainable multifunctional forest management environment. Furthermore, it defined requirements for DSS implementation and provided a consistent European-wide quality reference for the development of decision systems that enhanced sustainable forest management.	Transfer of knowledge and experience. Methodologies and DSS models to be used as starting points in the SILVANUS project.
COST Action FP0603 - Forest models for research and decision support in sustainable forest management, (2007-2011), EU-funded	The main objective of the Action was to promote the development of methodologies to improve forest models to support the sustainable management of forests. The Action enhanced the quality and consistency of forest growth models to simulate the responses of forests to alternative managerial and climate scenarios. The Action demonstrated variations in regional concepts as they have evolved depending on the background of the model developers and society needs.	Transfer of knowledge and experience. Methodologies and forest models to be used as starting points in the SILVANUS project.

Individual exploitation plan

TUZVO will use the results of SILVANUS project in its further research activities, by extending its knowledge base and expertise in forest and fuel management to enhance the wildfire resilience. TUZVO will also use SILVANUS to apply for further research grants as at national level as international level to continue with further research and development of SILVANUS project outcomes.

TUZVO has already been involved as a principal investigator in several projects of applied science in the area of protection of forest against fire, provided as for state administration bodies as for private stakeholders. When considering expected project outcomes, it is evident, that it will extend its portfolio of advisory and analytical services which will be capable to provide not only for professionals, stakeholders, and but also general public, and even not only at national level, but also international level, as a part of the Board of the Analytical and Advisory Centre built in the frame TUZVO also provides teaching activities at various levels, starting from bachelor degree studies, through master, ending up with doctorate (3rd level) studies. Involvement in SILVANUS will help attract new PhD. students with new innovative theses of dissertation works.

Communication strategy for promoting project outcomes

TUZVO staff will publish the results of the SILVANUS project in current scientific and academic journals and present them on scientific conferences and workshops, as it has been doing in all past projects.

Description of significant infrastructure and major items of technical equipment relevant to the project

TUZVO has several specialized laboratories equipped with progressive research infrastructure, which will be utilized in the project:

Laboratory of Combustion: laboratory provides standardized combustion tests using progressive analytical infrastructure for investigating the oxygen limit index with a superstructure to measure the optical density of the smoke (STN EN ISO 4589-2); ignition (STN EN 11925-2); flash and spontaneous ignition temperature (STN ISO 871); mass loss rate (non-standardized test); dominant combustion products (TESTO 350-L);

Laboratory of Calorimetry: laboratory provides calorimetry analyses using two kinds of bomb calorimeters: IKA 200 and IKA 5000 to investigate the gross and net calorific value of biomass (forest fuel).

Chemical laboratories: gas chromatograph with mass detector (GC-MS: HP 7890A-5975C VL MSD) for analytical determination of the characteristics of fuel thermal decomposition; FTIR Nicolet IS10 Spectrophotometer to determine fuel changes after thermal loading and burning; IR Video Thermometer for determining the temperature of the temperature fields.

Laboratory of Geoinformatics: The laboratory is equipped with specialized workstations with the following software: Idrisi (Idrisi Selva), ArcGIS ver. 10.0 (ArcEditor, ArcInfo, Spatial Analyst, 3D Analyst, Network Analyst, Geostatistical Analyst), eCognition for digital image analyses. The laboratory is also equipped with Trimble GeoExplorer GNSS devices and FieldMap device. Geographic database containing vector and raster data, including historical and present orthophotos from the Slovak Republic territory are available, too.

Laboratory for modelling and simulation of crisis phenomena: The laboratory is equipped with 21 PCs with a monitor with the following configuration: 1 x 2 GHz CPU, 512 MB VRAM graphics card, 4GB RAM, 1TB HDD, with LCD monitor and accessories. This site has licenses for multi-vendor software products that are installed on each of the 21 PCs. The products Idrisi (Idrisi Selva), ArcGIS 10.0 (ArcEditor, ArcInfo, Spatial Analyst, 3D Analyst, Network Analyst, Geostatistical Analyst) are used for solving scientific research projects and teaching in the field of modelling and simulation of crisis phenomena. ArcGIS Server is used to make digital maps and geographic data available. The FARSITE 4 software environment is available for modelling the behaviour of fires in the natural environment.

4.1.47 Yayasan AMIKOM Yogyakarta

Partner Name: Yayasan Amikom Yogyakarta	
Company website: https://amikom.ac.id/	
Type: International collaborator (Universitas Amikom Yogyakarta)	

Partner profile

Yayasan AMIKOM Yogyakarta is a foundation that manages Universitas AMIKOM Yogyakarta. Universitas AMIKOM Yogyakarta (AMIKOM) is located in the center of Yogyakarta city, which lies in the eastern part of Yogyakarta, Indonesia. AMIKOM students are not only from many different places in Indonesia but from abroad as well. AMIKOM is one of the private IT-based University in Yogyakarta, Indonesia. This university was established on December 29, 1992.

Universitas AMIKOM Yogyakarta has more than 11.000 students studying in 3 faculties, Faculty of Computer Science, Faculty of Science and Technology, and Faculty of Economics and Social. The university has been committed to excellence in scholarship, research, and service. The research itself is mainly about the Internet of Things, Computer Vision, Natural Language Processing, Geospatial Analysis, Community Resilience, Disaster Mitigation, and Capacity Building.

Besides the academic area, Universitas AMIKOM Yogyakarta has an incubator to support student generating start-ups. For instance, the growing start-up could apply their technology in the community. One of the best products from the incubator is the drone project that will be helpful for the SILVANUS Project.

Next to Universitas AMIKOM Yogyakarta, Yayasan AMIKOM Yogyakarta managed other business units working on IT and animations. The animation unit is called MSV Studio which produces animation movies. One of its most iconic movies is “Battle of Surabaya” that got more than 40 awards. Likewise, IT business units produce some IT-related products such as “Sihat”, National Food Security Management System, and Ship Game Simulator.

CVs of involved key researchers / staff members

Dr. Kusrini, M.Kom (female): An associate professor from Universitas AMIKOM Yogyakarta Indonesia. She finished her doctoral program from Universitas Gadjah Mada Yogyakarta Indonesia in 2010. She is interested in exploring many things about machine learning and other artificial intelligence fields. She also loves doing research about decision support systems and databases. She has experience in international research collaboration in computer vision. She has more than 30 copyright and more than 30 Scopus indexed papers.

Expected contribution to the project : Kusrini will be responsible for coordinating the implementation of the research.

Dr. Arief Setyanto, M.T (male) : A senior lecturer from Universitas AMIKOM Yogyakarta Indonesia. He finished his PhD program on Computer Science and Electronics Engineering, Essex University, in 2016. He works on hierarchical video segmentation for his PhD Thesis. Currently his research focuses on computer vision as well as natural language processing. He has 27 scopus indexed academic publications related to computer vision, video and image processing and natural language processing.

Expected contribution to the project: He can contribute on Computer vision work such as processing the satellite imagery to recognize hotspots, vegetation, urban areas etc. He can also work in determining the semantic meaning from the visual data. Arief is currently working on Natural Language Processing, more specifically in Indonesian language, therefore, he is expected to contribute in social media analytics.

Gardyas Bidari Adninda, S.T., M.A.: A junior lecturer from Universitas AMIKOM Yogyakarta, Indonesia. She finished her bachelor's degree in Urban and Regional Planning (2014) at Universitas Gadjah Mada, Indonesia. She finished her master's degree in Policy Science (2016) from Ritsumeikan University, Japan. Her research mostly about disaster management focusing on post-disaster recovery and disaster mitigation as well.

Expected contribution to the project:

During the SILVANUS project, Gardyas will work on the disaster management system regarding forest fire, including mitigation, preparedness, response, and recovery in phase 1-3. She will also participate in reviewing the Indonesia forest fire cases to build an environmental threat level model of the forest fire.

Ika Afianita S, S Si., M.Sc (female): 2011-2013: M.Sc (Master) Management Planning on River and Coastal Area Geography, Universitas Gadjah Mada Yogyakarta Indonesia

2007-2011: S.Si (Bachelor) Environmental Geography, Geography, Universitas Gadjah Mada Yogyakarta Indonesia
Expected contribution to the project:

During the SILVANUS project, Ika will work on the aspect of geography with some approach analysis including spatial, ecological, and regional complexes. Specifically on community and capacity building toward disaster preparedness.

Expertise and contribution to the project

- Coordinator of WP6, contribution to Phase C pilot demonstration

- Kusrini: Research Coordinator
- Arief Setyanto: IT technology development and implementation
- Gardyas Bidari Adninda: Disaster Management Model
- Ika Afianita: Geospatial Analysis

Role in the project

- **WP1:** AMIKOM will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** AMIKOM will contribute to the participatory process.
- **WP4:** AMIKOM will contribute to the data collection process. The background asset of mobile applications will be brought into the project for the collection of biodiversity metrics from pilot demonstration site.
- **WP5:** AMIKOM will contribute to big-data framework
- **WP6:** AMIKOM will coordinate the workpackage activities and will lead the investigation of soil rehabilitation analysis.
- **WP7:** AMIKOM will contribute to the future of forest management within south-east Asia
- **WP9:** AMIKOM will lead the pilot demonstration as outlined below.
- **WP10:** AMIKOM will disseminate and exploit the project results through established international links.

Relevant publications, and/or products, services or other achievements

- 2020; Data augmentation for automated pest classification in Mango farms; Kusrini Kusrini, Suputa Suputa, Arief Setyanto, I Made Artha Agastya, Herlambang Priantoro, Krishna Chandramouli, Ebroul Izquierdo; Computers and Electronics in Agriculture, Volume 179, December 2020, 105842
- 2021; Sentiments Analysis of Customer Satisfaction in Public Services Using KNN Algorithm and NLP Approach; Elik Hari Muktafin, Pramono, Kusrini; Telkomnika, vol. 19, no. 1
- 2019; Comparison of SIFT and SURF methods for porn image detection; Hartatik, Setyanto, A., Kusrini, K., Made Artha Agastya, I.; 2019 4th International Conference on Information Technology, Information Systems and Electrical Engineering, ICITISEE 2019;
- 2019; Sentiment Analysis In Twitter Using Lexicon Based and Polarity Multiplication; Kusrini ; Mochamad Mashuri; 2019 International
- 2019; The prototype of decision support system for selecting the lands of crops; Tobing, D.M.L., Kurniasih, J., Tetik, Y.N. , Kusrini ; 2019 4th International Conference on Information Technology, Information Systems and Electrical Engineering, ICITISEE 2019;
- 2019; Prototype of Pornographic Image Detection with YCbCr and Color Space (RGB) Methods of Computer Vision; Kusrini, Fatta, H.A., Pariyasto, S., Widiyanto, W.W; 2019 International Conference on Information and Communications Technology, ICOIACT 2019;
- 2019; Temple rock damage detection system in digital image at borobudur conservation center; Lutfiyana, U., Kusrini, K.; 2019 International Conference on Information and Communications Technology, ICOIACT 2019;
- 2018; Analysis of Telkomsel's user internet service user satisfaction in social media twitter using R programming; K. Sussolaikah and Kusrini; 2018 3rd International Conference on Information Technology, Information Systems and Electrical Engineering, ICITISEE 2018, pp. 259–264;
- 2018; GIS-based decision support system for cash waqf distribution; K. Kusrini, K. C. Kirana, M. I. Purwanto, and A. D. Laksito; J. Theor. Appl. Inf. Technol., vol. 96, no. 3, pp. 701–711
- 2018; Convolutional Neural Network for Pornographic Images Classification; I Made Artha Agastya ; Arief Setyanto ; Kusrini ; Dini Oktarina Dwi Handayani; 2018 Fourth International Conference on Advances in Computing, Communication & Automation (ICACCA);
- 2018; Pornographic Novel Criterion on Indonesian Cultural Background; Hartatik Hartatik ; Arief Setyanto ; Kusrini Kusrini; 2018 6th International Conference on Cyber and IT Service Management (CITSM);
- 2017; GIS technology selection for visualization of independent economic modeling of former Woman Migrant Worker (WMW); K. Kusrini, M. I. Purwanto, K. C. Kirana, and A. D. Laksito; 2017 5th International Conference on Cyber and IT Service Management, CITSM 2017, 2017;
- Setyanto A., Setiaji, B., Hayati, M., Krisnawati, Cheating Activity Detection on Secure Online Mobile Exam,(2020) Journal of Engineering Science and Technology, 15(6)
- Kurniasari, L., Setyanto, A. Sentiment analysis using recurrent neural network-lstm in bahasa Indonesia,(2020) Journal of Engineering Science and Technology, 15 (5), pp. 3242-3256.

- Kurniasari, L., Setyanto, A., Sentiment Analysis using Recurrent Neural Network,(2020) Journal of Physics: Conference Series, 1471 (1), art. no. 12018
- Sari, E.Y., Wierfi, A.D., Setyanto, A., Sentiment Analysis of Customer Satisfaction on Transportation Network Company Using Naive Bayes Classifier,(2019) 2019 International Conference on Computer Engineering, Network, and Intelligent Multimedia, CENIM 2019 - Proceeding, 2019-November, art. no. 8973262, .
- Wayan Pandu Swardiana, I., Setyanto, A., Sudarmawan, Comparison of pornographic image classification based on texture, color, and shape features(2019), 2019 4th International Conference on Information Technology, Information Systems and Electrical Engineering, ICITISEE 2019, art. no. 9003842, pp. 95-100.
- Hartatik, Setyanto, A., Kusrini, K., Made Artha Agastya, I., Comparison of SIFT and SURF methods for porn image detection(2019), 2019 4th International Conference on Information Technology, Information Systems and Electrical Engineering, ICITISEE 2019, art. no. 9003773, pp. 281-285.
- Munandar, A., Setyanto, A., Raharjo, S., Wicahyono, G., Pregnancy mapping and monitoring web based geographic's information system(2019), 2019 4th International Conference on Information Technology, Information Systems and Electrical Engineering, ICITISEE 2019, art. no. 9003916, pp. 490-494.
- Setyanto, A., Raharjo, S., Wicahyono, G., Munandar, A., Toha, E.R., Prasetya, C.R., Pregnancy monitoring and mapping using integrated mobile application and geographic information system,(2019) International Journal of Advanced Trends in Computer Science and Engineering, 8 (6), art. no. 109, pp. 3362-3368.
- Maulana, M.A., Habib, M., Setyanto, A., Oktavia, Tourism Trend Mapping Based on Social Media Using SAW Algorithm,(2018) Journal of Physics: Conference Series, 1140 (1), art. no. 012041, .
- Hermanto, D.T., Ziaurrahman, M., Bianto, M.A., Setyanto, A., Twitter Social Media Sentiment Analysis in Tourist Destinations Using Algorithms Naive Bayes Classifier,(2018) Journal of Physics: Conference Series, 1140 (1), art. no. 012037, .
- Agastya, I.M.A., Setyanto, A., Kusrini, Handayani, D.O.D., Convolutional Neural Network for Pornographic Images Classification, (2018) Proceedings - 2018 4th International Conference on Advances in Computing, Communication and Automation, ICACCA 2018, art. no. 8776843,
- Agastya, I.M.A., Setyanto, A., Classification of Indonesian batik using deep learning techniques and data augmentation,(2018) Proceedings - 2018 3rd International Conference on Information Technology, Information Systems and Electrical Engineering, ICITISEE 2018, art. no. 8720990, pp. 27-31.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
Drone for Agriculture UAV/Unmanned Aerial Vehicle designed to manage the agriculture needs using IoT. Furthermore, to investigate the field using multispectral.	<p>Enhancing agriculture management by making it faster, cheaper, and easier to control compared to manual work.</p> <p>The list of components in the system are as follows:</p> <ul style="list-style-type: none"> • Professional Remote and Application • AMU (Agriculture Management Unit) • Radar • Electric pump • Nozzle sprayer 	<p>The drone will be modified to investigate fire areas using multispectral cameras. Multispectral technology is able to see hotspots when a fire occurs.</p> <p>The collected data transfer to the SILVANUS system to do further analysis of policy making. Besides, drones can be used to carry out fire fighting equipment using a sprayer. Furthermore, it can be used to investigate the most appropriate evacuation routes.</p>
Soil Nutrition Sensor based on IoT The system aims to monitor the soil fertility through a sensor and controlled by the android system to manage the soil	<p>This system allows the sensor to check the soil condition automatically in each meter of the land depending on the distance between the plants.</p> <p>All of the collected data can be accessed through a web</p>	<p>The soil sensor will be connected to the IoT to detect potential fires in a location. This sensor is buried in several locations inside the fire-prone areas. The collected data will detect the increasing temperature in ground surface temperature shortly before the fire occurs. It could be attached to the SILVANUS system as an input for data analyzing.</p>

I Ph, soil temperature, and soil moisture.	server and android smartphone	
Weather Climate Sensor based on IoT The system aims to forecast the weather to help the farmers predict the cultivating season. The sensor itself integrated with the android system so that it could be operated easily.	This system allows the sensor to check and forecast the weather in order to predict the cultivating season.	Weather sensors will be used to forecast the fire disaster and where the wind blows the fire. It is important to use it as a prediction of where the fire spread. This will be a very beneficial input for SILVANUS to decide a faster response policy.
Data Augmentation for Automated Pest Classification in Mango Farms An advanced machine learning (ML) technique for analyzing large-scale mango fields and identification of the onset of biological threats using computer vision and deep-learning technologies.	The ML technique extends the pre-trained VGG-16 deep-learning model to supplement the last layer with a fully connected network training consisting of 2-layers. Considering the real-world operational conditions commonly faced by Indonesian farmers for collecting and processing visual information obtained from the Mango farms.	The system will be modified to acknowledge the forest molt in order to understand the first phase of the fire detection.
Battle of Surabaya An animation movie produced by one of business unit in Universitas AMIKOM Yogyakarta	In 2002 the business developed terms of making animations to broadcast the research project. The result of this research was used for enfolding the animation film education of its main company Universitas AMIKOM Yogyakarta. Apart from that, it was also used for serving the government necessities in expanding animation in Indonesia. In 2015 MSV Pictures launched a 2D widescreen animated film titled "Battle of Surabaya."	This business unit supports SILVANUS Project in animation film production as terms of making animations to broadcast the research project. The result of this research was used for enfolding the animation film education of its main company Universitas AMIKOM Yogyakarta. Apart from that, it was also used for serving the government necessities in expanding animation in Indonesia. In 2015 MSV Pictures launched a 2D widescreen animated film titled "Battle of Surabaya."

Individual exploitation plan

- Arranging an environmental threat level model for forest fire cases in Indonesia. Through collaboration with related stakeholders, the threat level model develops using the previous cases that occurred in Indonesia.
- Developing remote sensing technologies using original technologies made by Amikom to support SILVANUS project.

Communication strategy for promoting project outcomes

- Managing a pilot project of the SILVANUS system to be applied in Indonesia.
- Submitting publication in a high index journal to promote the results of the project.
- Participate in an international conference to promote the SILVANUS project.

Description of significant infrastructure and major items of technical equipment relevant to the project

- High-quality talents and facilities in its animation studio which has successfully worked on several world-class animation projects.
- Professional laboratories and servers which are qualified to manage the artificial intelligence computation.
- Fully equipped drones for research purposes.

Pilot demonstration

Indramayu is a town and district which serves as the capital of Indramayu Regency in the West Java province of Indonesia, and is located in the northern coastal area of West Java, east from Jakarta, north-east from the city of Bandung, and north-west of the city of Cirebon. Most of its land are situated below sea level, which makes the district vulnerable to high tide in stormy conditions. The district is only protected by some dunes and barrages at the seaside.

Indramayu mangoes, botanically classified as *Mangifera indica*, are large fruits of a tropical, evergreen tree that can grow up to thirty-five meters in height and is a member of the Anacardiaceae family. Native to Indonesia, Indramayu mangoes are known for their sweet flavor and thick skin, which allows the fruit to have a longer storage life and be transported more efficiently for commercial use. Indramayu mangoes were once one of the most popular varieties in Indonesia, but other newer mango cultivars have recently overshadowed them. Though the fruits have diminished in fame, they can still be found at fresh markets and have remained the preferred variety by locals for use in fresh salads.



Figure 23 - Biodiversity land assessment for agriculture



Figure 24 - Soil composition analysis to be analysed for Phase C activity

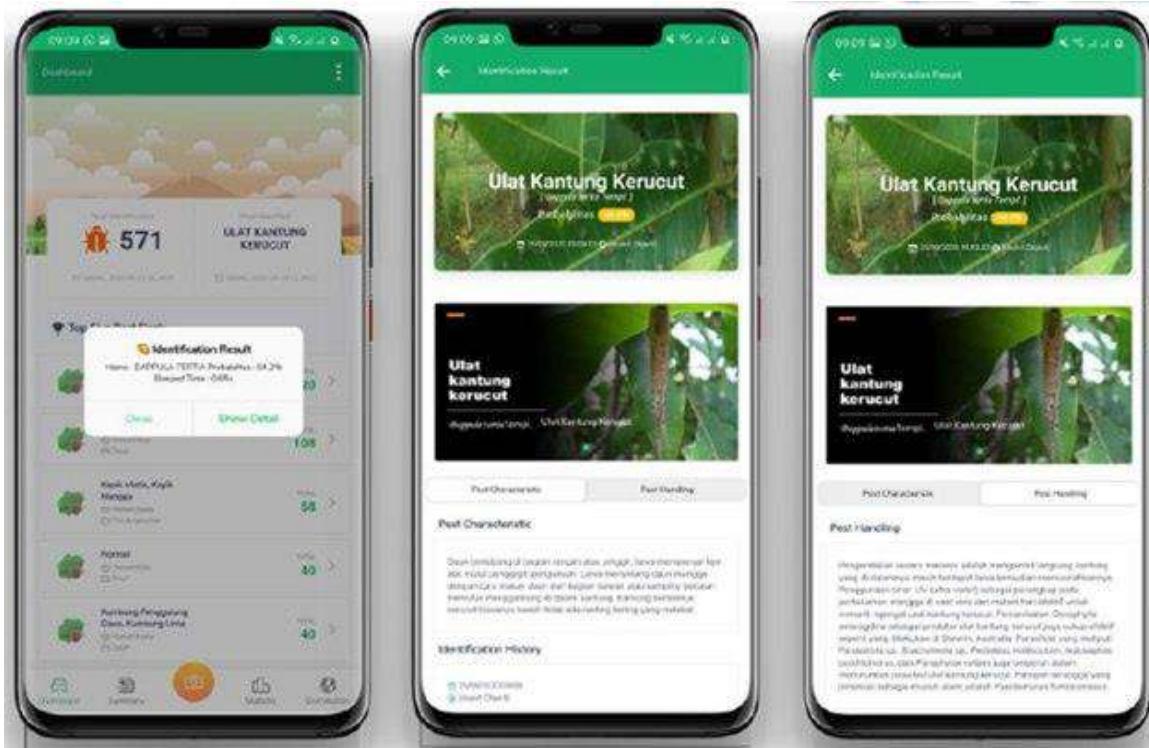


Figure 25 - Mobile application for capturing regional biodiversity

4.1.48 Commonwealth Scientific and Industrial Research Organisation

Partner Name: Commonwealth Scientific and Industrial Research Organisation

Company website: https://www.csiro.au/	
Type: International collaborator (NGO)	

Partner profile

The CSIRO (Commonwealth Scientific and Industrial Research Organisation) is Australia's National Science Agency. It is one of the world's most multi-disciplinary research organisations, with fundamental and applied research in technology, materials science, environment, agriculture and food, minerals and resources. The CSIRO was founded more than 100 years ago and today it has approximately 5,500 staff over 50 sites. Most of the sites are based in Australia, but CSIRO also has offices in the USA, Chile and France. One of its main goals is to create impact linking novel research with the needs of industry. It has an annual budget of approximately \$AUD 1 billion. It has strong partnerships with industry and research groups from all over the world. The organisation measures success in terms of scientific publications, patents, commercialisation and licensing and creation of spin-out companies.

Relevant to this proposal, one of the most prominent Groups in CSIRO is the Robotics and Autonomous Systems Groups. It specialises in field and mobile robotics focusing on mapping, localisation and navigation methods. The Group has approximately 50 full time staff and an additional 50 post-grad students. The Group has experience with navigation in off-road terrain including underground and forest environments, which are directly related to the topic of this proposal.

CVs of involved key researchers / staff members

Dr Borges is a Principal Research Scientist in the Robotics and Autonomous Systems Group at the CSIRO, located in Brisbane, Australia, where he currently leads the Robotics Perception Team. His work includes research in robotics, team and project management, securing funding, and post-graduate student supervision. In the past, he has held a Visiting Scientist appointment at ETH Zürich, he has worked as a researcher at the University of London and at the Federal University of Santa Catarina (UFSC), and as an intern at the University of Manchester. I am a recipient of the Endeavour Executive Award and of a Winston Churchill Fellowship for which he will undertake a visiting scientist appointment at NASA AMES in 2021. In the last several years his core experience has been in perception and autonomous navigation solutions (state estimation, planning, obstacle detection, integration) for the manufacturing, energy, and agriculture industries. Dr Borges has a BSc and MSc from UFSC and a PhD from QMUL, all in Electronic Engineering.

Tirtha is a Senior Research Scientist at the Robotics and Autonomous Systems Group (RASG) focusing on robust robot locomotion and mobility for field robots. At RASG, he is the principal research investigator for climbing robotics where he explores the interplay between robust adhesion, robot morphology and mobility of high dimensional multi-limbed robots in complex 3-D discontinuous natural and man-made structures. In this capacity he supervises PhD students, leads and contributes to various research and industry projects on the topic of locomotion and robot navigation. Prior to joining CSIRO, he was a post-doctoral fellow at SMART, Singapore developing mobility on demand solutions for self-driving vehicles that took into account pedestrian intentions to navigate safely in a crowded environment. He also led the work in SMART on navigation on autonomous surface vessels in choppy Singapore waters. At the Robotics Group, Tirtha initiated the multi-limbed climbing robotics research. Since 2016, he led a team of robotics engineers and scientists towards the development of highly flexible magnetic foot multi-limbed inspection robot (Magneto) that went on to win the First prize in Sprint Robotics 2019 for the New Innovative Technology in Inspection, Maintenance or Cleaning category. Magneto is now being licensed by an Australian SME for commercial development.

Role in the project

Role in the project

- **WP1:** CSIRO will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
- **WP2:** CSIRO will contribute to the participatory process.
- **WP4:** CSIRO lead the activity on UGV development.

- **WP8:** CSIRO will contribute to the platform integration and demonstrate the pilot outlined below during testing.
- **WP10:** CSIRO will disseminate and exploit the project results through established international links.

Relevant publications, and/or products, services or other achievements

An number of technical papers related to navigation in unstructured terrain have been published by the Robotics and Autonomous Systems Group. A summary is:

- Felipe G. Oliveira, Armando A. Neto, David Howard, Paulo V K Borges, Mario F. M. Campos, Douglas G. Macharet, "Three-dimensional Mapping with Augmented Navigation Cost through Deep Learning", accepted in Journal of Intelligent & Robotic Systems, 2020. (Impact Factor: 2.52)
- Jiadong Guo, Paulo V. K. Borges, Abel Roman Gawel, Chanoh Park, "Local Descriptor for Robust Place Recognition using LiDAR Intensity" in IEEE Robotics and Automation Letters, 2019. (Impact Factor: 3.6)
- Marko Bjelonic, Navinda Kottege, Timon Homberger, Paulo V. K. Borges, Philipp Beckerle, Margarita Chli, "Weaver: Hexapod Robot for Autonomous Navigation on Unstructured Terrain", Journal of Field Robotics, 2018.
- Thomas Lowe, Paulo Borges, Serge Lichman, David Haddon, James Brett, Matt Wildie, Paul Cronin, "An Autonomous Terrain Coverage and Marking System for Humanitarian Landmine Clearance", in Australasian Conference on Robotics and Automation (ACRA 2020), Brisbane, Australia, December 2020.
- Riley Bowyer, Thomas Lowe, Paulo V K Borges, Tirtha Bandy, Tobi Loew, Dave Haddon, "PaintPath: Defining Path Directionality in Maps for Autonomous Ground Vehicles" in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2020), Las Vegas, October 2020.
- Tobi Loew, Tirtha Bandy, Paulo V K Borges, "Identification of Effective Motion Primitives for Ground Vehicles" in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2020), Las Vegas, October, 2020.
- Caio Silva, Paulo V K Borges, Eduardo Castanho "Environment-Aware Sensor Fusion using Deep Learning" in 16th International Conference on Informatics in Control, Automation and Robotics, Prague, Czech Republic, July 2019.
- Ueli Graf, Paulo V K Borges, Emili Hernandez, Roland Siegwart, Renaud Dube, "Optimization-Based Terrain Analysis and Path Planning in Unstructured Environments" in IEEE International Conference on Robotics and Automation, Montreal, Canada, May 2019.
- Fabio Ruetz, Emili Hernández, Mark Pfeiffer, Helen Oleynikova, Mark Cox, Thomas Lowe, Paulo V. K. Borges "OVPC Mesh: 3D Free-space Representation for Local Ground Vehicle Navigation" in IEEE International Conference on Robotics and Automation, Montreal, Canada, May, 2019.
- Philipp Egger, Paulo V. K. Borges, Gavin Catt, Andreas Pfrunder, Roland Siegwart, Renaud Dubé, "Pose-Map: Lifelong, Multi-Environment 3D LiDAR Localization", in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Madrid, Spain, October 2018.
- Adrian Rechy, Paulo V. K. Borges, Alberto Elfes, Andreas Pfrunder, "Map-Aware Particle Filter for Localization", in IEEE International Conference on Robotics and Automation, Brisbane, Australia, May, 2018.
- Konrad Cop, Paulo V. K. Borges, Renaud Dubé, "DELIGHT: An Efficient Descriptor for Global Localisation using LiDAR Intensities", in IEEE International Conference on Robotics and Automation, Brisbane, Australia, May, 2018.
- Andreas Pfrunder, Paulo V K Borges, Adrian R Romero, Gavin Catt, Alberto Elfes, "Real-Time Autonomous Ground Vehicle Navigation in Heterogeneous Environments Using a 3D LiDAR", in IEEE International Conference on Intelligent Robots and Systems, Vancouver, Canada, 2017.

Patents:

- Konrad Cop, Paulo V. K. Borges, Ross Dungavel, Renaud Dubé, "Method and system for use in performing localisation", Provisional Patent 2017903569, 2017.
- Pavel Verchesky, Mark Cox, Paulo V K Borges, Thomas Lowe, "Method and System for Use in Colourisation of a Point Cloud", Provisional Patent [2018901452](#), 2018.
- Tom Lowe, Riley Bower, Paulo V K Borges, Tirtha Bandy, "Method for Path Planning", Provisional Patent 2020900936, 2020.
- Ron Denning, Sharon Edwards, Peter Herwig, Paulo V K Borges, Michelina Del Giudice, Doug Dower, Andrew Kraweiski, "Heat Barrier Laminate" - Provisional Patent Application - 2020901293, 2020.

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within FORTORI
DARPA SubT Challenge	CSIRO was the only non-American team leading one of the Group's competing in one of the DARPA Challenges, which are the world's most well-known and prestigious robotics challenges.	It is relevant as it is directly related to off-road navigation of mobile robots in unstructured terrain, similarly to the task of the proposal

Individual exploitation plan

For CSIRO and the Robotics Group, this engagement in the project will strengthen its fundamental skills in off-road and forest navigation using cutting-edge mapping and localisation methods. The project is in direct alignment with the exploitation strategy of CSIRO, as bushfire fighting and prevention are a major topic in Australia.

Communication strategy for promoting project outcomes

- Submit and publish findings and research results in high impact journals and conferences in the areas of robotics, with particular focus on field robotics.
- Disseminate project related information via our social media channels, including subscribers to our website (research.csiro.au/robotics) and LinkedIn (<https://www.linkedin.com/company/18905289/admin/>) and our YouTube channel (<https://www.youtube.com/channel/UCTyn7S-kU-f45slyIK17AqA>)
- Identify, together with our Business Development Department, strategies for commercialisation of the technology.

Description of significant infrastructure and major items of technical equipment relevant to the project

- The CSIRO Robotics Group is one of the world's largest field robotics group. It is based at QCAT (Queensland Centre for Advanced Technologies), which is a world-class facility for robotic development and testing, including structured (buildings, roads) and unstructured (fields, bush, forest, creek) environments. The test facility accommodates for ground, air and underwater robotics research. A summary of the facility is present in <https://youtu.be/fivY-ZIO1vI>
- The Group will contribute with several kinds of working robotic ground platforms to the development of the project.

Pilot demonstration site and activity.

CSIRO's test site for UGVs will be the large area of QCAT (Queensland Centre for Advanced Technologies), located in Brisbane, Australia. The region contains a large area characterized by a variety of mixtures of different terrain features (Figure 2(a)). It comprises an urban-like environment, industrial sheds, asphalt roads and, more importantly for this project, a large off-road area with bushes, dense and large trees, all consisting of steep and flat grass, dirt, and pebble ground. Figure 1 below shows the map of Brisbane in South East Queensland, Australia. The area was severely damaged by the Australian Wildfires of 2019-20. The area highlighted in red is CSIRO test site, shown in details in Figure 2. The site represents a typical Australian bushland, similar to the ones most affected by the wildfires in recent years. A satellite image of the site is shown in Figure 2 below, on the left. On the right, we show a 3D mapped version of the site using CSIRO's 3D mapping technology using a mobile robotic platform. Being able to create such maps is essential for efficient and real-time operations. The locally acquired 3D map serves as the basis for local robotic navigation, including localisation, obstacle detection, terrain analysis and path planning. This site forms a perfect testing ground for the technology proposed and UGV development.

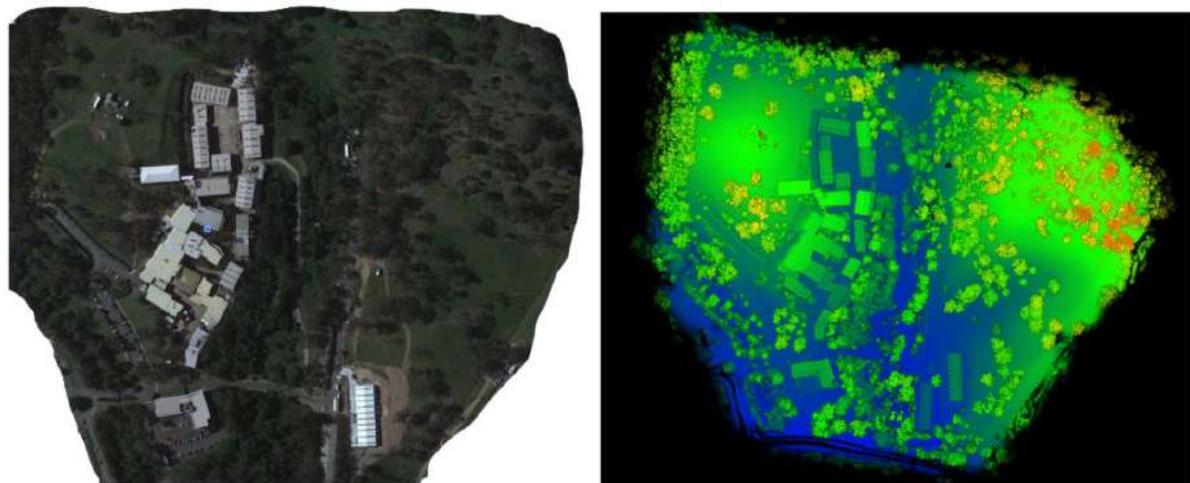


Figure 1. Test site for UGV operations (left). 3D mapped version of the site using Lidar and a mobile ro-bot (right).



Figure 2. Map of Southeast Queensland with the test area highlighted in red.

4.1.49 Federal University of Rio de Janeiro

Partner Name: COPPE/UFRJ

Company website: www.coppe.ufrj.br

Type: International Collaborator (University)

**COPPE
UFRJ**

Partner profile

Computational Intelligence, Big Data, Deep Learning, Remote Sensing.

- Academic, Research and Development

CVs of involved key researchers / staff members

Nelson Francisco Favilla Ebecken, Civil Engineer, D.Sc. 1977

Professor of Computational Systems at COPPE/Federal University of Rio de Janeiro. He has given courses on Computational Methods for Engineering Problems since 1973 and Artificial Intelligence since 1995. He has published 142 articles in scientific journals. He has advised 135 M.Sc. and 138 D.Sc. theses. Participated in about 336 R&D projects carried out through the COPPETEC Foundation. His research focuses on IA computing methodologies for modeling and extracting knowledge from data and their application across different disciplines.

Titular Professor

Computing methodologies for modeling and extracting knowledge from data and their application across different disciplines. To develop models for complex systems, big data and to integrate ideas and computational tools.

Rogério Pinto Espíndola, Mathematician, D.Sc. 2004

He has experience in Computer Science, with an emphasis on Data Science.

Adjunct Professor

He coordinates and participates in research projects in several areas of knowledge, namely: biotechnology, ecology, urban mobility and public data mining and is co-leader of the High Performance Computing research groups.

Role in the project

- **WP1:** UFRJ will contribute to the overall project management and will participate in the general assembly meetings organised by administrator and scientific coordinator (PEG/Z&P).
 - **WP2:** UFRJ will contribute to the participatory process.
 - **WP7:** UFRJ will contribute to the future of forest management
 - **WP9:** UFRJ will lead the pilot demonstration as outlined below.
 - **WP10:** UFRJ will disseminate and exploit the project results through established international links.
-
- To do best use of existing data (e.g. remote sensing, in-situ or community-based data), technologies (e.g. Big Data and Artificial Intelligence) to be completed following the workplan consolidation

Relevant publications, and/or products, services or other achievements

- List of papers related to the technology recently published
- COSTA, ALVARO M.; COSTA, PEDRO V. M; MIRANDA, ANTONIO C. O.; **Ebecken, Nelson F. F.**; NISHIMOTO, KAZUO; MENEGHINI, JULIO R.; DE ESTON, SÉRGIO M.; DE TOMI, GIORGIO; RUGGERI, FELIPE; BRANDÃO, CAMILA; BREDA, ALEXANDRE. Salt Rock: a Strategic Geomaterial in Brazil. Polytechnica, v. 1, p. 1-12, 2020.
- COSTA, PEDRO VASSALO MAIA DA; DA COSTA, ALVARO MAIA; MENEGHINI, JULIO R.; NISHIMOTO, KAZUO; SAMPAIO, CLAUDIO M.; ASSI, GUSTAVO; MALTA, EDGARD; GOULART, MARIANA B.R.; BERGSTEN, ANDRE; UDEBHULU, OKHIRIA D.; AZEVEDO, RICARDO CABRAL; DE ESTON, SÉRGIO M.; DE TOMI, GIORGIO; **EBECKEN, NELSON F.F.**; ROSA, Luiz Pinguelli; MIRANDA, ANTONIO C.O.; BRANDÃO, CAMILA; BREDA, ALEXANDRE. Parametric study and geomechanical design of Ultra-deep-water Offshore Salt Caverns for Carbon Capture and Storage in Brazil. INTERNATIONAL JOURNAL OF ROCK MECHANICS AND MINING SCIENCES, v. 131, p. 104354, 2020.
- CARVALHO, GUSTAVO DE ARAÚJO; MINNETT, PETER J.; **Ebecken, Nelson F. F.**; LANDAU, Luiz. Classification of Oil Slicks and Look-Alike Slicks: A Linear Discriminant Analysis of Microwave, Infrared, and Optical Satellite Measurements. Remote Sensing, v. 12, p. 2078, 2020.

- **EBECKEN, NELSON F.F.**. Challenges of Computational Data Modelling in Petroleum Engineering. International Journal of Latest Engineering and Management Research, v. 05, p. 35-39, 2020.
- GOULART, MARIANA BARBERO RIBEIRO; COSTA, PEDRO VASSALO MAIA DA; COSTA, Alvaro Maia da; MIRANDA, ANTONIO C.O.; MENDES, ANDRE BERGSTEN; **EBECKEN, NELSON F.F.**; MENEGHINI, JULIO R.; NISHIMOTO, KAZUO; ASSI, GUSTAVO R.S. Technology readiness assessment of ultra-deep Salt caverns for carbon capture and storage in Brazil. International Journal of Greenhouse Gas Control, v. 99, p. 103083, 2020.
- SILVA, CORBINIANO ; HEILBRON FILHO, PAULO FERNANDO LAVALLE ; PÉREZ GUERRERO, JESÚS SALVADOR ; XAVIER, ANA MARIA ; PEREIRA, Gilberto Carvalho ; LACERDA, GLEIDE BORGES MORAES ; PIMENTEL, LUIZ CLAUDIO GOMES ; LANDAU, Luiz ; **EBECKEN, NELSON FRANCISCO FAVILLA** . A computational model for estimation of ^{226}Ra and ^{228}Ra concentrations in sludge from petrol exploitation, based on radiation-level measurements on stored packages. Environmental Earth Sciences, v. 79, p. 489, 2020.
- Eduardo Paiva; **EBECKEN, N. F. F.** Convolutional Neural Networks and Long Short-Term Memory Networks for Textual Classification of Information Access Requests. IEEE Latin America Transactions, v. 100, p. 1-8, 2020.
- DIAS, A.; SCAVARDA, A.; REIS, A.; SILVEIRA, H.; **EBECKEN, N. F. F.** Managerial Strategies for Long-Term Care Organization Professionals: COVID-19 Pandemic Impacts. Sustainability, v. 12, p. 1-19, 2020.
- Oliveira, Marilia Mitidieri F. ; Jorge Luiz Fernandes de Oliveira; FERNANDES, P. J. F; **EBECKEN, N. F. F.** Análise de tendências anuais e sazonais de extremos da Temperatura da Superfície do Mar próximo à costa da América do Sul no período de 1979 a 2018. REVISTA BRASILEIRA DE GEOGRAFIA FÍSICA, v. 13, p. 2531-2551, 2020.
- MAIA DA COSTA, ALVARO; V.M. COSTA, PEDRO; C.O. MIRANDA, ANTONIO; B.R. GOULART, MARIANA; D. UDEBHULU, OKHIRIA; **F.F. EBECKEN, NELSON**; C. AZEVEDO, RICARDO; M. DE ESTON, SÉRGIO; DE TOMI, GIORGIO; B. MENDES, ANDRÉ; R. MENEGHINI, JULIO; NISHIMOTO, KAZUO; MUELLER SAMPAIO, CLAUDIO; BRANDÃO, CAMILA; REDA, ALEXANDRE. Experimental salt cavern in offshore ultra-deep water and well design evaluation for CO₂ abatement. INTERNATIONAL JOURNAL OF MINING SCIENCE AND TECHNOLOGY, v. 31, p. 1-16, 2019.
- Pereira, G.C.; ANDRADE, L.P.; ESPÍNDOLA, R.P.; **Ebecken, N.F.F.** Ecological networks simulation by fuzzy ecotoxicological rules. ECOLOGICAL MODELLING, v. 409, p. 108733, 2019.
- DE OLIVEIRA, MARILIA MITIDIERI FERNANDES; **EBECKEN, NELSON FRANCISCO FAVILLA**; de Oliveira, Jorge Luiz Fernandes ; DE CASTRO JR, JOSÉ MARIA. Tropospheric NO₂ Monitoring Using the Multi-Axis Differential Optical Absorption Spectroscopy in Urban Area. ENVIRONMENT AND NATURAL RESOURCES RESEARCH, v. 9, p. 9-22, 2019.
-
- List of products/services to be brought into the project as background knowledge. Include references to external resources on the marketing material available (if any)

List of relevant previous projects or activities, connected to the subject of this proposal

Project name, funding body, link, objectives	Project contribution	Relevance and background knowledge exploited within SILVANUS
RADARSAT Images for oil spills and spills on the surface of the sea in the Gulf of Mexico and Brazilian Continental Margin: a Machine Learning Approach.	Efficient Classifiers using deep learning neural networks.	Remote Sensing
Elaboration of a Study on the Causes of the Geological Event in the City of Maceió	Probabilistic finite element analysis	High Performance Computing
Development of Machine Learning Techniques for Facies Identification, from X-ray Tomography of Carbonate Rocks, in Multiscale, for Fluid Flow Analysis	Deep learning image analysis	Intensive Data Processing

Convergent Network for Innovation	Natural Language processing for Innovation	Innovation Search
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Individual exploitation plan

Performing simulations and new analyses, making comparisons and looking for innovative strategies. The internal exploitation of project outcomes and the expected/projected revenue growth due to occur from the project participation can only be estimated when the work plan is established.

Communication strategy for promoting project outcomes

Use the communication sectors of UFRJ to disseminate the results obtained from the project. Promote the products developed in technological fairs and social networks for industry and business incubators. Participate in all technological dissemination events promoted by the government to alert the new strategies developed.

Description of significant infrastructure and major items of technical equipment relevant to the project

Use of Nacad's computational resources. The Advanced Core of High-Performance Computing (NACAD) at COPPE / UFRJ is a laboratory specialized in the application of high-performance computing to engineering and science problems in general, and other areas of knowledge.

Pilot description

The Pantanal is about 140,000–160,000 km² (54,000–62,000 sq mi), gently-sloped basin that receives runoff from the upland areas (the Planalto highlands) and slowly releases the water through the Paraguay River and tributaries. The formation is a result of the large, concave pre-Andean depression of the earth's crust, related to the Andean orogeny of the Tertiary. It constitutes an enormous internal river delta, in which several rivers flowing from the surrounding plateau merge, depositing their sediments and erosion residues, which have been filling, throughout the years, the large depression area of the Pantanal. This area is also one of the distinct physiographic provinces of the larger Parana-Paraguay Plain area, which encompasses a total of 1.5 million square kilometres (580,000 square miles).

The Pantanal is bounded by the Chiquitano dry forests to the west and northwest, by the Arid Chaco dry forests to the southwest, and the Humid Chaco to the south. The Cerrado savannas lie to the north, east and southeast. The Pantanal is a tropical wet and dry region with an average annual temperate of 21.5 °C (70.7 °F) and rainfall at 1,320 mm (52 in) a year.[9] Throughout the year, temperature varies about 6.0 °C (10.8 °F) with the warmest month being November (with an average temperature of 26 °C or 79 °F) and the coldest month being June (with an average temperature of 20 °C or 68 °F). Its wettest month is January (with an average of 340 mm or 13 in) and its driest is June (with an average of 3 mm or 0.12 in).

- Wildfires erupting in August have ravaged much of Brazil's Pantanal Matogrossense National Park, which is a part of the Pantanal region, the world's largest tropical wetland.
- Fires have so far consumed nearly 4.5 million hectares across the Pantanal, totaling about 30% of the biome and nearly 22 times the area lost between 2000 and 2018.

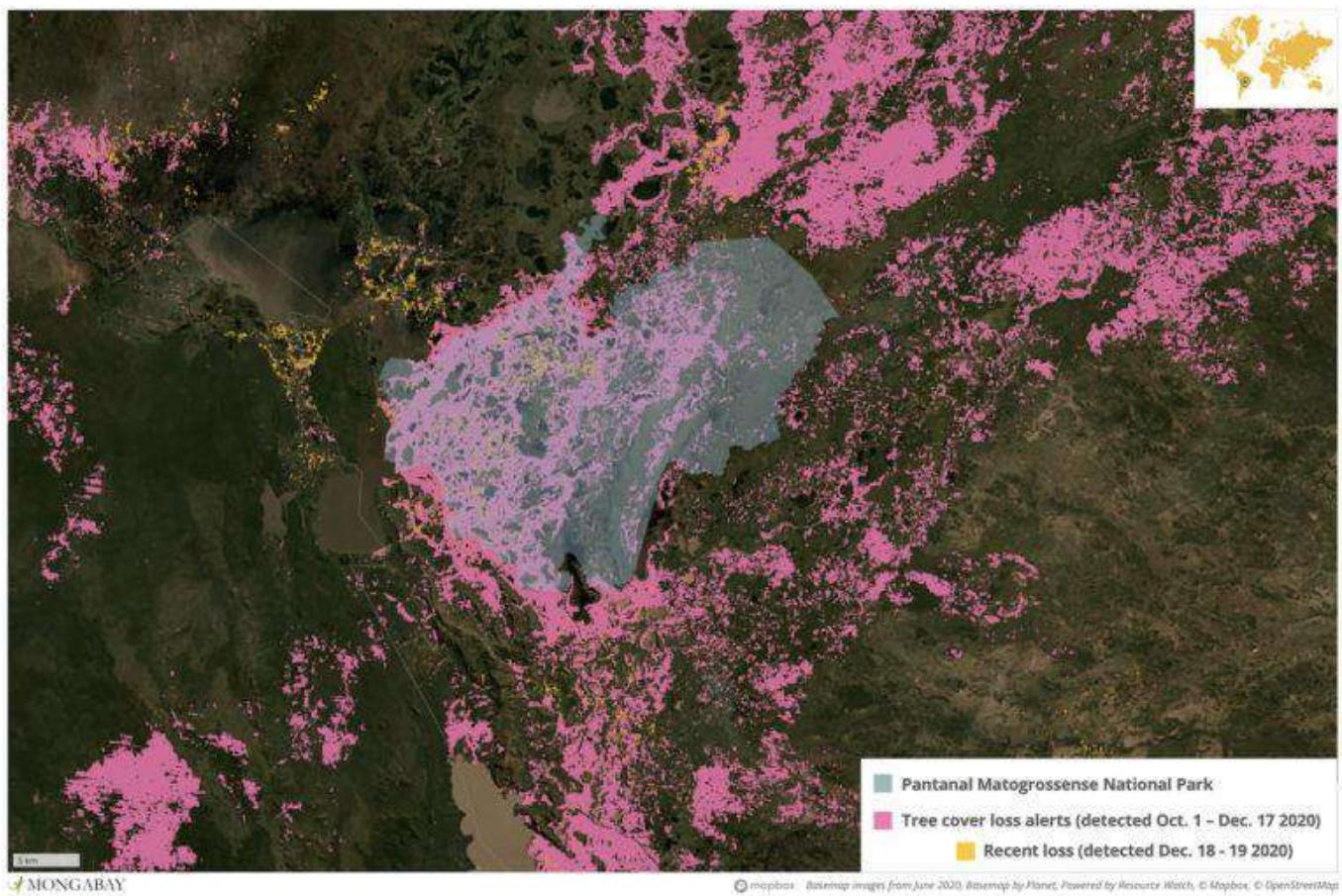


Figure 26 - Satellite data of areas of tree cover of Pantanal Matogrossense National Park following the latest spate of wide-ranging, out of control wildfires

The pilot will demonstrate Phase A and C activities within the region.

4.2 Third parties involved in the project (including the Use of Third-Party Resources)

4.2.1 P6. ATOS IT SOLUTIONS AND SERVICES IBERIA SL (ATOS)

Does the participant plan to subcontract certain tasks (please note that core tasks of the project should not be sub-contracted)	NO
<i>If yes, please describe and justify the tasks to be subcontracted:</i>	
Does the participant envisage that part of its work is performance by linked third parties? ⁵⁷	YES
<p>Atos IT Solutions and Services Iberia S.L will be supported by Atos Spain S.A (www.atos.net). Both companies are affiliated to the Atos Group. The research & innovation division of the Atos group (ARI) is composed of researchers and experts from several Atos group companies, including Atos Spain and Atos IT Solutions and Services Iberia S.L. The Atos Research & Innovation team taking part in the project are staff of both Atos IT Solutions and Services Iberia S.L. (main beneficiary) and Atos Spain S.A., and for this reason the latter will act as a third party of Atos Spain focused on the specific delivery in WP10 "Dissemination & Exploitation". Regarding the performance of Atos in SILVANUS, the expertise and activities of Atos Research and Innovation will be delivered by staff of two legal entities working effectively as a single team.</p>	
<ul style="list-style-type: none"> - list of tasks and subtasks they will be part of (the Part A will be adjusted accordingly) 	
WP10 Dissemination and exploitation <ul style="list-style-type: none"> T10.1 Self-sustainability models for the "Centre of Adaptation Strategies and Development (CASD)" T10.2 Exploitation of SILVANUS platform services T10.3 Dissemination and communication across global communities T10.4 Stakeholders' community building and management <p>15PMs total = 0.5 + 13.5 + 0.5 +0.5</p>	
Budget: <ul style="list-style-type: none"> a) Direct personnel costs declared as actual: 71,250.00 € f) Other direct costs: 3,000.00 € h) Indirect costs: 18,562.50 € j) Total costs: 92,812.50 € k) Maximum EU contribution (70%): 64,968.75 € l) Maximum grant amount: 64,968.75 € 	
Does the participant envisage the use of contributions in kind provided by third parties (Articles 11 and 12 of the General Model Grant Agreement)	NO
<i>If yes, please describe the third party and their contributions:</i>	

⁵⁷ A third party that is an affiliated entity or has a legal link to a participant implying a collaboration not limited to the action (Article 14 of the Model Grant Agreement).

5 Ethics

5.1 Ethics

5.1.1. Introductory remarks – Ethics self-assessment

SILVANUS highly values the EU considerations on the ethical and societal impact of research, giving priority on these issues already from the conceptual stage of the proposal. Having in mind that excellence is achieved by adhering to high ethical standards, SILVANUS is committed to ensuring that all the activities carried out within the Action shall comply with ethical principles and the applicable national, EU and international legislation.

Following the ethical requirements set by H2020 framework, under the “How to complete your ethics self-assessment” of the European Directorate-General for Research & Innovation Horizon 2020 Programme Guidance, Version 6.1 4 February 2019”, the ethical and social issues of SILVANUS, are assessed in order to enhance the quality of the research.

SILVANUS does not involve ethical issues related to Human Embryos/Foetuses, Human Cells/Tissues, Animals and Environmental Protection. However, the Project implementation includes ethical aspects related to humans, protection of personal data, dual use and misuse.

In addition, the Consortium commits itself to address the ethical dimension of the project and respect all principles representing the shared values of the EU.

Within this context, the Consortium shall respect the key ethical principles and the applicable national European and international legislation, such as:

- The Charter of Fundamental Rights of the European Union
- The European Convention on Human Rights and its additional Protocols
- The Universal Declaration of Human Rights, United Nations
- Ethics in Social Science and Humanities, European Commission, October 2018
- The H2020 Rules for Participation with special focus on articles 13 (“Proposals”), 14 (“Ethics Review”), 18 (“Grant Agreement”), 23 (“Implementation of Action”) as well as Articles 34 (“Ethics”) and 39 (“Processing of Personal Data”).
- The European Code of Conduct for Research Integrity, ALLEA (All European Academies) and ESF (European Science Foundation), 2017.
- Codified and widely accepted principles of research ethics and ethical treatment of research participants including the Nuremberg Code, the Helsinki Declaration, and the Belmont Report.

The Consortium will, in this spirit:

- respect human dignity and integrity
- ensure honesty and transparency towards research subjects
- respect individual autonomy and obtaining free and informed consent
- ensure privacy and confidentiality
- promote justice and inclusiveness
- minimise harm and maximise benefit
- demonstrate social responsibility
- commits itself to deliver high quality scientific outputs

The Consortium commits to responsible research, good practices and solid mitigation strategies from the early stages of the project’s lifetime and throughout its duration, especially during the management phase, trials, development of the platform, dissemination and communication phase.

For that reason, a dedicated Task (Task 1.6 - Ethics and Legal Management) has been created to monitor the ethics and legal issues that may arise during the research activities. KEMEA will be leading this task, ensuring the establishment of H2020 requirements, their communication with the Project Management Team and all partners will be contributing by providing information and requested documentation to demonstrate compliance with the highest standards of research integrity and the applicable national, regional and international law.

Considering the H2020 guidelines on “How to complete your ethics self-assessment”, the ethics checklist for SIL-VANUS is attached:

Section / question	Yes	No	Section
1. Human embryos & fetuses			
Does your research involve Human Embryonic Stem Cells (hESCs)?		NO	
Does your research involve the use of human embryos?		NO	
Does your research involve the use of human foetal tissues / cells?		NO	
2. Human beings			
Does your research involve human participants?	YES		323
Are the volunteers for social or human sciences research?	YES		323
Are they persons unable to give informed consent?		NO	
Are they vulnerable individuals or groups?		NO	
Are they children/minors?		NO	
Are they patients?		NO	
Are they healthy volunteers for medical studies?		NO	
Does your research involve physical interventions on the study participants?		NO	
3. Human cells or tissues			
Does your research involve human cells or tissues (other than from Human Embryos/Foetuses, see section 1)?		NO	
4. Personal data			
Does your research involve processing of personal data?	YES		323
Does your research involve further processing of previously collected personal data?	YES		323
Does your research involve publicly available data?	YES		323
Is it planned to export personal data from the EU to non-EU countries?	YES		323
Is it planned to import personal data from non-EU countries into the EU?	YES		323
5. Animals			
Does your research involve animals?		NO	
6. Non-EU countries			
In case non-EU countries are involved, do the research related activities undertaken in these countries raise potential ethics issues?		NO	
Is it planned to use local resources (<i>e.g.</i> , animal and/or human tissue samples, genetic material, live animals, human remains, materials of historical value, endangered fauna or flora samples, etc.)?		NO	
Is it planned to import any material from non-EU countries into the EU?	YES		323

Section / question	Yes	No	Section
Is it planned to export any material from the EU to non-EU countries?	YES		323
In case research involves low and/or lower-middle income countries, are any benefit-sharing actions planned?		NO	
Could the situation in the country put the individuals taking part in the research at risk?		NO	
7. Environment, health & safety			
Does your research involve the use of elements that may cause harm to the environment, to animals or plants?		NO	
Does your research deal with endangered fauna and/or flora /protected areas?		NO	
Does your research involve the use of elements that may cause harm to humans, including research staff?		NO	
8. Dual use			
Does this research involve dual-use items in the sense of Regulation 428/2009, or other items for which an authorisation is required?	YES		323
9. Exclusive focus on civil applications			
Could your research raise concerns regarding the exclusive focus on civil applications?		NO	
10. Potential misuse of research results			
Does your research have a potential for misuse of research results?	YES		323
11. Other ethics issues			
Are there any other ethics issues that should be taken into consideration?		NO	

5.1.2 Ethical Considerations in the context of SILVANUS activities

5.1.2.1 Ethical Monitoring

The SILVANUS Consortium having consciousness on the significance of the legal and ethical aspects, envisages all related challenges which may be raised during the project and is determined to uphold ethical standards. To this end, specific tasks have been developed, to tackle all potential related issues; at the same time, the Ethics Advisory Board (EAB) has been set up. At the same time, an Ethics Advisory Board (EAB) has been set up to monitor throughout the project legal and ethical issues. More specifically the EAB will give advice on the legal and ethical issues that will arise over the course of the project as well as, review the identified ethics sensitive deliverables to mitigate potential risks related to legal or ethical matters. The EAB has the following composition:

- **Ethics Officer (EO):** Leader of the EAB, will appoint internal ethics advisors and external ethics advisors.
- **Internal Ethics Advisors (IEA):** will work closely with EO and EEA to ensure compliance with the Ethics rules and requirements in place at European and national level
- **External Ethics Advisors (EEA):** will revise independently ethical issues to ensure compliance with the Ethics rules and requirements in place at European and national level.

The following paragraphs the Consortium address the identified ethical challenges of SILVANUS, focusing on:

- Human Beings
- Protection of personal data
- Environment, Health and Safety

- Dual use
- Exclusive focus on Civil applications
- Potential Misuse of Research Results

5.1.2.2 Human embryos & foetuses

SILVANUS **does not** involve research on human embryos & foetuses.

5.1.2.3 Human beings

SILVANUS research activities involve human beings, who will be participating voluntarily.

They **do not** involve as research participants **neither**:

- a) persons unable to give informed consent, including children and minors or
- b) any vulnerable individuals or groups or
- c) patients or healthy volunteers for medical studies or
- d) physical interventions on the study participants.

SILVANUS is planning the conduct of pilot trials respectively, with different scenarios, corresponding to the combination of different factors leading to forest fires and the effects, fires have, on the environment of forests in different regions of Europe and outside of it.

It is foreseen that the human beings that may be recruited as research participants in the SILVANUS trials (organized by PIU, FINC, SIMAVI, AUA, EDP, FRB-MSR, RINI, TUZVO-PLAMEN-UISAV, hosted in France, Italy, Romania, Greece, Portugal, the Czech Republic, Croatia, Slovakia) will be healthy adults internal to the Consortium (*e.g.*, members of the Consortium partners, citizens, first responders, public administration officers / civil servants and researchers). The participants will be adequately informed about their participation to the trial and their informed consent for their participation will be requested priorly. The participants will be informed about the benefits and risks -if any- stemming from their participation and have enough time to decide on their participation freely and voluntarily. They will be, among others, informed that, in case they wish to withdraw from their participation in the trials, they will be free to do so, without any repercussions, at any time.

Additionally, events, conferences, workshops, exhibition fairs, webinars and trainings will be organized during the project lifetime, under its dissemination purposes. The participation of the following groups is envisaged in these cases: citizens, first responders, public administration officers / civil servants and researchers. In many cases, the participants will be members of the Consortium. A distinction will be made for members of the Consortium whose participation will be *necessary* for the conduct of the Consortium's activities (project management purposes- Consortium meetings). As regards the participation of externals to the projects' activities or to internals to the Consortium in other research activities, such as pilot demonstrations, they will be conducted under the free and fully informed consent of the research participants. We will inform all people involved about their rights and about potential risks (if any). Our research methodologies will not result in discriminatory practices or unfair treatment. The participants will not suffer any psychological, social, legal, economic, environmental harms.

To ensure employees are not coerced to participate, it is important that participation in research is not linked to career progression or employee evaluation. Each employer will support the participation of employees, but the recruitment will be purely voluntary. To ensure that consent is **voluntary, 'opt in' and 'opt out'** option to their participation will be provided to the potential participants. In addition, the team will ensure that participation is entirely voluntary throughout the demonstrations and workshops by informing the research participants that they can **withdraw** without penalty at any time.

Advice will be requested by the EAB on the recruitment of human participants, the methodology used within trials, workshops, and other research activities. OAB will contribute on this.

The Consortium may use relevant material (such as photos) for dissemination and communication purposes, under the explicit consent of the data subjects. Their participation in such activities will not be dependent on their consent for the processing of their personal data for dissemination purposes (Recital 43 GDPR).

All in all, to ensure that consent during all SILVANUS research activities will be **informed**, we will prepare participant **Information Sheets** written in lay terms to ensure that it is "user friendly" and that it will meet the information

needs of the potential participants who will be informed that they can ask questions regarding their participation. **Information Sheets** will be explaining, *inter alia*, what the project is about, what participation would involve, the entirely voluntary participation and verification of absence of any form of obligation or coercion, who are the organization's contact persons, the right to withdraw at any time without providing any explanation or justification and without any consequences, what data will be collected and the rights to modify or delete (if any), benefits and disadvantages (if any) of participating, potential risks and mitigation measures.

Further to this, participants will be provided with an **informed Consent Form**, in order to decide about to their participation or not. The option of providing oral consent before participating will be explored. To ensure that consent is competent, the team will discuss the project with all trial/workshop etc. volunteers and check for any signs that the potential participants do not have the capacity to consent (*e.g.*, is sleep-deprived, intoxicated etc.).

Overall, the Consortium will be providing information with regard to human participation procedures and will contain, if applicable:

- The procedures and criteria that will be used to identify/recruit research participants.
- The informed consent procedures that will be implemented for the participation of humans.
 - Templates of the Informed Consent forms and Information Sheets covering the voluntary participation (humans).
 - Clarification that children and/or adults unable to give informed consent will **not** be involved.
 - Clarification that vulnerable individuals/groups will **not** be involved.
 - Details on incidental findings policy

5.1.2.4 Human cells or tissues

SILVANUS **does not** involve research with human cells or tissues.

5.1.2.5 Protection of personal data

SILVANUS will be adhering to the standards of the following legislation, when applicable:

- **Regulation (EU) 2016/679** of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation) (Text with EEA relevance).
- **Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications)**

In principle, SILVANUS is not a project that does primarily aim at the processing of personal data. Taking into consideration though, that its activities include trials and workshops or other events it cannot be excluded that, when necessary, personal data may be processed, while at the same time, for the purposes of the Project, specific technology will be used (sensors) to draw conclusions on the impact of fires to first responders and citizens.

Firstly, as regards SILVANUS trials, their purpose is to test the platform or retrieve anonymous information that will permit to conclude on how fires affect persons and **not to** identify or uniquely identify a person; however, personal data shall be collected (as far as trials are concerned personal data may incidentally be retrieved). SILVANUS Consortium will ensure that it complies with the personal data protection framework and among others, with the principles of **lawfulness, fairness, transparency, purpose limitation, data minimisation, accuracy, storage limitation, integrity and confidentiality (security) and accountability**. Additionally, a **Privacy by Design** approach will be pursued through the technology design, in coordination with the Consortium. As explained above, the data subjects participating in the trials will be provided with an Information Sheet and will be requested to provide their informed consent for the processing of their personal data, prior to the respective activity.

As for the workshops or other events, when necessary, basic personal data of the participants will be collected, such as their contact information (*e.g.*, necessary for the performance of the Grant Agreement, such as for communication

purposes or project management purposes). In case photos are taken or a video/audio is recorded for dissemination purposes, the participants will be asked to provide their explicit consent.

The consortium will ensure that **appropriate technical and organisational measures** are implemented to ensure a level of security appropriate to the potential risks for the data subjects in the event of unauthorised access to, or disclosure, or accidental or unlawful destruction, or loss, or alteration of their data. Examples of the safeguards to be used are indicatively: pseudonymisation/ encryption/anonymisation of personal data where necessary; use of dummy data when possible; the ability to ensure the ongoing confidentiality, integrity, availability and resilience of processing systems and services; the ability to restore the availability and access to personal data in a timely manner in the event of a physical or technical incident; physical security measures.

As **informed consent** is the cornerstone of research ethics, it shall be given by a clear affirmative act establishing a freely given, specific, informed and unambiguous indication of the subject's agreement to the processing of their personal data. Therefore, we will ensure that:

- Informed consent procedures will be implemented for the processing of personal data of the data subjects and
- Templates of the Informed Consent forms and Information Sheets on the processing of the data subjects' personal data will be provided.

The data subjects who will be participating in the trials and workshops or other events, will be fully informed about their personal data handling during the data lifecycle, including: where and how their personal data will be stored, who will have access rights to it, how long it will be stored, how it will be anonymised and processed and when it will be securely deleted. They will be also informed about their data protection rights and specifically the right to request information, the right to access, the right to rectification, the right to erasure, the right to the restriction of the processing operations, the right to data portability, the right to lodge a complaint with a supervisory authority and the right to withdraw their consent at any time.

Further processing of previously collected personal data (secondary use) might occur, in case of social media networks used for social sensing by the Centre for Research and Technology Hellas . Material will be collected from open sources (publicly available data). The data minimisation principle will be strictly followed. Appropriate safeguards (anonymisation/ pseudonymisation/ encryption techniques) will be implemented. The data controller will consult the Data Protection Officer of the organization/entity (if applicable).

Our research **does not** include tracking or observation of the participants, as trials will be taking place in simulated conditions, under specific scenarios, with the participation of volunteers under a specific timeline with no real consequences for the participants.

The Consortium is going to issue internal guidelines to respect all related ethical issues, including the protection of personal data, under **Task 1.6**. The methodology to be applied personal data handling during the project activities including trials and workshops will be subject to approval by the EAB. Additionally, the Data Management Plan to be developed under **Task 1.4** will include the procedures for data handling and ethics aspects on personal data handling.

5.1.2.6 Animals

SILVANUS research activities **do not** involve animals.

5.1.2.7 Does your research involve non-EU countries? Yes

There are 3 non-EU countries participating in the project: Australia, Brazil and Indonesia.

In relation to (potential) transfer of personal data outside the EU, and more specifically in Australia, Brazil and Indonesia, adequate level of protection of natural persons will be ensured by applying either article 46 ("*Transfers subject to appropriate safeguards*"), either article 47 ("*Binding corporate rules*") or article 49 ("*Derogations for specific situations*") GDPR. In case any personal data of European citizens are processed in Brazil, Indonesia and Australia during the lifetime of the project, GDPR is applicable and compliance with EU law has to be demonstrated. The data subjects will be fully informed via Information Sheets about such processing and Consent Forms will be signed. In case of transfer of personal data from Australia, Brazil and Indonesia to the EU, confirmation of compliance with the laws of the country in which the data was collected will be sought.

In relation to research and countries outside EU, it is possible that research will be conducted partially or wholly, in a non-EU country, or that participants or resources come from a non-EU country or that material is imported from or exported to a non-EU country.

It is ensured in all aforementioned cases that human beings will participate in the research only if they are wholly comfortable with being part of a research project conducted by researchers from outside their own country, only if they are fully aware of what will happen to their data and they will not subject to any undue pressure to participate (participation on a voluntary basis).

If researchers decide to voluntarily participate in trials outside of the EU, a risk assessment will be undertaken and appropriate safety measures will be taken; the possibility to include insurance cover or health and safety measures will be examined, such as no lone working, contact points via phone, counselling support, etc.

We will NOT use local resources should research activities be undertaken in Australia, Brazil and Indonesia (if any).

Technological resources may be transferred across borders; if this is the case, Consortium will examine if it is necessary to obtain an authorisation for the transfer, and if an agreement which describes the conditions for the export and the terms of utilisation and is necessary. (See also dual use.)

The situation in the country could NOT put the individuals taking part in the research at risk. Australia and Brazil are included in the high-income economies, while Indonesia is listed under the upper-middle income economies.

5.1.2.8 Environment & Health & Safety

SILVANUS is **not** a project that may adversely affect either the environment or the health & safety of the researchers involved.

Our research **does not** deal with endangered fauna and/or flora and/or protected areas. To the point that it does (in the sense that this project aims to combat against the ignition and spread of forest fires), research is made in order to protect fauna and/or flora and/or protected areas. There is no experimental design of the research that could lead to such consequences nor do the technologies used have undesirable side-effects. In any case, taking into consideration that the trials are going to be conducted under the supervision the respective Partner of the Consortium, which will ensure that all appropriate physical safety and security measures will be implemented, guaranteeing the safety and integrity of all research participants.

Demonstration that appropriate health and safety procedures, conforming to relevant local/national guidelines/legislation, are followed for participants, involved in this project, during the trials will be submitted by the respective partners to ensure the safety and physical integrity of all human participants.

5.1.2.9 Dual Use

Within the frame of SILVANUS exporting of technologies (such as software and sensors) may take place, should it be decided that trials will be deployed in the country of a non-EU SILVANUS Partner, i.e. in non-EU territory. Whenever exporting of technology takes place, such exporting will be made only after the appropriate authorizations, declarations, statements or export licenses are provided by the respective partners. The Consortium will act applying Regulation 428/2009.

5.1.2.10 Exclusive focus on civil applications

Our research focuses **exclusively** on civil applications and could **not** raise any concerns.

5.1.2.11 Misuse

The technologies, methods and knowledge used in SILVANUS are developed for ethical purposes and under the objective to enhance resilience towards risks in forest fires. A brief assessment of the risk for the misuse of research findings will be conducted if necessary and appropriate measures to prevent it will be implemented. The EAB will be monitoring the relevant deliverables throughout the project to avoid the potential for misuse.

In relation to personal data collected and processed during the SILVANUS Project (as described above), the consortium will consider and decide, if necessary, on risk mitigation measures (physical, technical) including, indicatively: anonymization, pseudonymization, encryption of data; use of dummy data where possible; physical security measures to prevent unauthorized access to the system; technical mechanisms to protect information from being accessed by unauthorized parties; signing of confidentiality/non-disclosure agreements not only between the partners but also with third parties and/or any affiliated entities participating in the project; regular verification of the effectiveness of technical and organisational measures for ensuring continuous security.

Furthermore, it is ensured that special caution will be given when publishing or otherwise disseminating results. In addition, specific deliverables will be of restricted nature.

5.1.11. Other Ethics Issues

Our research **does not** raise any additional ethics issues.

5.2 Societal Impact

The societal self-assessment is as follows:

Table 7. Societal impact table

Section / question	Yes	No	Section
Does your research meet the need of society?			
Q1. Does the proposed research address document societal security need(s) (e.g., life, liberty, health, employment, property, environment, values)?	YES		1.31
Q2. Does the research output meet these needs? Will this be demonstrated? Will the level of societal acceptance be assessed?	YES		1.31
Q3. Does the research address threats to society (e.g., crime, terrorism, pandemic, natural and man-made disasters, etc.)?	YES		1.31
Q4. Does the proposed research address in an appropriate way these threats?	YES		1.31
Does your research benefit society?			
Q5. Do segment(s) of society benefit from the proposed research?	YES		1.31
Q6. Does society as a whole benefit from the proposed research?	YES		1.31
Does your research have negative impact on society?			
Q7. Are there other European societal values that are enhanced by the proposed research e.g., public accountability and transparency; strengthened community involvement; human dignity; good governance; social and territorial cohesion; sustainable development, etc.?	YES		1.31
Q8. If implemented, could the research have a negative impact on the rights and values enshrined in the Treaties (e.g., freedom of association, freedom of expression, protection of personal dignity, privacy and data protection)?		NO	
Q9. If implemented, could the research impact disproportionately upon specific groups or unduly discriminate against them?		NO	
Q10. Will specific measures be taken to ensure that the research outcomes comply with the European Charter of Fundamental Rights and to mitigate against any of the negative impacts described above?	YES		1.31

In the following section, answers have been provided to the call-specific questions:

5.2.1 The proposed research address documented societal security need(s) (e.g. life, liberty, health, employment, property, environment, values).

The SILVANUS project has been formulated to produce an innovative and integrated approach to create a framework, tools, solution and platform for implementing improved real-time, evidence-based security management of forest fires and provide recommendations for policy planning, engagement of the civil society and first responders.

SILVANUS addresses the issue of coordinating and improving the response to threats and incidents through enhancing security management of forest fires and information sharing with the competent authorities.

Specifically, SILVANUS responds to the right to life, by attempting to eliminate fatalities from wildfires, reduce accidental fire ignitions, emissions from wildfires, control of any extreme and potentially harmful wildfire, better

protect Natura 2000 protected areas to be fire-resilient, reduce building losses, increase surface area of prescribed fire treatments at EU level.

SILVANUS is a part of realising European Union's priority "to boost the EU's ability to predict and manage environmental disasters". SILVANUS aims to protect the EU community and its citizens from multiple threats, and the ways under which this is achieved, has direct implications for life and the safeguarding of European values.

5.2.2 The research output meets these needs and specific demonstrations will take place. The level of societal acceptance will be addressed.

SILVANUS will contribute towards the protection of human lives and protection of nature, by providing tools and methodologies to detect and manage risks related to forests. This will be demonstrated through the implementation of trials. Trials will be hosted in France, Italy, Romania, Greece, Portugal, the Czech Republic, Croatia, Slovakia and in non-EU countries, such as Indonesia, Australia and Brazil with different scenarios, corresponding to the combination of typical forest fires that different regions have to cope. Testing and validation in different locations will provide a variety of feedback to the effectiveness of the suggested solutions under different environmental and social conditions. The level of societal acceptance will be addressed under a specific task, that of 6.5 dedicated to citizen's engagement.

In addition, the project platform provides a holistic ability for the regional and national authorities to monitor forest resources, evaluate the biodiversity index, generate fire danger index and promote safety regulations among citizens through awareness campaign. The project will carry out detailed **training programme** and activities to support fire brigade organisations on the utilisation of the project outcomes. SILVANUS will also **develop community engagement tools** to engage with citizens and promote fire safety awareness among stakeholders to support the evacuation process and procedures. Finally, the case studies will lead to the **development of policy recommendations** on the effective use of technological systems in combating the initiation and spread of wildfires in compliance with the legal and ethical regulations for wide-spread social acceptance.

5.2.3 The research address threats to society (e.g. crime, terrorism, pandemic, natural and human made disasters etc.)?

The SILVANUS project seeks to respond to forest fires and delivers an environmentally sustainable and climate resilient forest management platform that offers innovative capabilities to combat against the ignition and spread of forest fires. The platform will cater the demands of efficient resource utilisation and provide protection against threats of wildfires encountered globally. The project platform brings together synergies from (i) environment; (ii) human aspects and (iii) scientific innovation to provide a holistic ability for the regional and national authorities to monitor forest resources, evaluate the biodiversity index, generate fire danger index and promote safety regulations among citizens through awareness campaign. Its pilot trials are focusing on the three phases of wildfires management: Phase A: Prevention and preparedness, Phase B: Detection and Response, Phase C: Restoration and adaptation. It is therefore a project that addresses threats to society provoked by natural and human disasters, i.e. wildfires.

5.2.4. The proposed research addresses these threats in an appropriate way.

The wildfires threats are addressed in an appropriate way, fulfilling the highest standards of research integrity and H2020 ethics requirements. SILVANUS Consortium has taken into account the existing society and authorities' needs and complying with the legal and ethical requirements applicable. The project addresses wildfires in a multitude of areas, aiming to create a platform for the protection against threats of wildfires encountered globally. The various work packages study past events, current policies in preventing and fighting wildfires as well as for restoring the ecosystem. Land management, forest management, detecting technologies, interaction with citizens and other key actions will be used to minimize wildfires occurrence and impacts.

5.2.5 Segments of society and society as a whole benefits from the proposed research.

The research benefits not only specific segments of society (e.g., academia, industry, fire brigades, health care providers and citizens) but also society and the environment as a whole.

It is expected that both the first responders and the general public will benefit from the effective prevention strategies adopted, preparedness activities, executed trials and innovative use of social media and advanced technological solutions (e.g. UAVs, UGVs) towards a zero fatality from wildfires. In addition, loss of lives in burning building due to wildfires will be reduced, in WUI areas.

Environment will benefit through reduced accidental fire ignitions and reduction in emissions from wildfires. Natura 2000 protected areas will be enhanced towards fire-resilient areas. Animal life and ecosystems will be better protected.

Confidence to the financial sector to ensure structure properties that are affected by forest fires will be enhanced due to improved land management and risk assessment methodologies.

5.2.6 European societal values are enhanced by the proposed research e.g. public accountability and transparency; strengthened community involvement; human dignity; good governance; social and territorial cohesion; sustainable development etc.

The technological platform of the SILVANUS project will integrate resilience models, environmental and ecological studies carried out through the assessment of fire risk index for continuous monitoring of forests. Training programmes for first responders with the support of AR/VR will be developed during the implementation of SILVANUS. Community engagement tools will also be created in order to engage and promote fire safety awareness among citizens and other stakeholders. Policy recommendations will be developed on the effective use of technological systems for combating wildfires and restoring the ecosystem. SILVANUS will aggregate environment, human aspects and scientific innovation for sustainable development, territorial cohesion, strengthened community involvement, good governance, human dignity against wildfires.

During the project duration where the different phases of the plot timeline are addressed, the counter-tools that will be assessed as well as the operational models have to comply with the data protection legal framework (taking into account the General Data Protection Regulation 679/16/EU) must follow the directives respecting the personal data protection and the core. We conduct our research in compliance with purpose limitation principle and the proportionality principle (including data minimisation). SILVANUS will address ethical issues from the outset in a consistent and coherent way. By the design and deployment of counter-tools and operational models we shall consider and deal with all ethical and legal issues that may arise.

Lastly, protecting forests and nature, aims directly to and safeguards sustainable development.

5.2.7 Negative impact

The research is not foreseen to have a negative impact either on society or on the rights and values enshrined in the Treaties (e.g. freedom of association, freedom of expression, protection of personal dignity, privacy and data protection).

Negative, unbalanced or discriminatory impacts are not foreseen either on society or on the rights and values enshrined in the Treaties (e.g. freedom of association, freedom of expression, protection of personal dignity, privacy and data protection). In any case, the ethical monitoring of the project performed by the EAB which will ensure that if they were to arise, they will be handled promptly, pertinently and with due respect for fundamental rights and values. A specific task, that of 1.6 is dedicated to this objective.

5.2.8 Non-discrimination

The research could not impact disproportionately upon specific groups or unduly discriminate against them.

5.2.9 Fundamental rights compliance

Specific measures will be taken to ensure that the research outcomes comply with the fundamental rights under Task 1.6 with a focus on the protection of personal data, privacy and the free movement of persons.

The research outcomes of SILVANUS project will be fully compliant with the mandates of the “Charter of Fundamental Rights” of the European Union, as well as the “European Convention on Human Rights” of the Council of Europe. Therefore, the results of the research conducted by SILVANUS project are taking thoroughly into consideration the universal values of human dignity, freedom, the rights to personal data protection and privacy.

The project will be ethically monitored during its lifetime, from its start until the end as envisioned under Task 1.6. This Task will manage the ethical aspects of the project as well as the legal framework for the project solutions, ensuring that they comply with the national, regional and international legal standards.

ANNEX A: Informed consent template

Templates of Information Sheets and Informed Consent Forms

ANNEX A: INFORMATION SHEET FOR PARTICIPATION IN RESEARCH

Dear participant,

You are invited to take part in an interview/questionnaire/pilot carried out as part of the H2020 EU funded SILVANUS research project. In the context of Task <number of the Task> Deliverable <number of the deliverable> ‘<title of the deliverable>’ of the SILVANUS project (Task Leader: <name of the Task leader>), <full description of the task>.

Before you decide to participate in the present **interview/questionnaire/pilot**, please, be informed of the following details and, if you wish, consent to your participation by signing the hereby attached Consent Form.

What is the SILVANUS research project about?

[Description of the project]

Why have you been asked to take part?

You were asked to take part in this research activity due to [participation/recruitment criteria].

What will you need to do?

For the purposes of the current research activity you will participate in the interview/questionnaire/pilot carried out as part of <number of the deliverable> and give your answers via audio recording/on paper/online.

Where will this take place?

This research activity will take place at <add location>.

How often will you have to take part, and for how long?

You will take part once. The interview/questionnaire/pilot will last <number> minutes/hours/days/months.

Who will be responsible for all the information when the research activity is over?

Responsible for the interview/questionnaire/pilot and for the information kept on the Consent Form will be the researcher (see contact details below).

What will happen to the information when the research activity is over?

<Description depending on the specific conditions of each research activity>

The information on the hereby attached Consent Form will be kept securely by the researcher/data controller during the lifecycle of the SILVANUS project and for a 5-year period after its completion (until ...) according to Articles X of the SILVANUS Grant Agreement.

How will the SILVANUS Consortium use what they find out?

As it has been stated above, the Task Leader has to draft a specific report based on the results of interviewing users/carry out a pilot. This report/pilot ... <description>.

How will the SILVANUS Consortium deal with incidental findings?

An incidental findings policy exists and is included in one of the project’s ethics deliverables (DX.X).

No incidental findings are anticipated during the interview/questionnaire. /

It is likely that incidental findings occur during the use-cases (WPX). The anticipated incidental findings are [possible incidental findings]. Depending on the nature of the findings, different procedures will be followed *ad hoc* in accordance with the relevant international, European and national legislation. Prior consultation of the legal and ethical experts involved in the project will be requested.

How long is the whole SILVANUS research likely to last?

The duration of the project is [... months].

How can you find out about the results of the study?

The results of the carried-out interviews/pilots will be reported by the Task leader in the context of <number of the deliverable> of the SILVANUS Grant Agreement. This report is confidential according to the Grant Agreement, in other words, the results are available only amongst the Consortium.

Are there any foreseeable risks, discomfort or disadvantages that might ensue?

There are no foreseeable risks, discomfort or disadvantages. /

There are the following risks...<description of the risks, if any>.

Are there any benefits?

<Description of the benefits>

When will you have the opportunity to discuss your participation?

The present Information Sheet and the attached Consent Form for participation in research will be provided to you **before** the interview/questionnaire/pilot and you will have time to carefully read them before deciding.

What if you do not wish to take part?

Your participation is **totally voluntary**. You have the right to **entirely or partially** refuse to participate and your refusal will not disadvantage you in any way.

What if you change your mind during the study?

In that case, you are free to **withdraw your consent** to your participation from any part of the present activity **at any time, without consequences**.

Who is the contact person?

In case you have any questions and concerns or if adverse effects occur after this research activity you can contact<name and contact details of the researcher (both partner/legal entity and the natural person carrying out the research activity)>. For the exercise of your rights related to data protection you may contact <contact details of the DPO, if any> or the researcher.

**ANNEX B: INFORMED CONSENT FORM
FOR PARTICIPATION IN RESEARCH**

Hereby I, (name, surname)

	YES	NO
I have read the Information Sheet for this research activity, i.e. for the interview/questionnaire/pilot that will be carried out as part of <deliverable number and title> of the H2020 SILVANUS research and innovation project.		
My questions about the research activity have been answered to my satisfaction and I understand that I may ask further questions at any point.		
I understand that I am free to withdraw from the research at any time without giving a reason for my withdrawal without any consequences to my future treatment by the researcher.		
I agree to provide information to the researchers under the conditions set out in the Information Sheet.		
I wish to participate in the research (interview, questionnaire, pilot) under the conditions set out in the Information Sheet.		
I consent to the information collected for the purposes of this research activity, once anonymised (so that I cannot be identified), to be used for any other research purposes related to the SILVANUS project.		

I have received a copy of the Information Sheet for Participation in Research.

<Place, Date>

Researcher's Name and Signature:

Participant's Signature:

ANNEX C: INFORMATION SHEET FOR DATA PROCESSING

Dear participant,

We inform you that in the context of Task <number of the task> Deliverable <name and title of the deliverable> of the SILVANUS project (Task Leader <name of the partner leading the task>), a specific report/pilot ...<description of the report/pilot according to the task>. The interview/questionnaire/pilot will involve processing of your personal data.

Data controller:

<Name of the partner responsible><contact details>

Data Protection Officer:

<Name of the DPO><contact details>

Types of personal data to be processed:

Your <types of personal data, e.g. name, email address, voice, other> will be processed by the data controller for the purposes mentioned below.

Purposes of the processing:

Personal data will be processed for the purpose of carrying out an interview/questionnaire/pilot in the context of <deliverable number>.

- 1.<type of personal data and specific purpose>
- 2.<type of personal data and specific purpose>

We will not use personal data for any other purpose, unless a new legal basis exists, in which case you will be notified accordingly or asked for renewed consent.

Legal basis for the processing:

Personal data which is collected as part of the interview/questionnaire/training pilot is processed by the data controller **based on your consent** (see attached the Informed Consent Form to be signed).

Recipients:

<name of the recipient(s) if any>

Transfer to non-EU countries/international organisations:

The personal data is processed in Europe.

No transfer to non-EU countries or international organisations is foreseen. / Personal data will be transferred to the SILVANUS partner(s) from the <non-EU Countries>. All appropriate safeguards have been implemented.

Storage period:

Personal data (e-mail address, voice, other) is retained by the data controller for as long as it is necessary to fulfil the purposes for which it was collected, and in any case no more than the lifecycle of the project. After this period, the information will be permanently deleted.

Personal data on the attached Consent Form will be retained by the data controller during the lifecycle of the project and for a 5-year period after its completion according to Articles X of the SILVANUS Grant Agreement.

Rights of the data subject:

You have the right to:

- Request information about whether we hold personal information about you, and, if so, what that information is and why we are holding it.

- Request access to your personal information. This enables you to receive a copy of the personal information we hold about you and to check that we are lawfully processing it.
- Request rectification of the personal information that we hold about you. This enables you to have any incomplete or inaccurate information we hold about you corrected.
- Request erasure of your personal information. This enables you to ask us to delete or remove personal information where there is no good reason for us continuing to process it.
- Request the restriction of processing of your personal information. This enables you to ask us to suspend the processing of personal information about you.
- Request transfer of your personal information in an electronic and structured form to you or to another party (right to “data portability”). This enables you to take your data from us in an electronically useable format and to be able to transfer your data to another party in an electronically useable format.
- Lodge a complaint with a supervisory authority.
- Withdraw your consent at any time. Please note that the withdrawal does not affect the processing of your data which is based on the consent you have given before the withdrawal. Once we have received notification that you have withdrawn your consent, we will no longer process your personal information for the purpose/purposes you originally agreed to.

Contact:

For the exercise of your rights and for any other data-related information, you may contact:

the **Data Protection Officer** of <name of the partner being the data controller> by sending an e-mail to <name and e-mail address of the DPO of the partner> or calling <telephone number of the DPO of the institution> or, alternatively,

the **data controller**<name of the partner> by sending an email to <name and e-mail address of the person responsible on behalf of the data controller> or calling <telephone number of the person responsible on behalf of the data controller>.

6 Security

The SILVANUS project involves neither activities nor results raising security issues nor EU-classified information as background or results.

Activities or results raising security issues: No

EU-classified information as background or results: No

Annex 1: Expression of interest /Letters of commitment to join the External Advisory board



BPR: 80002 / KO: 80002

Naziv dokumenta Document Name	Broj dokumenta Document No.	Datum dokumenta Document Date	Verzija / Nivo Rev. / Level	Oznaka CLS
DOPIS LETTER	21093800085	22.1.2021.	1/0	DOP-21-00085/1

UNIVERSITY OF APPLIED SCIENCES VELIKA GORICA
Adress: Zagrebačka 5, 10410 Velika Gorica,
Croatia
E-mail: projekti@vvg.hr

Predmet Subject
Sub: Expression of interest to support the SILVANUS project submitted to LC-GD-1-1-2020: Preventing and fighting extreme wildfires with the integration and demonstration of innovative means. Subtopic 1 (IA).

I, on behalf of the Energy Institute Hrvoje Požar, would like to confirm our interest in supporting the project titled "**SILVANUS: Integrated Technological and Information platform for wildfire management**", if funded by the European Commission under the research programme Horizon 2020 LC-GD-1-1-2020: Preventing and fighting extreme wildfire with the integration and demonstration of innovative means, subtopic 1 (IA).

We see potential in this project because its activities are structured to bring together triple synergies from (i) environment; (ii) human aspects and (iii) scientific innovation. The project outcomes will deliver holistic ability for the regional and national authorities to monitor forest resources and evaluate biodiversity index and promote safety regulations among citizens. The novelty of the SILVANUS platform lies in the **development and integration of advanced semantic technologies to systematically formalise** the knowledge of forest administration and resource utilisation. Additionally, the platform will integrate **big-data processing framework** capable of analysing heterogeneous data sources including earth observation resources, climate models and weather data, continuous on-board computation of multi-spectral video streams. Also, the project integrates a series of **sensor and actuator technologies using innovative wireless communication infrastructure** through the coordination of aerial vehicles and ground robots.

The project will also carry out detailed **training programme** and activities to support fire brigade organisations on the utilisation of the project outcomes. Finally, the project will **develop community engagement tools** to efficiently and effectively engage with citizens and promote fire safety awareness among stakeholders to support the evacuation process and procedures. The case studies demonstrated within the project, will lead to the **development of policy recommendations** on the effective use of technological systems in combating the initiation and spread of wildfires in compliance with the legal and ethical regulations for wide-spread social acceptance.

Through this letter, we acknowledge our support to University of Applied Sciences Velika Gorica in this project and we believe that the outcome of this project can have a lasting positive effect.

Yours sincerely,
[Dražen Jakšić, director]

Date: 25.1.2021
Location: Zagreb

ENERGETSKI INSTITUT
HRVOJE POŽAR
ZAGREB, SAVSKA CESTA 163

Energetski Institut Hrvoje Požar / Energy Institute Hrvoje Požar | Savska cesta 163, Zagreb, Hrvatska / Croatia
tel: +385 1 6040 589 | fax: +385 1 6040 589 | www.eihp.hr | eihp@eihp.hr | OIB / PIN: HR43980170614
MBS / RNS: 080162843 Trgovački sud u Zagrebu / Commercial Court in Zagreb
IBAN: HR8424020061100820670, Erste&Steiermärkische Bank d.d., Rijeka
Ravnatelj / CEO: Dražen Jakšić



str. 1 / 1



UČKA
Park prirode
Nature Park

JAVNA USTANOVА 'PARK PRIRODE UČKA'
A Liganj 42, 51415 Lovran, Hrvatska
T +385 (0)51 293 753
F +385 (0)51 293 751

E Info@pp-ucka.hr
W www.pp-ucka.hr
IBAN HR15234000977042647
OIB 54113345521

To

UNIVERSITY OF APPLIED SCIENCES VELIKA GORICA

Adress: Zagrebačka 5, 10410 Velika Gorica, Croatia

E-mail: projekti@vvg.hr

**Sub: Expression of interest to support the SILVANUS project submitted to
LC-GD-1-1-2020: Preventing and fighting extreme wildfires with the integration and
demonstration of innovative means. Subtopic 1 (IA).**

I, on behalf of the Učka Nature Park Public Institution, would like to confirm our interest in supporting the project titled "*SILVANUS: Integrated Technological and Information platform for wildfire management*", if funded by the European Commission under the research programme Horizon 2020 LC-GD-1-1-2020: Preventing and fighting extreme wildfire with the integration and demonstration of innovative means, subtopic 1 (IA).

We see potential in this project because its activities are structured to bring together triple synergies from (i) environment; (ii) human aspects and (iii) scientific innovation. The project outcomes will deliver holistic ability for the regional and national authorities to monitor forest resources and evaluate biodiversity index and promote safety regulations among citizens. The novelty of the SILVANUS platform lies in the **development and integration of advanced semantic technologies to systematically formalise** the knowledge of forest administration and resource utilisation. Additionally, the platform will integrate big-data **processing framework** capable of analysing heterogeneous data sources including earth observation resources, climate models and weather data, continuous on-board computation of multi-spectral video streams. Also, the project integrates a series of **sensor and actuator technologies using innovative wireless communication infrastructure** through the coordination of aerial vehicles and ground robots.

The project will also carry out detailed **training programme** and activities to support fire brigade organisations on the utilisation of the project outcomes. Finally, the project will **develop community engagement tools** to efficiently and effectively engage with citizens and promote fire safety awareness among stakeholders to support the evacuation process and procedures. The case studies demonstrated within the project, will lead to the **development of policy recommendations** on the effective use of technological systems in combating the initiation and spread of wildfires in compliance with the legal and ethical regulations for wide-spread social acceptance.

Through this letter, we acknowledge our support to University of Applied Sciences Velika Gorica in this project and we believe that the outcome of this project can have a lasting positive effect.

Yours sincerely,

Egon Vasiljević, director

Date: 22. 01. 2021.
Location: Lovran


REPUBLIC OF CROATIA
MINISTRY OF THE INTERIOR
CIVIL PROTECTION DIRECTORATE

To

UNIVERSITY OF APPLIED SCIENCES VELIKA GORICA

Adress: Zagrebačka 5, 10410 Velika Gorica, Croatia

E-mail: projekti@vvg.hr

**Sub: Expression of interest to support the SILVANUS project submitted to
LC-GD-1-1-2020: Preventing and fighting extreme wildfires with the integration and demonstration of
innovative means. Subtopic 1 (IA).**

I, on behalf of the **Civil Protection Directorate of the Ministry of the Interior of the Republic of Croatia**, would like to confirm our interest in supporting the project titled "**SILVANUS: Integrated Technological and Information platform for wildfire management**", if funded by the European Commission under the research programme Horizon 2020 LC-GD-1-1-2020: Preventing and fighting extreme wildfire with the integration and demonstration of innovative means, subtopic 1 (IA).

We see potential in this project because its activities are structured to bring together triple synergies from (i) environment; (ii) human aspects and (iii) scientific innovation. The project outcomes will deliver holistic ability for the regional and national authorities to monitor forest resources and evaluate biodiversity index and promote safety regulations among citizens. The novelty of the SILVANUS platform lies in the **development and integration of advanced semantic technologies to systematically formalise** the knowledge of forest administration and resource utilisation. Additionally, the platform will integrate big-data **processing framework** capable of analysing heterogeneous data sources including earth observation resources, climate models and weather data, continuous on-board computation of multi-spectral video streams. Also, the project integrates a series of **sensor and actuator technologies using innovative wireless communication infrastructure** through the coordination of aerial vehicles and ground robots.

The project will also carry out detailed **training programme** and activities to support fire brigade organisations on the utilisation of the project outcomes. Finally, the project will **develop community engagement tools** to efficiently and effectively engage with citizens and promote fire safety awareness among stakeholders to support the evacuation process and procedures. The case studies demonstrated within the project, will lead to the **development of policy recommendations** on the effective use of technological systems in combating the initiation and spread of wildfires in compliance with the legal and ethical regulations for wide-spread social acceptance.

Through this letter, we acknowledge our support to University of Applied Sciences Velika Gorica in this project and we believe that the outcome of this project can have a lasting positive effect.

Yours sincerely,

Assistant Minister
Damir Trut, PhD

Date: 22-01-2021
Location: Zagreb, Nehajska 5





To

Prof. Luigi Moccia,
UNIVERSITA TELEMATICA PEGASO
PIAZZA TRIESTE E TRENTO 48, 80132, NAPOLI, IT
Email: luigi.moccia@unipegaso.it

**Sub: Expression of interest to support the SILVANUS project submitted to
LC-GD-1-1-2020: Preventing and fighting extreme wildfires with the integration and demonstration of
innovative means. Subtopic 1 (IA).**

I Felipe Spina Avino, Senior Conservation Analyst from WWF-Brazil, would like to confirm my availability to participate in the external advisory board of the innovation action project titled "**SILVANUS: Integrated Technological and Information platform for wildfire management**", if funded by the European Commission under the research programme Horizon 2020 LC-GD-1-1-2020: Preventing and fighting extreme wildfire with the integration and demonstration of innovative means, subtopic 1 (IA). For over 15 years, I have worked as a Tropical Conservation Biologist, mainly with Protected Areas, Biodiversity Monitoring, and Conservation Technologies in the Amazon and other regions in Brazil, Latin America, and Africa. Throughout my career, I have often focused on trialing and promoting the use of new Conservation technologies tools, such as mobile phone applications, drones, and camera traps among Rangers, park managers, and the local community. Thus, gaining useful insights about how technology can aid conservation, and how different professionals can work together to develop innovative conservation technologies solutions, as well as how to best transfer the technology and train front-line conservation staff on it. That led me to believe that technological intervention for the development of prevention, detection, response, and rehabilitation of forest landscape is a crucial topic of interest.

The project activities structured to bring together triple synergies from (i) environment; (ii) human aspects and (iii) scientific innovation. The project outcomes will deliver holistic ability for the regional and national authorities to monitor forest resources and evaluate biodiversity index and promote safety regulations among citizens. The novelty of the SILVANUS platform lies in the **development and integration of advanced semantic technologies to systematically formalise** the knowledge of forest administration and resource utilisation. Additionally, the platform will integrate big-data **processing framework** capable of analysing heterogeneous data sources including earth observation resources, climate models and weather data, continuous on-board computation of multi-spectral video streams. Also, the project integrates a series of **sensor and actuator technologies using innovative wireless communication infrastructure** through the coordination of aerial vehicles and ground robots.

The project will also carry out detailed **training programme** and activities to support fire brigade organisations on the utilisation of the project outcomes. Finally, the project will **develop community engagement tools** to efficiently and effectively engage with citizens and promote fire safety awareness among stakeholders to support the evacuation process and procedures. The case studies demonstrated within the project, will lead to the **development of policy recommendations** on the effective use of technological systems in combating the initiation and spread of wildfires in compliance with the legal and ethical regulations for wide-spread social acceptance.

As such, I intend to attend and actively participate in the relevant project activities, meetings, workshops and demonstration events in order to review and assess the project outputs as well as to offer constructive feedback, comments, expert opinions and help steer the development of the project. I am also interested to participate to the SILVANUS field trials and consult their execution and assessment, aiming to promote technical exchange among the project experts, and Conservation and front-line staff from Latin America.

Yours sincerely,

Felipe Spina Avino
Senior Conservation Analyst
WWF – Brazil

Edegar de Oliveira Rosa
Conservation Director
WWF - Brazil



KONČAR

Končar - Power Plant and
Electric Traction Engineering Inc.

ISO 9001, ISO 14001, ISO 27001,
ISO 45001 & ISO 50001 certificated

To:

**M.Sc. Igor Kršić
MICRO DIGITAL d.o.o.**

Rudeška cesta 177,
10110, Zagreb, HR

Email: igor.krsic@microdigital.eu

Your reference:
Our reference:

Mobile: +385 98 486 490
Fax: +385 1 3667 515
Name: Stjepan Sučić
E-mail: stjepan.sucic@koncar-ket.hr

Date: 25.1.2021.

Subject: Expression of interest to support the SILVANUS project submitted to LC-GD-1-1-2020: Preventing and fighting extreme wildfires with the integration and demonstration of innovative means. Subtopic 1 (IA).

I, on behalf of the KONČAR - Power Plant and Electric Traction Engineering Inc., would like to confirm our interest in supporting the project activities of project titled "SILVANUS: Integrated Technological and Information platform for wildfire management", if funded by the European Commission under the research programme Horizon 2020 LC-GD-1-1-2020: Preventing and fighting extreme wildfire with the integration and demonstration of innovative means, subtopic 1 (IA). We confirm to have engaged with the SILVANUS project coordinator and team of proposers to identify the key areas of research and innovation for combating against wildfires.

The project activities structured to bring together triple synergies from (i) environment; (ii) human aspects and (iii) scientific innovation. The project outcomes will deliver holistic ability for the regional and national authorities to monitor forest resources and evaluate biodiversity index and promote safety regulations among citizens. The novelty of the SILVANUS platform lies in the development and integration of advanced semantic technologies to systematically formalise the knowledge of forest administration and resource utilisation. Additionally, the platform will integrate big-data processing framework capable of analysing heterogeneous data sources including earth observation resources, climate models and weather data, continuous on-board computation of multi-spectral video streams. Also, the project integrates a series of sensor and actuator technologies using innovative wireless communication infrastructure through the coordination of aerial vehicles and ground robots.

The project will also carry out detailed training programme and activities to support fire brigade organisations on the utilisation of the project outcomes. Finally, the project will develop community engagement tools to efficiently and effectively engage with citizens and promote fire safety awareness among stakeholders to support the evacuation process and procedures. The case studies demonstrated within the project, will lead to the development of policy recommendations on the effective use of technological systems in combating the initiation and spread of wildfires in compliance with the legal and ethical regulations for wide-spread social acceptance. Considering our background as critical infrastructure technology provider, this area is highly interesting for us.



KONČAR

Končar - Power Plant and
Electric Traction Engineering Inc.

We intend to attend and actively participate in the relevant project activities, meetings, workshops and demonstration events in order to review and assess the project outputs as well as to offer constructive feedback, comments, expert opinions and help steer the development of the project.

Our background is primarily in development of cyber-secure industrial automation software, widely utilized in critical infrastructures and Micro Digital is our long time partner and collaborator in several research and innovation projects. We are well experienced in project activities funded within FP7 and HORIZON programmes, through projects such as OS4ES, SYNERGY, frESCO, HOLISDER, FLEXCoop, CROSBOW, TRINITY, BALIHT, ATTEST and others. Considering our project portfolio and research, development and innovation activities, we see high potential in the proposed SILVANUS developments. We believe the outcomes of SILVANUS project will have lasting positive effects and therefore, I confirm on behalf of KONČAR – Power Plant and Electric Traction Engineering Inc. that we are highly interested in following and supporting SILVANUS execution, assessment and replication activities.

Yours sincerely,

»KONČAR-INŽENJERING ZA
ENERGETIKU I TRANSPORT«
d.d.

ZAGREB
PhD Stjepan Sučić
Business Unit Director



AMCB - Association of Municipalities of Cova da Beira

Largo dos Bombeiros Voluntários
6250-088 Belmonte
PORTUGAL

To
Mr. Manuel Pio Silva
EDP-NEW R&D
Rua Cidade de Goa, nº4
2685-039 Sacavém
PORTUGAL

**Letter of support for Project Proposal SILVANUS on Horizon 2020 call topic
LC-GD-1-1-2020: "Preventing and fighting extreme wildfires with the integration and demonstration of innovative means"**

Dear Sir,

I, **António Pinto Dias Rocha**, on behalf of **AMCB - Association of Municipalities of Cova da Beira**, am pleased to provide this support letter to the **SILVANUS** consortium's proposal entitled **Integrated Technological and Information Platform for wildfire management**, that will be submitted on the scope of Horizon 2020 Call for Proposals "Building a low-carbon, climate resilient future: Research and innovation in support of the European Green Deal" addressing the topic LC-GD-1-1-2020: "Preventing and fighting extreme wildfires with the integration and demonstration of innovative means".

The objectives and activities of **SILVANUS** are fully adequate to and in line with our strategic activities. Hence, we would like to express our interest in **SILVANUS** project, committing to:

- Follow the activities carried out, being aware of the key results of the project.
- Provide our feedback on the project progress in case it is asked.
- Support the consortium to meet its objectives by providing needed data when possible.
- Support project developments giving advice on previous experiences related to its incoming activities.
- Follow project's progress, keeping our associates informed as well as participating in the dissemination of **SILVANUS** project.

AMCB - Association of Municipalities of Cova da Beira was established in 1981 and currently consists of 13 municipalities: Almeida, Belmonte, Celorico da Beira, Figueira de Castelo Rodrigo, Fornos de Algodres, Fundão, Guarda, Manteigas, Meda, Penamacor, Pinhel, Sabugal and Trancoso. The area comprised by the municipalities that compose AMCB covers 5577 km² and a population, according to the 2011 census, of 150 991 inhabitants. AMCB is a non-profit institution that has experience, human and technical resources capable of managing projects and programs of great complexity and difficulty, as has been verified over the years.

Belmonte, 13 January 2021



António Pinto Dias Rocha

ESTIMATED BUDGET FOR THE ACTION

 Associated with document Ref. Ares(2021)5870004 - 27/09/2021

Estimated eligible ¹ costs (per budget category)										EU contribution			Additional information			
A. Direct personnel costs				B. Direct costs of subcontracting	/C. Direct costs of fin. support/	D. Other direct costs		E. Indirect costs ²	Total costs	Reimbursement rate %	Maximum EU contribution ³	Maximum grant amount ⁴	Information for indirect costs	Information for auditors	Other information:	
A.1 Employees (or equivalent)		A.4 SME owners without salary		A.5 Beneficiaries that are natural persons without salary		D.1 Travel D.2 Equipment D.3 Other goods and services <i>[D.4 Costs of large research infrastructure]</i>		D.5 Costs of internally invoiced goods and services						Estimated costs of in-kind contributions not used on premises	Declaration of costs under Point D.4	Estimated costs of beneficiaries/linked third parties not receiving funding/international partners
Form of costs ⁶	Actual	Unit ⁷	Unit ⁸		Actual	Actual	Actual	Unit ⁹	Flat-rate ¹⁰	25%						
	a	Total b	No hours	Total c	d	[e]	f	Total g	h = 0,25 x (a +b+c+f+g +[i1] ¹³ +[i2] ¹³ -n)	j = a+b+c+d +[e]+f+g+h +[i1]+[i2]	k	l	m	n	Yes/No	
1. PEGASO	858 571.00	0.00	0.00	0.00	0.00	0.00	66 000.00	0.00	231 142.75	1 155 713.75	70.00	808 999.63	808 999.63	0.00	No	n/a
2. Z&P	400 000.00	0.00	0.00	0.00	0.00	0.00	56 000.00	0.00	114 000.00	570 000.00	70.00	399 000.00	399 000.00	0.00	No	n/a
3. INTRA	870 000.00	0.00	0.00	0.00	0.00	0.00	53 000.00	0.00	230 750.00	1 153 750.00	70.00	807 625.00	807 625.00	0.00	No	n/a
4. TRT	790 075.00	0.00	0.00	0.00	0.00	0.00	41 000.00	0.00	207 768.75	1 038 843.75	70.00	727 190.63	727 190.63	0.00	No	n/a
5. FINC	663 000.00	0.00	0.00	0.00	0.00	0.00	37 000.00	0.00	175 000.00	875 000.00	70.00	612 500.00	612 500.00	0.00	No	n/a
6. ATOS IT	413 250.00	0.00	0.00	0.00	0.00	0.00	38 000.00	0.00	112 812.50	564 062.50	70.00	394 843.75	394 843.75	0.00	No	n/a
- ATOS SA	71 250.00	0.00	0.00	0.00	0.00	0.00	3 000.00	0.00	18 562.50	92 812.50	70.00	64 968.75	64 968.75	0.00	No	n/a
Total beneficiary	484 500.00	0.00			0.00	0.00	41 000.00	0.00	131 375.00	656 875.00		459 812.50	459 812.50	n/a	n/a	0.00
7. DELL	854 900.00	0.00	0.00	0.00	0.00	0.00	41 000.00	0.00	223 975.00	1 119 875.00	70.00	783 912.50	783 912.50	0.00	No	n/a
8. SIMAVI	670 000.00	0.00	0.00	0.00	0.00	0.00	54 600.00	0.00	181 150.00	905 750.00	70.00	634 025.00	634 025.00	0.00	No	n/a
9. EDP	375 000.00	0.00	0.00	0.00	0.00	0.00	36 000.00	0.00	102 750.00	513 750.00	70.00	359 625.00	359 625.00	0.00	No	n/a
10. ADP	245 000.00	0.00	0.00	0.00	0.00	0.00	26 000.00	0.00	67 750.00	338 750.00	70.00	237 125.00	237 125.00	0.00	No	n/a
11. TP	115 000.00	0.00	0.00	0.00	0.00	0.00	50 000.00	0.00	41 250.00	206 250.00	70.00	144 375.00	144 375.00	0.00	No	n/a
12. 3MON, s. r. o.	218 400.00	0.00	0.00	0.00	0.00	0.00	82 000.00	0.00	75 100.00	375 500.00	70.00	262 850.00	262 850.00	0.00	No	n/a
13. CTL	550 000.00	0.00	0.00	0.00	0.00	0.00	36 000.00	0.00	146 500.00	732 500.00	70.00	512 750.00	512 750.00	0.00	No	n/a
14. SYNC	292 600.00	0.00	0.00	0.00	0.00	0.00	30 000.00	0.00	80 650.00	403 250.00	70.00	282 275.00	282 275.00	0.00	No	n/a
15. EAI	409 500.00	0.00	0.00	0.00	0.00	0.00	36 000.00	0.00	111 375.00	556 875.00	70.00	389 812.50	389 812.50	0.00	No	n/a
16. ITTI	480 000.00	0.00	0.00	0.00	0.00	0.00	36 000.00	0.00	129 000.00	645 000.00	70.00	451 500.00	451 500.00	0.00	No	n/a
17. VMG	582 200.00	0.00	0.00	0.00	0.00	0.00	36 000.00	0.00	154 550.00	772 750.00	70.00	540 925.00	540 925.00	0.00	No	n/a
18. MDS	303 400.00	0.00	0.00	0.00	0.00	0.00	41 000.00	0.00	86 100.00	430 500.00	70.00	301 350.00	301 350.00	0.00	No	n/a
19. CMCC F	420 000.00	0.00	0.00	0.00	0.00	0.00	37 100.00	0.00	114 275.00	571 375.00	100.00	571 375.00	571 375.00	0.00	No	n/a
20. EXUS	379 500.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	103 625.00	518 125.00	70.00	362 687.50	362 687.50	0.00	No	n/a
21. RINI	462 000.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	124 250.00	621 250.00	70.00	434 875.00	434 875.00	0.00	No	n/a
22. MD	193 344.17	0.00	1 576.67	45 155.83	0.00	0.00	35 000.00	0.00	68 375.00	341 875.00	70.00	239 312.50	239 312.50	0.00	No	n/a
23. WUT	224 000.00	0.00	0.00	0.00	0.00	0.00	33 000.00	0.00	64 250.00	321 250.00	100.00	321 250.00	321 250.00	0.00	No	n/a
24. HB	412 800.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	111 950.00	559 750.00	100.00	559 750.00	559 750.00	0.00	No	n/a
25. AUA	398 360.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	108 340.00	541 700.00	100.00	541 700.00	541 700.00	0.00	No	n/a
26. CERTH	324 000.00	0.00	0.00	0.00	0.00	0.00	36 000.00	0.00	90 000.00	450 000.00	100.00	450 000.00	450 000.00	0.00	No	n/a
27. UTH	239 700.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	68 675.00	343 375.00	100.00	343 375.00	343 375.00	0.00	No	n/a
28. IST	114 000.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	37 250.00	186 250.00	100.00	186 250.00	186 250.00	0.00	No	n/a
29. UASVG	160 000.00	0.00	0.00	0.00	0.00	0.00	23 000.00	0.00	45 750.00	228 750.00	100.00	228 750.00	228 750.00	0.00	No	n/a
30. UISAV	460 000.00	0.00	0.00	0.00	0.00	0.00	68 000.00	0.00	132 000.00	660 000.00	100.00	660 000.00	660 000.00	0.00	No	n/a
31. PUI	327 600.00	0.00	0.00	0.00												

ESTIMATED BUDGET FOR THE ACTION

 Associated with document Ref. Ares(2021)5870004 - 27/09/2021

Estimated eligible ¹ costs (per budget category)										EU contribution			Additional information			
A. Direct personnel costs			B. Direct costs of subcontracting	C. Direct costs of fin. support	D. Other direct costs		E. Indirect costs ²	Total costs	Reimbursement rate %	Maximum EU contribution ³	Maximum grant amount ⁴	Information for indirect costs	Information for auditors	Other information:		
A.1 Employees (or equivalent)		A.4 SME owners without salary			D.1 Travel	D.5 Costs of internally invoiced goods and services										
A.2 Natural persons under direct contract		A.5 Beneficiaries that are natural persons without salary			D.2 Equipment											
A.3 Seconded persons					D.3 Other goods and services											
[A.6 Personnel for providing access to research infrastructure]					[D.4 Costs of large research infrastructure]											
Form of costs ⁶	Actual	Unit ⁷	Unit ⁸		Actual	Actual	Actual	Unit ⁹	Flat-rate ¹⁰							
	a	Total b	No hours	Total c	d	[e]	f	Total g	25%							
32. SGSP	151 800.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	46 700.00	233 500.00	100.00	233 500.00	233 500.00	0.00	No	n/a
33. ASSET	304 500.00	0.00	0.00	0.00	0.00	0.00	155 000.00	0.00	114 875.00	574 375.00	100.00	574 375.00	574 375.00	0.00	No	n/a
34. LETS	245 000.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	70 000.00	350 000.00	70.00	245 000.00	245 000.00	0.00	No	n/a
35. PNRT	160 000.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	48 750.00	243 750.00	100.00	243 750.00	243 750.00	0.00	No	n/a
36. FptSMURD	248 400.00	0.00	0.00	0.00	0.00	0.00	60 000.00	0.00	77 100.00	385 500.00	100.00	385 500.00	385 500.00	0.00	No	n/a
37. ASFOR	243 000.00	0.00	0.00	0.00	0.00	0.00	60 000.00	0.00	75 750.00	378 750.00	100.00	378 750.00	378 750.00	0.00	No	n/a
38. KEMEA	412 500.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	111 875.00	559 375.00	100.00	559 375.00	559 375.00	0.00	No	n/a
39. HRT	225 600.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	65 150.00	325 750.00	100.00	325 750.00	325 750.00	0.00	No	n/a
40. AHEPA	171 000.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	51 500.00	257 500.00	100.00	257 500.00	257 500.00	0.00	No	n/a
41. OIR	90 000.00	0.00	0.00	0.00	0.00	0.00	20 000.00	0.00	27 500.00	137 500.00	100.00	137 500.00	137 500.00	0.00	No	n/a
42. PSTE	140 400.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	43 850.00	219 250.00	100.00	219 250.00	219 250.00	0.00	No	n/a
43. FRS MB	255 000.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	72 500.00	362 500.00	100.00	362 500.00	362 500.00	0.00	No	n/a
44. HVZ	95 370.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	32 592.50	162 962.50	100.00	162 962.50	162 962.50	0.00	No	n/a
45. TUZVO	392 850.00	0.00	0.00	0.00	0.00	0.00	41 000.00	0.00	108 462.50	542 312.50	100.00	542 312.50	542 312.50	0.00	No	n/a
46. Plamen	160 000.00	0.00	0.00	0.00	0.00	0.00	35 000.00	0.00	48 750.00	243 750.00	100.00	243 750.00	243 750.00	0.00	No	n/a
47. AMIKOM	200 000.00	0.00	0.00	0.00	0.00	0.00	18 750.00	0.00	54 687.50	273 437.50	100.00	273 437.50	273 437.50	0.00	No	n/a
48. CSIRO	360 000.00	0.00	0.00	0.00	0.00	0.00	40 000.00	0.00	100 000.00	500 000.00	100.00	500 000.00	500 000.00	0.00	No	n/a
49. UFRJ	100 000.00	0.00	0.00	0.00	0.00	0.00	45 000.00	0.00	36 250.00	181 250.00	100.00	181 250.00	181 250.00	0.00	No	n/a
Total consortium	17 232 870.17	0.00		45 155.83	0.00	0.00	2 071 450.00	0.00	4 837 369.00	24 186 845.00		19 902 190.26	19 902 190.26			0.00

¹ See Article 6 for the eligibility conditions.² Indirect costs already covered by an operating grant (received under any EU or Euratom funding programme; see Article 6.5.(b)) are ineligible under the GA. Therefore, a beneficiary/linked third party that receives an operating grant during the action's duration cannot declare indirect costs for the year(s)/reporting period(s) covered by the operating grant, unless it can demonstrate that the operating grant does not cover any costs of the action (see Article 6.2.E).³ This is the theoretical amount of EU contribution that the system calculates automatically (by multiplying all the budgeted costs by the reimbursement rate). This theoretical amount is capped by the 'maximum grant amount' (that the Agency decided to grant for the action) (see Article 5.1).⁴ The 'maximum grant amount' is the maximum grant amount decided by the Agency. It normally corresponds to the requested grant, but may be lower.⁵ Depending on its type, this specific cost category will or will not cover indirect costs. Specific unit costs that include indirect costs are: costs for energy efficiency measures in buildings, access costs for providing trans-national access to research infrastructure and costs for clinical studies.⁶ See Article 5 for the forms of costs.⁷ Unit : hours worked on the action; costs per unit (hourly rate) : calculated according to the beneficiary's usual accounting practice.⁸ See Annex 2a 'Additional information on the estimated budget' for the details (costs per hour (hourly rate)).⁹ Unit and costs per unit : calculated according to the beneficiary's usual accounting practices.¹⁰ Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs (see Article 6.2.E).¹¹ See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit).¹² See Annex 2a 'Additional information on the estimated budget' for the details (units, costs per unit, estimated number of units, etc).¹³ Only specific unit costs that do not include indirect costs.¹⁴ See Article 9 for beneficiaries not receiving funding.¹⁵ Only for linked third parties that receive funding.

ANNEX 2a

ADDITIONAL INFORMATION ON THE ESTIMATED BUDGET

Unit cost for SME owners without salary

1. Costs for a SME owners not receiving a salary

Units: hours worked on the action

Amount per unit ('hourly rate')*:

- *MICRO DIGITAL DOO ZA INFORMACIJSKE TEHNOLOGIJE* [partner N.22]: EUR 45,155.83

* Amount calculated as follows:
For MD: 28.64

Total hours worked on the action: 1,576.67 hours (11 PM)

Estimated number of units: see Annex 2



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ZANASI ALESSANDRO SRL (Z&P), established in VIA G B AMICI 29, MODENA 41100, Italy, VAT number: IT03141870364, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('2')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Alessandro ZANASI with ECAS id nzanasal signed in the Participant Portal on 29/09/2021 at 10:35:09 (transaction id SigId-18700-bBSD hMC2LKGzPVIGpnRJneSXKnNusCbzr8N7fPjgWStg8cSa7aVFpWpi m9SLWO2MihecGzyPARWF7HXRRKF0-jpjZscgsw0KwfOyDFdfrEC-6 zuiFq8DDmV86aZy9Uhf0JfptvJRHIk79vHheT053DckheAB65gQ6HTI s9CAa45QjxjdUzJTuql1zn4lRYu75m). Timestamp by third party at 2021.09.29 11:35:15 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

INTRASOFT INTERNATIONAL SA (INTRA), established in RUE NICOLAS BOVE 2B, LUXEMBOURG 1253, Luxembourg, VAT number: LU16853659, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('3')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

THALES (TRT), established in TOUR CARPE DIEM PLACE DES COROLLES ESPLANADE NORD, COURBEVOIE 92400, France, VAT number: FR54552059024, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('4')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Cédric DEMEURE with ECAS id ndemeuce signed in the Participant Portal on 28/09/2021 at 17:00:40 (transaction id SigId-59320-smiUt 6pAL5lsp teenvYnSRkDFwbfjTnhU95quxfmfpJQ86mySgB4NaLEJvy8 O1KrLRBnCxT6NHYmB1Zvd9bkW-rS0vSrmBGYCagVEG22GDby-0W 7EXybezVeBiUIqDjmZim0wehAX88SjQQORRsSvY0BdyzNMaVdh7n4 qXxfkVYYv5h7c3Ndp146o0IizKksKCJ0). Timestamp by third party at 2021.09.28 18:00:45 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FINCONS SPA (FINC), established in CORSO MAGENTA 56, MILANO MI 20123, Italy, VAT number: IT12795320154, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('5')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Michele MORETTI with ECAS id nmettimi signed in the Participant Portal on 28/09/2021 at 16:53:06 (transaction id SigId-59241-uKmz WaXJLCV5AVRNQotxyYsvpzjhwC0aSx9pFfezX75mDvzeFGZn4JQV8z NB20adGF2CEpFf7jW9VlP89jBU5-rS0vSrmBGYCagVEG22GDby-ORz hzUziSTOOgYTtr8i7ZA4otZBGNjWb7bsCXzbmjdksjnxnE3N1SurCSgs sx8g9naWBFVT4XaPE9jmJfgbHoHi). Timestamp by third party at 2021.09.28 17:53:11 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ATOS IT SOLUTIONS AND SERVICES IBERIA SL (ATOS IT), established in RONDA DE EUROPA 5, TRES CANTOS MADRID 28760, Spain, VAT number: ESB85908093, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('6')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

EMC INFORMATION SYSTEMS INTERNATIONAL (DELL), established in IDA INDUSTRIAL SITE, OVENS, Ireland, VAT number: IE9692485U, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('7')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SOFTWARE IMAGINATION & VISION SRL (SIMAVI), established in SOSEAUA BUCURESTI-PLOIESTI 73-81 COMPLEX VICTORIA CORP CLADIRE C4 EТАJ 2, BUCURESTI 013685, Romania, VAT number: RO41963989, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('8')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Alexandru-Mihail Radasanu with ECAS id n003431r signed in the Participant Portal on 28/09/2021 at 16:19:05 (transaction id SigId-58804-5x18dP8lYwOvvzMx1zKnGt7qpKuDU2rzizva558lxowuOCoiezLm9lGUjdCbUd8D2zqPtQj19tzmZeumgk5mNpk-rS0vSrmbGYCagVEG22GDb-yZb6zRnSzsaZVaBEVWn5nUTwrP8mqSVB3uMqFwuQzsHiQu7Zd0NEbKwzNBhmztobrKaZtcl3SDDOWt23Zeg6w6am). Timestamp by third party at 2021.09.28 17:19:10 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

CNET CENTRE FOR NEW ENERGY TECHNOLOGIES SA (EDP), established in RUA CIDADE DE GOA 4, SACAVEM E PRIOR VELHO LISBOA 2685 039, Portugal, VAT number: PT513247521, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('9')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

João Gonçalo MACIEL with ECAS id nmaciejo signed in the Participant Portal on 30/09/2021 at 16:02:16 (transaction id SigId-36780-SOd09tu3aa8XV2kD9dhTnUOGKIkGXZa6jjm3L720OQZmyb22zzf68O196TD5z0RIO0ujnYrtcCiJUDlwtnHwG-jpJZscgsw0KwfOyDFdrEC-x2TR5ZbXvt3NJAqot5fLszW9UQ9CVzy0xq0NhujfOZw7zM8DMI1FwibOw6CdeEjaJ2HqVMjGixPJRccN2CeYgW). Timestamp by third party at 2021.09.30 17:02:21 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ADP VALOR - SERVIÇOS AMBIENTAIS, S.A. (ADP), established in Rua Visconde de Seabra 3, LISBOA 1700 421, Portugal, VAT number: PT 505296950, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('10')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

TERRAPRIMA - SERVICOS AMBIENTAIS SOCIEDADE UNIPESSOAL LDA (TP), established in QUINTA DA FRANCA BORRALHEIRA, CARIA 6200 710, Portugal, VAT number: PT508759790, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('11')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Tiago DOMINGOS with ECAS id ndomtiag signed in the Participant Portal on 28/09/2021 at 17:23:12 (transaction id SigId-12691-ZeK3n zwxuUazeoV7aey4xZclys8pZbcHv9Dqd7cwsBuzLzsmkim19TFhzcDI TLe4yj8VazN2ki4Or5MyKCtQTR3G-jpjZscgsw0KwfOyDFdfEC-zhzwE xVcQqnIX2joD1oXqzWINse56QhC3zq3SFWU5YmVfGrdztJAMW97exc hJB2fFgzSegVq6xGR63Dk3TcavvMG). Timestamp by third party at 2021.09.28 18:23:17 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

3MON, S. R. O. (3MON, s. r. o.), established in CERNYSEVSKEHO 10, BRATISLAVA 851 01, Slovakia, VAT number: SK2023248458, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('12')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

CATALINK LIMITED (CTL), established in CHARITINIS SAKKADA 5, NICOSIA 1040, Cyprus, VAT number: CY10378448C, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('13')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Pavlos Kosmidis with ECAS id n0021luv signed in the Participant Portal on 29/09/2021 at 07:09:18 (transaction id SigId-15679-7FBXT vN2d6Ip70Gmse6vJU6iZnkiG4awIprsdzOEHzWXQAHkoKrvwEyv5d4 17Sn9MwpQ7uvzV8b7sdzYNHdzr3Z-jpjZscgsw0KwfOyDFdfrEC-Q6c zLIOAxq9h69d8lnnrJNfzhRWWDETvo5LThLMY0hsyLhDB8a1L2Gs18 7zztergYxOsb1nhzTWed5Ks3EelsR). Timestamp by third party at 2021.09.29 08:09:31 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

SYNTHESIS CENTER FOR RESEARCH AND EDUCATION LIMITED (SYNC), established in TAGMATARCHI POULIOU 33, LEFKOSIA 1101, Cyprus, VAT number: 10133359J, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('14')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

George ISAIAS with ECAS id nisaiage signed in the Participant Portal
on 29/09/2021 at 08:00:42 (transaction id SigId-16077-p35nRwlQXU
6Gow8ETgYIUJILS0ZiryzZcCBzOIwtDE56OYWZBdB0GoCOvjN25ba7f
DsFMNdDcwzXKgKAzyYGGzG-jpjZscgsw0KwfOyDFdfrEC-fmzYwZmv
YRUWGC10IOsEsj8K4QXax6r4nwafFymoEmn99v6ZmcvQ0zHoE5f1
etHfg5kzjp6RtlPOqzyTM3WMzx). Timestamp by third party at
2021.09.29 09:00:47 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

EXPERT.AI S.P.A. (EAI), established in VIA FORTUNATO ZENI 8, ROVERETO 38068, Italy, VAT number: IT02608970360, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('15')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ITTI SP ZOO (ITTI), established in RUBIEZ 46, POZNAN 61 612, Poland, VAT number: PL7811019801, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('16')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Rafal RENK with ECAS id nrenkra signed in the Participant Portal
on 29/09/2021 at 07:23:43 (transaction id SigId-15775-yIlvcDMSUz
W2zSzqEQKP7iEMI6XPPQqwEFmAwqutBxbMzo0Pg4hTF47sNGx1H
sBKCFvOqnHB3MLgEJKK2cwwSkW-jpjZscgsw0KwfOyDFdfrEC-ji46H
uNbniAbT7eEWp5zKpeZzjPruD1DjgWKnTp7pDEPVzTJLFcvx1P80D
CPWAxSatClqUBNazlidl8G9Z8vj0). Timestamp by third party at
2021.09.29 08:23:48 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

IZQUIERDO/PIATRIK GBR (VMG), established in OLGA-BENARIO-PRESTES-STRASSE 2, BERLIN 10407, Germany, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('17')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Ebroul IZQUIERDO with ECAS id nizquero signed in the Participant Portal on 29/09/2021 at 16:22:42 (transaction id SigId-24328-Y31XjXyOKJgffzHKSMefX8WkLJTrCitt6OMOVBB4S1Zhnl2VysHpEXFnEkN74wzKmqAwqdzUdYzJnkhT7zkXbS-jpjZscgsw0KwfOyDFdfrEC-HvpqgV58VcpUi4OBL1UiowssX2MfdUUJggskUzPizvda7ubYFaVd6XtC3NzsJ1ql8HoOaHzhv5HzLqHfNrTVrgQ). Timestamp by third party at 2021.09.29 17:22:48 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

MASSIVE DYNAMIC SWEDEN AB (MDS), established in SANKT ERIKSGATAN 117, STOCKHOLM 113 43, Sweden, VAT number: SE559239008101, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('18')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Sokratis Nifakos with ECAS id mnifasok signed in the Participant Portal on 29/09/2021 at 14:41:29 (transaction id SigId-22586-OGH 2zeIKbExyzned7W5KC8RD5FCXacrF2CuAwPdQDIDwaaRdu6fcvfOzyBm37AJ4snvIdZvqTWuA2jzSyAXEgg4-jpJZscgsw0KwfOyDFdfEC-B aPlU0n4jIKqnjoajztzgQqg0X0uX3DnifTxpflIjv0XFv0RYQxBB0t8kL MsmOzrPnAErNjfSjtsIgj5L2F38m). Timestamp by third party at 2021.09.29 15:41:35 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FONDAZIONE CENTRO EURO-MEDITERRANEOSUI CAMBIAMENTI CLIMATICI (CMCC F), established in VIA A IMPERATORE 16, LECCE 73100, Italy, VAT number: IT03873750750, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('19')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

EXUS SOFTWARE MONOPROSOPI ETAIRIA PERIORISMENIS EVTHINIS (EXUS), established in 73-75 MESOGION AVENUE, ATHENS 11526, Greece, VAT number: EL800663995, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('20')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Michael MELACHRINIDIS with ECAS id nmelamic signed in the Participant Portal on 01/10/2021 at 07:36:30 (transaction id SigId-5503-5PoXObQO83WLkO6CUTSIpcWndCK7k3G2zzWyfI88gNoCnHcudamXhk7jr8rVApIMmqynjE2BBID7KUXNzt2Le8m-yntOf97TTHq7ktbp37lfAm-BwG6cWvC1td3pDKPedhJvNMbaZH0TcxVwZj8b6Bze4UCyjr0jcWWZgl7puehszpfLJ7fHqDmRpRN6Z7WwjOE2D).
Timestamp by third party at
2021.10.01 08:36:41 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

RINIGARD DOO ZA USLUGE (RINI), established in KUSLANOVA 2, Zagreb 10000, Croatia, VAT number: HR55503963392, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('21')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Marija Osterman with ECAS id n002oq03 signed in the Participant Portal on 30/09/2021 at 07:16:01 (transaction id SigId-28245-1U1gWK HHMXjTCx6WSguNH9CNYzcbh4P5loAZGeqb1sGUPV9x4eMfNShbzhNj kxqV5DFdXFr99hqAFyXqmj5EUi-jpjZscgsw0KwfOyDFdfrEC-vzzuQms9 ETBQhzzpE7hXvJCLm9mOZKHWukFzgcjpcGLPzWTWls2FZCIggF6nbW 2QoMI7F7kQQARvdDBSnk4Ytnhm). Timestamp by third party at 2021.09.30 08:16:07 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

MICRO DIGITAL DOO ZA INFORMACIJSKE TEHNOLOGIJE (MD), established in RUDESKA CESTA 177, ZAGREB 10000, Croatia, VAT number: HR81606288326, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('22')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Igor Krstic with ECAS id n002mq6o signed in the Participant Portal on 28/09/2021 at 18:06:39 (transaction id SigId-12935-oNQzmkGx 9nT839DQ6aktcXBsgFWaWzP7c2VH6zY4j6l3DJL3zppSUcfPsg9VTm 6Bk209aHzzhuktiBANnTII05Xm-jpJZscgsw0KwfOyDFdfrEC-JIHAC6 sBsZ8pfOg9E00PQmbB1WS1qrwVhczsB32njHNX25X0ojwBHfYatk a76b0jTaPjZfsvqzjTbr3OqFJc98). Timestamp by third party at 2021.09.28 19:06:44 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

POLITECHNIKA WARSZAWSKA (WUT), established in PLAC POLITECHNIKI 1, WARSZAWA 00 661, Poland, VAT number: PL5250005834, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('23')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

HOEGSKOLAN I BORAS (HB), established in ALLEGATAN 1, BORAS 50190, Sweden, VAT number: SE202100313801, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('24')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

GEOPONIKO PANEPISTIMION ATHINON (AUA), established in IERA ODOS 75, ATHINA 11855, Greece, VAT number: EL090042767, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('25')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Stavros ZOGRAFAKIS with ECAS id nzogrsta signed in the Participant Portal on 29/09/2021 at 09:01:43 (transaction id SigId-16944-UGvHlx 3zijfkaTnS6drAlTnIVLGF3o55IW3Hfd7V2OznnO3zIsh8gcjZRI2VAvJRK uVOIDYS2EmmjkMydTACLW-jpJZscgsw0KwfOyDFdfrEC-iy4NybEfud9 xKweDnBLzR2mfzvE2qUDkqUH2Vyd6uAjCKMKFQmzmgWS2H9ohjr 3wa6ra421zmGZ2czSjafLCCK). Timestamp by third party at 2021.09.29 10:01:47 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ETHNIKO KENTRO EREVNAS KAI TECHNOLOGIKIS ANAPTYXIS (CERTH), established in CHARILAOU THERMI ROAD 6 KM, THERMI THESSALONIKI 57001, Greece, VAT number: EL099785242, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('26')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Dimitrios TZOVARAS with ECAS id ntzovadi signed in the Participant Portal on 30/09/2021 at 11:04:18 (transaction id SigId-31926-nAm7 U1weXgmecfknezgg4yBh3zjuebRiyzICbxNBCfTzjHW8CctFwBGQvDd CuydGwzzbVmKryQHmcKozRwBYoNS-jpjZscgsw0KwfOyDFdrEC-jX UxUfUeX1oeZdtvoMe5yMnAlx9rjb4RJNnoowXU7RzW32dxuXj3fl1zO YkzzrGLQiDNsBaZPMWWFauelLiYQq). Timestamp by third party at 2021.09.30 12:04:24 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

PANEPISTIMIO THESSALIAS (UTH), established in ARGONAFTON FILELLINON, VOLOS 38221, Greece, VAT number: EL090055634, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('27')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Ioanna Laliotou with ECAS id n002d498 signed in the Participant Portal on 29/09/2021 at 07:26:49 (transaction id SigId-15801-2Sja6 rXfzadBsUznTdv9tufHkXrzeUpvqAtfU0kYfXRBTevjOXOREu9rzZlzlY GUWEuFzbluivqymu8O42NzezKzG-jpjZscgsw0KwfOyDFdfEC-RoX WhzsGyGubrPzjlTpVN4FpI1Gfa8qoztZ2WzYDosq6G3lJaITEk0GRJ bqo2qeyHGsuHlrbr8OufjnPkAmhm). Timestamp by third party at 2021.09.29 08:26:54 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ASSOCIACAO DO INSTITUTO SUPERIOR TECNICO PARA A INVESTIGACAO E DESENVOLVIMENTO (IST), established in AVENIDA ROVISCO PAIS 1, LISBOA 1049 001, Portugal, VAT number: PT509830072, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('28')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Rogério COLAÇO with ECAS id ncolarog signed in the Participant Portal on 28/09/2021 at 19:08:03 (transaction id SigId-13297-8nNYI hm5Hhe3pSowBLPQorMahMHgjGtni2AU0a6BYczgVGIZdzPtvv7YGFy A7tHeIVierEO2DT8lmacwMLiHr0-jpjZscgsw0KwfOyDFdfEC-5Dqth 7bQLZfvKMhXezzr1B4rc1NSmMq0vBEDCB23UDN5mMSEV1DoqAf16 pC0e2rpLBSDjzfxkWRCD2eoHjytnQG). Timestamp by third party at 2021.09.28 20:08:09 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

VELEUCILISTE VELIKA GORICA (UASVG), established in ZAGREBACKA 5, VELIKA GORICA 10410, Croatia, VAT number: HR09032023114, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('29')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Ivan TOTH with ECAS id ntthivan signed in the Participant Portal
on 29/09/2021 at 08:34:59 (transaction id SigId-16557-PGAp38fhz
fcBixSZwB8ikzxeRYpwAZTrDKEMrlBgWExjYv9bk4OqGorcFNGCab
iyziUce9t0kJNvKe8kFyWJiyG-jpJZscgsw0KwfOyDFdfrEC-CzQPxcvIP
Jm3DwObiNrizzYmQVywthh3d7hk7ojjk3MYChofoi3FnRMLA4w22
YLiTVB7VwzaoEfRGhTTqzhHE3l). Timestamp by third party at
2021.09.29 09:35:05 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

USTAV INFORMATIKY, SLOVENSKA AKADEMIA VIED (UISAV), established in DUBRAVSKA CESTA 9, BRATISLAVA 845 07, Slovakia, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('30')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Robert ANDOK with ECAS id nandokro signed in the Participant Portal on 29/09/2021 at 12:51:26 (transaction id SigId-20819-6pop BurSYdIQxyrsj4qCrbiBrEfMyI6WOZkqeHnXmt9AEJSyErWY6m3ylB VNrOzIqJabp6TrnyxFVMhwSXMK-jpJZscgsw0KwfOyDFdfrEC-QxhNk IKyTsDkhoQuFIi1Brkrc3MEzKS1uGD8BHQocEB8STIAQDRt4uVnU vzuUCVcJVYTOyztomRczRSQzonT). Timestamp by third party at 2021.09.29 13:51:31 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

POMPIERS DE L'URGENCE INTERNATIONALE (PUI), established in 1 AVENUE DE L ABATTOIR, LIMOGES 87000, France, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('31')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Philippe Besson with ECAS id n00298q9 signed in the Participant Portal on 28/09/2021 at 19:15:18 (transaction id SigId-13355-kt8d 5zxeG74ztP3k1cOIIWtrBqj1wckXIHl01fXaAELOPB85Jl8IoXR19aBBn 4NJRwwNsEuUjt2KWWtTY56A6r-jpZscgsw0KwfOyDFdfrEC-qmxzjo RQVjbagtIALSJmnqe1HvxvzPKCdwFwO4NlJZTxbWw29eAuZtzam3 0LtUtcOfFdxyLWBqjR15q6zRkzvOI). Timestamp by third party at 2021.09.28 20:15:25 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

THE MAIN SCHOOL OF FIRE SERVICE (SGSP), established in SLOWACKIEGO 52/54, WARSZAWA 01-629, Poland, VAT number: PL1180035927, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('32')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Mariusz Feltnowski with ECAS id n005t42y signed in the Participant Portal on 29/09/2021 at 11:21:23 (transaction id SigId-19560-FVcKS5I i6ZPPKqhZlHvWnzHNBzdIBPeDm1kqfGP9WQJRjFEjM6lHS9ezhrAtTKf V8KyC3yVom1iKvPzUjoL2pW-jpJZscgsw0KwfOyDFdfrEC-Wo4W3cCN4 IBYlEpiyCpOrefFsBi5ukyEtIBwT4xj72HawzqzjQIOjo3WoYLTVs2tB02eV RboRbdxpWzjUT0ZdA10). Timestamp by third party at
2021.09.29 12:21:29 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

AGENZIA REGIONALE STRATEGICA PER LO SVILUPPO ECOSOSTENIBILE DEL TERRITORIO (ASSET), established in VIA GIOVANNI GENTILE 52, BARI 70126, Italy, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('33')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

raffaele sannicandro with ECAS id n002te8o signed in the Participant Portal on 28/09/2021 at 14:50:15 (transaction id SigId-57307-ujFL1dg LzhzaZTJEETm49dhGGExBiB7FK2iFO8x5yQiky7keSitgNFb8yHvviM5t OoknSIDHzpFOIbGYZY49lzO-rS0vSrmBGYCagVEG22GDby-ztOnL5dO 4PMysuv2rgPFi7zPF3jGHp3AKtgEzmAypQh7Z7SBJ0OLDkRSOKjsph muazSmzdwTU4y60qoftpNyp). Timestamp by third party at 2021.09.28 15:50:20 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

LETS ITALIA SRLS (LETS), established in VIA PARINI 164, MODENA 41123, Italy, VAT number: IT03757240365, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('34')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

PARCO NATURALE REGIONALE DI TEPILORA (PNRT), established in VIA ATTILIO DEFFENU 69, BITTI 08021, Italy, VAT number: IT01465970919, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('35')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Marianna Agostina Mossa with ECAS id n007a8gs signed in the Participant Portal on 29/09/2021 at 13:32:41 (transaction id SigId-21359-zoSz7VeCP2oqtEA0QFrE97r5iBKZ8d7UXYeVUxAFeNA1ySScKsh96rqcZl7slyueLjbA1zdQzUbdeCcObXoeyW-jpjZscgsw0KwfOyDFdfrEC-gzVwCq9KfpjL5dtTgDFz8yS4mjVK0aHiokDDO3AL25KEAe7bnozMmkzuOryk5Ij5KazVRzgkXSVylGrPK6Bwc8uG). Timestamp by third party at 2021.09.29 14:33:06 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

FUNDATIA PENTRU SMURD (FptSMURD), established in STRADA GHEORGHE MARINESCU 50, MURES TIRGU MURES 540136, Romania, VAT number: RO28076033, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('36')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Ioana Mirela Daramus with ECAS id n0039vm signed in the Participant Portal on 02/10/2021 at 11:55:56 (transaction id SigId: 15074-jT3Yp40f4XDriE7Wa525EVtC0jgj8LBp47HaPM8fsjkWzzeOjwD3 o8jhMA5E8S9Vx4GFzGzOKKLm9Wd2SRzdxnU-yntOf97THq7ktbp37IfAm-WzfzYU1FvRWJ9Mh5qkrwcN23jk3q5apF8L FQcsoBPWQbdax3qfnzkoAxYNje6vzUwEZUkmjTlqYj1cKZxOvkPNq).
Timestamp by third party at
2021.10.02 12:56:06 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ASOCIATIA FORESTIERILOR DIN ROMANIA ASFOR (ASFOR), established in SOS PIPERA 46 A SECTOR 2, BUCURESTI 020112, Romania, VAT number: RO6812970, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('37')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

ciprian musca with ECAS id n00515pz signed in the Participant Portal
on 28/09/2021 at 13:38:54 (transaction id SigId-56026-O9tDk3ojr4u4
Tv9akUc3RqvGFTTbKQ42R5c5IGzg1tUIyFL907cYe9VoxOHhGCzyggGf
n6bcOzctNm0wZojCapG-rS0vSrmBGYCagVEG22GDby-zzoQTmP5R8
vh80qdWtoqTTU3MucVmHMKBaNkdatWapHQtcmc5c9YSO3RVDXu2
XMI84Uzhfzdx6NG6HXyXDYr92). Timestamp by third party at
2021.09.28 14:38:59 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

KENTRO MELETON ASFALEIAS (KEMEA), established in P KANELLOPOULOU 4 ST, ATHINA 10177, Greece, VAT number: EL999333507, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('38')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

THEODOROS DRAVILLAS with ECAS id n0034ojm signed in the Participant Portal on 28/09/2021 at 15:03:19 (transaction id SigId-57546-hKkpUujWPB18Pk7OsSztpXPaQ7XDYDIR4jhgowwVfH34BTBn3Q4vAezjjdXH2IzguTH07tqQiy1MpvXozL5fzw0rS0vSrmBGYCagVEG22GDby-aLU9syhxllJzNgezly7apalhMh3y9m8hHjzGWszSCldkziPk2hNGoMbzUDze40ohDwzGG59FQ3w8TQFvSoPVJS).
Timestamp by third party at
2021.09.28 16:03:26 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ELLINIKI OMADA DIASOSIS SOMATEIO (HRT), established in EMM PAPA 5, THESSALONIKI 54 248, Greece, VAT number: EL090197790, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('39')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

ARISTOTELIO PANEPISTIMIO THESSALONIKIS (AHEPA), established in KEDEA BUILDING, TRITIS SEPTEMVRIOU, ARISTOTLE UNIV CAMPUS, THESSALONIKI 54636, Greece, VAT number: EL090049627, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('40')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

OSPEDALE ISRAELITICO (OIR), established in P ZZA SAN BARTOLOMEO ALL ISO 21, ROMA 00186, Italy, VAT number: IT02133341004, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('41')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Riccardo Fragomeni with ECAS id n003shfd signed in the Participant Portal on 01/10/2021 at 15:01:54 (transaction id SigId-12824-7IfDo426JrtMPj4l5fRraFWK9wLv8tMnRwzzzv2q7czSg4X54QV7WzmFDLAWhfragG453asPlmOlpjTKhixJLm-yntOf97TTHq7ktbp37lfAm-GDdMrX6atbQjBM2ocj53UfdJrBuh5AEUuXrW9F4KhnRrkqSGjENQUzYVHdoBLy8UXqp5gzaAk2N8A1KkBjjqK). Timestamp by third party at 2021.10.01 16:02:06 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

PERIFEREIA STEREAS ELLADAS (PSTE), established in YPSILANDI 1, LAMIA 35131, Greece, VAT number: EL997947718, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('42')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Themistoklis CHEIMARAS with ECAS id ncheithe signed in the Participant Portal on 29/09/2021 at 07:14:46 (transaction id SigId-15720-rSxyJGNGLQQvb36zr1lIr5j7R7EjTXMQTHxi7TizQZg3mYHG5G7f GpVJMqZFYg9B1HzgiFp9RPu4AuwNn6b36d-jpJZscgsw0KwfOyDFdfrEC-OIMMPGf3qXahedjiEAoOnO7bS1ZNS5qujf0kj00ifRhj5vjO3xFDMYqLYKHdvxTOCcjPI75TKxPjYNwo3zrvM).
Timestamp by third party at
2021.09.29 08:14:57 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

HASICSKY ZACHRANNY SBOR MORAVSKOSLEZSKEHO KRAJE (FRS MB), established in VYSKOVICKA 40 ZABREH, OSTRAVA 700 30, Czech Republic, VAT number: CZ70884561, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('43')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

HRVATSKA VATROGASNA ZAJEDNICA (HVZ), established in SELSKA CESTA 90A, ZAGREB 10000, Croatia, VAT number: HR08474627795, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('44')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

TECHNICKA UNIVERZITA VO ZVOLENE (TUZVO), established in T G MASARYKA 24, ZVOLEN 960 01, Slovakia, VAT number: SK2020474808, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('45')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Rudolf KROPLIL with ECAS id nkoprud signed in the Participant Portal on 30/09/2021 at 14:47:40 (transaction id SigId-35266-7s9zXq 5sfGzths0zUxmfechAuWQq4KxarhiKDrkzu8vGHc948NKlggOYztLdHKATgNW2MUaNzeo5WpDhisRSt5tm-jpjZscgsw0KwfOyDFdfrEC-iLmg3sQRv05p9rojqOuFIAHzQ0gMxZiEzsCybbaAcG27tPRjggjPmswp3 toDITu9i2FDynLstV2jRNx2zi9uem). Timestamp by third party at 2021.09.30 15:47:45 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

OBCIANSKE ZDRUZENIE PLAMEN BADIN (Plamen), established in HLINY 426 7, BADIN 976 32, Slovakia, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('46')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Jan Hanuliak with ECAS id n005rvuw signed in the Participant Portal on 28/09/2021 at 16:51:16 (transaction id SigId-59220-Hbv6z mAjj1SlzNFPZFnAkT0FW40oIMnNdXf5exuMbRkkqpwiijdvruINHUsV jb3HpdjhLqYunSxD4ho6qSjjU3-rS0vSrmBGCagVEG22GDby-inBt9 HRMmpii11GReD82q7hs2vyzNAmY2yyZrdVFzhWjkWkhs17Qx2iki8 x8pUlnXjxx5wjzWPwXYk2BiSGCa). Timestamp by third party at 2021.09.28 17:51:21 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

YAYASAN AMIKOM YOGYAKARTA (AMIKOM), established in JL RINGROAD UTARA, DESA CONDONGCATUR, KECAMATAN DEPOK, KABUPATEN SLEMAN, PROPINSI DAERAH ISTIMEWA YOGYAKARTA, SLEMAN 55283, Indonesia, VAT number: ID016951071542000, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('47')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Arief Setyanto with ECAS id n003elqh signed in the Participant Portal on 30/09/2021 at 04:27:57 (transaction id SigId-27592-l9VBbb
MsgEMQTuq8SwS8NOWfDCy6BF8opf81RhIQChuaOBLR1vEGtznclRI
eZ7Ld5kzV1glar0h4pzPQCy0ED2m-jpjZscgsw0KwfOyDFdfrEC-TFN6S
DKBJBk9W8BoedT0WwaYei3iQbQ4kw0zzj30cKnTCHKGPzaqtgyRa1
kxi0f02Cow4rkYzV3glzdxV5Hw0u). Timestamp by third party at
2021.09.30 05:28:07 CEST



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANISATION (CSIRO), established in CLUNIES ROSS STREET CSIRO BLACK MOUNTAIN SCIENCE AND INNOVATION PARK, ACTON ACT 2601, Australia, VAT number: AU41687119230, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('48')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary



ANNEX 3

ACCESSION FORM FOR BENEFICIARIES

UNIVERSIDADE FEDERAL DO RIO DE JANEIRO (UFRJ), established in AV BRIGADEIRO TROMPOWSKI SN 2, RIO DE JANEIRO 21941 590, Brazil, ('the beneficiary'), represented for the purpose of signing this Accession Form by the undersigned,

hereby agrees

to become beneficiary No ('49')

in Grant Agreement No 101037247 ('the Agreement')

between UNIVERSITA TELEMATICA PEGASO and the European Research Executive Agency (REA) ('the Agency'), under the powers delegated by the European Commission ('the Commission'),

for the action entitled 'Integrated Technological and Information Platform for wildfire Management (SILVANUS)'.

and mandates

the coordinator to submit and sign in its name and on its behalf any **amendments** to the Agreement, in accordance with Article 55.

By signing this Accession Form, the beneficiary accepts the grant and agrees to implement it in accordance with the Agreement, with all the obligations and conditions it sets out.

SIGNATURE

For the beneficiary

Nelson EBECKEN with ECAS id nebeckne signed in the Participant Portal on 28/09/2021 at 15:23:35 (transaction id SigId-57933-iY5iN8LU18CAowzTzk8fMke1LeTvicxiqY5rVX5vIQK6e1FC8njZQxdQjofeNx tzUKDQePGPZMIahrzVOzhkszm-rS0vSrmBGYCagVEG22GDby-i3k6b ki49ND6pDElOpYRxSQfzzQvEj7TajBrUvmuqcCapeeyDPzwkklV6WFR kuDCno1rAZv1QmWQRYLknL1zr10). Timestamp by third party at 2021.09.28 16:23:41 CEST

FINANCIAL STATEMENT FOR [BENEFICIARY [name]/ LINKED THIRD PARTY [name]] FOR REPORTING PERIOD [reporting period]

Eligible ¹ costs (per budget category)													Receipts	EU contribution			Additional information
A. Direct personnel costs			B. Direct costs of subcontracting	C. Direct costs of fin. support	D. Other direct costs			E. Indirect costs ²	F. Costs of ...]		Total costs	Receipts	Reimbursement rate %	Maximum EU contribution ³	Requested EU contribution	Information for indirect costs :	
A.1 Employees (or equivalent)	A.4 SME owners without salary			[C.1 Financial support]	D.1 Travel	[D.4 Costs of large research infrastructure]	D.5 Costs of internally invoiced goods and services		[F.1 Costs of ...]	[F.2 Costs of ...]		Receipts of the action, to be reported in the last reporting period, according to Article 5.3.3				Costs of in-kind contributions not used on premises	
A.2 Natural persons under direct contract	A.5 Beneficiaries that are natural persons without salary			[C.2 Prizes]	D.2 Equipment												
A.3 Seconded persons					D.3 Other goods and services												
[A.6 Personnel for providing access to research infrastructure]																	
Form of costs ⁴	Actual	Unit	Unit		Actual	Actual	Actual	Unit	Unit		[Unit][Lump sum]	Receipts of the action, to be reported in the last reporting period, according to Article 5.3.3				Costs of in-kind contributions not used on premises	
	a	Total b	No hours	Total c	d	[e]	f	[g]	Total h	i=0,25 x (a+b+c+f+[g]+h+[j1] ⁶ +[j2] ⁶ -p)	No units	Total [j1]	Total [j2]	k = a+b+c+d+[e]+f+[g]+h+i+[j1]+[j2]	l	m	n
[short name beneficiary/linked third party]																p	

The beneficiary/linked third party hereby confirms that:

The information provided is complete, reliable and true.

The costs declared are eligible (see Article 6).

The costs can be substantiated by adequate records and supporting documentation that will be produced upon request or in the context of checks, reviews, audits and investigations (see Articles 17, 18 and 22).

For the last reporting period: that all the receipts have been declared (see Article 5.3.3).

① Please declare all eligible costs, even if they exceed the amounts indicated in the estimated budget (see Annex 2). Only amounts that were declared in your individual financial statements can be taken into account lateron, in order to replace other costs that are found to be ineligible.

¹ See Article 6 for the eligibility conditions

² The indirect costs claimed must be free of any amounts covered by an operating grant (received under any EU or Euratom funding programme; see Article 6.2.E). If you have received an operating grant during this reporting period, you cannot claim indirect costs unless you can demonstrate that the operating grant does not cover any costs of the action.

³ This is the *theoretical* amount of EU contribution that the system calculates automatically (by multiplying the reimbursement rate by the total costs declared). The amount you request (in the column 'requested EU contribution') may be less,

⁴ See Article 5 for the forms of costs

⁵ Flat rate : 25% of eligible direct costs, from which are excluded: direct costs of subcontracting, costs of in-kind contributions not used on premises, direct costs of financial support, and unit costs declared under budget category F if they include indirect costs (see Article 6.2.E)

⁶ Only specific unit costs that do not include indirect costs

ANNEX 5

MODEL FOR THE CERTIFICATE ON THE FINANCIAL STATEMENTS

- For options [*in italics in square brackets*]: choose the applicable option. Options not chosen should be deleted.
- For fields in [**grey in square brackets**]: enter the appropriate data

TABLE OF CONTENTS

TERMS OF REFERENCE FOR AN INDEPENDENT REPORT OF FACTUAL FINDINGS ON COSTS DECLARED UNDER A GRANT AGREEMENT FINANCED UNDER THE HORIZON 2020 RESEARCH FRAMEWORK PROGRAMME

INDEPENDENT REPORT OF FACTUAL FINDINGS ON COSTS DECLARED UNDER A GRANT AGREEMENT FINANCED UNDER THE HORIZON 2020 RESEARCH FRAMEWORK PROGRAMME



Terms of Reference for an Independent Report of Factual Findings on costs declared under a Grant Agreement financed under the Horizon 2020 Research and Innovation Framework Programme

This document sets out the ‘**Terms of Reference (ToR)**’ under which

[OPTION 1: [insert name of the beneficiary] (‘the Beneficiary’)] [OPTION 2: [insert name of the linked third party] (‘the Linked Third Party’), third party linked to the Beneficiary [insert name of the beneficiary] (‘the Beneficiary’)]

agrees to engage

[insert legal name of the auditor] (‘the Auditor’)

to produce an independent report of factual findings (‘the Report’) concerning the Financial Statement(s)¹ drawn up by the *[Beneficiary] [Linked Third Party]* for the Horizon 2020 grant agreement *[insert number of the grant agreement, title of the action, acronym and duration from/to]* (‘the Agreement’), and

to issue a Certificate on the Financial Statements’ (‘CFS’) referred to in Article 20.4 of the Agreement based on the compulsory reporting template stipulated by the Commission.

The Agreement has been concluded under the Horizon 2020 Research and Innovation Framework Programme (H2020) between the Beneficiary and *[OPTION 1: the European Union, represented by the European Commission (‘the Commission’)][OPTION 2: the European Atomic Energy Community (Euratom,) represented by the European Commission (‘the Commission’)][OPTION 3: the [Research Executive Agency (REA)] [European Research Council Executive Agency (ERCEA)] [Innovation and Networks Executive Agency (INEA)] [Executive Agency for Small and Medium-sized Enterprises (EASME)] (‘the Agency’), under the powers delegated by the European Commission (‘the Commission’).]*

The *[Commission] [Agency]* is mentioned as a signatory of the Agreement with the Beneficiary only. The *[European Union][Euratom][Agency]* is not a party to this engagement.

1.1 Subject of the engagement

The coordinator must submit to the *[Commission][Agency]* the final report within 60 days following the end of the last reporting period which should include, amongst other documents, a CFS for each beneficiary and for each linked third party that requests a total contribution of EUR 325 000 or more, as reimbursement of actual costs and unit costs calculated on the basis of its usual cost accounting practices (see Article 20.4 of the Agreement). The CFS must cover all reporting periods of the beneficiary or linked third party indicated above.

The Beneficiary must submit to the coordinator the CFS for itself and for its linked third party(ies), if the CFS must be included in the final report according to Article 20.4 of the Agreement.

The CFS is composed of two separate documents:

- The Terms of Reference (‘the ToR’) to be signed by the *[Beneficiary] [Linked Third Party]* and the Auditor;

¹ By which costs under the Agreement are declared (see template ‘Model Financial Statements’ in Annex 4 to the Grant Agreement).



H2020 Model Grant Agreements: H2020 General MGA — Multi: v5.0 – dd.mm.2017

- The Auditor's Independent Report of Factual Findings ('the Report') to be issued on the Auditor's letterhead, dated, stamped and signed by the Auditor (or the competent public officer) which includes the agreed-upon procedures ('the Procedures') to be performed by the Auditor, and the standard factual findings ('the Findings') to be confirmed by the Auditor.

If the CFS must be included in the final report according to Article 20.4 of the Agreement, the request for payment of the balance relating to the Agreement cannot be made without the CFS. However, the payment for reimbursement of costs covered by the CFS does not preclude the Commission / Agency, the European Anti-Fraud Office and the European Court of Auditors from carrying out checks, reviews, audits and investigations in accordance with Article 22 of the Agreement.

1.2 Responsibilities

The *[Beneficiary] [Linked Third Party]*:

- must draw up the Financial Statement(s) for the action financed by the Agreement in compliance with the obligations under the Agreement. The Financial Statement(s) must be drawn up according to the *[Beneficiary's] [Linked Third Party's]* accounting and book-keeping system and the underlying accounts and records;
- must send the Financial Statement(s) to the Auditor;
- is responsible and liable for the accuracy of the Financial Statement(s);
- is responsible for the completeness and accuracy of the information provided to enable the Auditor to carry out the Procedures. It must provide the Auditor with a written representation letter supporting these statements. The written representation letter must state the period covered by the statements and must be dated;
- accepts that the Auditor cannot carry out the Procedures unless it is given full access to the *[Beneficiary's] [Linked Third Party's]* staff and accounting as well as any other relevant records and documentation.

The Auditor:

- *[Option 1 by default]:* is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations].
- *[Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer]:* is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary].
- *[Option 3 if the Beneficiary or Linked Third Party is an international organisation]:* is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation].

The Auditor:

- must be independent from the Beneficiary *[and the Linked Third Party]*, in particular, it must not have been involved in preparing the *[Beneficiary's] [Linked Third Party's]* Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with this ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the *[Beneficiary] [Linked Third Party]*.



The Commission sets out the Procedures to be carried out by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement, the Auditor does not provide an audit opinion or a statement of assurance.

1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with²:

- the International Standard on Related Services ('ISRS') 4400 *Engagements to perform Agreed-upon Procedures regarding Financial Information* as issued by the International Auditing and Assurance Standards Board (IAASB);
- the *Code of Ethics for Professional Accountants* issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the [Commission]/[Agency] requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there is no conflict of interests in establishing this Report between the Auditor and the Beneficiary [*and the Linked Third Party*], and must specify - if the service is invoiced - the total fee paid to the Auditor for providing the Report.

1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7).

Under Article 22 of the Agreement, the Commission[, *the Agency*], the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are declared from [the European Union] [Euratom] budget. This includes work related to this engagement. The Auditor must provide access to all working papers (e.g. recalculation of hourly rates, verification of the time declared for the action) related to this assignment if the Commission [, *the Agency*], the European Anti-Fraud Office or the European Court of Auditors requests them.

1.5 Timing

The Report must be provided by /dd Month yyyy].

1.6 Other terms

[The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.]

[legal name of the Auditor]

[legal name of the [Beneficiary]/[Linked Third Party]]

[name & function of authorised representative]

[name & function of authorised representative]

[dd Month yyyy]

[dd Month yyyy]

Signature of the Auditor

Signature of the [Beneficiary]/[Linked Third Party]

² Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.



**Independent Report of Factual Findings on costs declared
under Horizon 2020 Research and Innovation Framework Programme**

(To be printed on the Auditor's letterhead)

To

[name of contact person(s)], [Position]
 [*Beneficiary's*] [*Linked Third Party's*] name]
 [Address]
 [dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with [OPTION 1: *insert name of the beneficiary*] ('the Beneficiary')]/ [OPTION 2: *insert name of the linked third party*] ('the Linked Third Party'), third party linked to the Beneficiary [*insert name of the beneficiary*] ('the Beneficiary')],

we

[name of the auditor] ('the Auditor'),

established at

[full address/city/state/province/country],

represented by

[name and function of an authorised representative],

have carried out the procedures agreed with you regarding the costs declared in the Financial Statement(s)³ of the [*Beneficiary*] [*Linked Third Party*] concerning the grant agreement [*insert grant agreement reference: number, title of the action and acronym*] ('the Agreement'),

with a total cost declared of

[total amount] EUR,

and a total of actual costs and unit costs calculated in accordance with the [*Beneficiary's*] [*Linked Third Party's*] usual cost accounting practices' declared of

[sum of total actual costs and total direct personnel costs declared as unit costs calculated in accordance with the [*Beneficiary's*] [*Linked Third Party's*] usual cost accounting practices] EUR

and **hereby provide our Independent Report of Factual Findings ('the Report')** using the compulsory report format agreed with you.

The Report

Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') examined.

³ By which the Beneficiary declares costs under the Agreement (see template 'Model Financial Statement' in Annex 4 to the Agreement).



The Procedures were carried out solely to assist the *[Commission] [Agency]* in evaluating whether the *[Beneficiary's] [Linked Third Party's]* costs in the accompanying Financial Statement(s) were declared in accordance with the Agreement. The *[Commission] [Agency]* draws its own conclusions from the Report and any additional information it may require.

The scope of the Procedures was defined by the Commission. Therefore, the Auditor is not responsible for their suitability or pertinence. Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, the Auditor does not give a statement of assurance on the Financial Statements.

Had the Auditor carried out additional procedures or an audit of the *[Beneficiary's] [Linked Third Party's]* Financial Statements in accordance with International Standards on Auditing or International Standards on Review Engagements, other matters might have come to its attention and would have been included in the Report.

Not applicable Findings

We examined the Financial Statement(s) stated above and considered the following Findings not applicable:

Explanation (to be removed from the Report):

If a Finding was not applicable, it must be marked as 'N.A.' ('Not applicable') in the corresponding row on the right-hand column of the table and means that the Finding did not have to be corroborated by the Auditor and the related Procedure(s) did not have to be carried out.

The reasons of the non-application of a certain Finding must be obvious i.e.

- i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable;*
- ii) if the condition set to apply certain Procedure(s) are not met the related Finding(s) and those Procedure(s) are not applicable. For instance, for 'beneficiaries with accounts established in a currency other than euro' the Procedure and Finding related to 'beneficiaries with accounts established in euro' are not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.*

List here all Findings considered not applicable for the present engagement and explain the reasons of the non-applicability.

....

Exceptions

Apart from the exceptions listed below, the *[Beneficiary] [Linked Third Party]* provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and evaluate the Findings.

Explanation (to be removed from the Report):

- If the Auditor was not able to successfully complete a procedure requested, it must be marked as 'E' ('Exception') in the corresponding row on the right-hand column of the table. The reason such as the inability to reconcile key information or the unavailability of data that prevents the Auditor from carrying out the Procedure must be indicated below.*
- If the Auditor cannot corroborate a standard finding after having carried out the corresponding procedure, it must also be marked as 'E' ('Exception') and, where possible, the reasons why the Finding was not fulfilled and its possible impact must be explained here below.*

List here any exceptions and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, include the corresponding amount.

....

***Example (to be removed from the Report):***

1. *The Beneficiary was unable to substantiate the Finding number 1 on ... because*
2. *Finding number 30 was not fulfilled because the methodology used by the Beneficiary to calculate unit costs was different from the one approved by the Commission. The differences were as follows: ...*
3. *After carrying out the agreed procedures to confirm the Finding number 31, the Auditor found a difference of _____ EUR. The difference can be explained by ...*

Further Remarks

In addition to reporting on the results of the specific procedures carried out, the Auditor would like to make the following general remarks:

Example (to be removed from the Report):

1. *Regarding Finding number 8 the conditions for additional remuneration were considered as fulfilled because ...*
2. *In order to be able to confirm the Finding number 15 we carried out the following additional procedures:*

Use of this Report

This Report may be used only for the purpose described in the above objective. It was prepared solely for the confidential use of the [Beneficiary] [Linked Third Party] and the [Commission] [Agency], and only to be submitted to the [Commission] [Agency] in connection with the requirements set out in Article 20.4 of the Agreement. The Report may not be used by the [Beneficiary] [Linked Third Party] or by the [Commission] [Agency] for any other purpose, nor may it be distributed to any other parties. The [Commission] [Agency] may only disclose the Report to authorised parties, in particular to the European Anti-Fraud Office (OLAF) and the European Court of Auditors.

This Report relates only to the Financial Statement(s) submitted to the [Commission] [Agency] by the [Beneficiary] [Linked Third Party] for the Agreement. Therefore, it does not extend to any other of the [Beneficiary's] [Linked Third Party's] Financial Statement(s).

There was no conflict of interest⁴ between the Auditor and the Beneficiary [and Linked Third Party] in establishing this Report. The total fee paid to the Auditor for providing the Report was EUR _____ (including EUR _____ of deductible VAT).

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance.

[legal name of the Auditor]

[name and function of an authorised representative]

[dd Month yyyy]

Signature of the Auditor

⁴ A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:

- was involved in the preparation of the Financial Statements;
- stands to benefit directly should the certificate be accepted;
- has a close relationship with any person representing the beneficiary;
- is a director, trustee or partner of the beneficiary; or
- is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Agreed-upon procedures to be performed and standard factual findings to be confirmed by the Auditor

The European Commission reserves the right to i) provide the auditor with additional guidance regarding the procedures to be followed or the facts to be ascertained and the way in which to present them (this may include sample coverage and findings) or to ii) change the procedures, by notifying the Beneficiary in writing. The procedures carried out by the auditor to confirm the standard factual finding are listed in the table below.

If this certificate relates to a Linked Third Party, any reference here below to ‘the Beneficiary’ is to be considered as a reference to ‘the Linked Third Party’.

The ‘result’ column has three different options: ‘C’, ‘E’ and ‘N.A.’:

- ‘C’ stands for ‘confirmed’ and means that the auditor can confirm the ‘standard factual finding’ and, therefore, there is no exception to be reported.
- ‘E’ stands for ‘exception’ and means that the Auditor carried out the procedures but cannot confirm the ‘standard factual finding’, or that the Auditor was not able to carry out a specific procedure (e.g. because it was impossible to reconcile key information or data were unavailable),
- ‘N.A.’ stands for ‘not applicable’ and means that the Finding did not have to be examined by the Auditor and the related Procedure(s) did not have to be carried out. The reasons of the non-application of a certain Finding must be obvious i.e. i) if no cost was declared under a certain category then the related Finding(s) and Procedure(s) are not applicable; ii) if the condition set to apply certain Procedure(s) are not met then the related Finding(s) and Procedure(s) are not applicable. For instance, for ‘beneficiaries with accounts established in a currency other than the euro’ the Procedure related to ‘beneficiaries with accounts established in euro’ is not applicable. Similarly, if no additional remuneration is paid, the related Finding(s) and Procedure(s) for additional remuneration are not applicable.

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A	ACTUAL PERSONNEL COSTS AND UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICE		
	<p>The Auditor draws a sample of persons whose costs were declared in the Financial Statement(s) to carry out the procedures indicated in the consecutive points of this section A.</p> <p><i>(The sample should be selected randomly so that it is representative. Full coverage is required if there are fewer than 10 people (including employees, natural persons working under a direct contract and personnel seconded by a third party), otherwise the sample should have a minimum of 10 people, or 10% of the total, whichever number is the highest)</i></p> <p>The Auditor sampled _____ people out of the total of _____ people.</p>		

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A.1	<p>PERSONNEL COSTS</p> <p><u>For the persons included in the sample and working under an employment contract or equivalent act (general procedures for individual actual personnel costs and personnel costs declared as unit costs)</u></p> <p>To confirm standard factual findings 1-5 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary:</p> <ul style="list-style-type: none"> ○ a list of the persons included in the sample indicating the period(s) during which they worked for the action, their position (classification or category) and type of contract; ○ the payslips of the employees included in the sample; ○ reconciliation of the personnel costs declared in the Financial Statement(s) with the accounting system (project accounting and general ledger) and payroll system; ○ information concerning the employment status and employment conditions of personnel included in the sample, in particular their employment contracts or equivalent; ○ the Beneficiary's usual policy regarding payroll matters (e.g. salary policy, overtime policy, variable pay); ○ applicable national law on taxes, labour and social security and ○ any other document that supports the personnel costs declared. <p>The Auditor also verified the eligibility of all components of the retribution (see Article 6 GA) and recalculated the personnel costs for employees included in the sample.</p>	<p>1) The employees were i) directly hired by the Beneficiary in accordance with its national legislation, ii) under the Beneficiary's sole technical supervision and responsibility and iii) remunerated in accordance with the Beneficiary's usual practices.</p> <p>2) Personnel costs were recorded in the Beneficiary's accounts/payroll system.</p> <p>3) Costs were adequately supported and reconciled with the accounts and payroll records.</p> <p>4) Personnel costs did not contain any ineligible elements.</p> <p>5) There were no discrepancies between the personnel costs charged to the action and the costs recalculated by the Auditor.</p>	
	<p><i>Further procedures if 'additional remuneration' is paid</i></p> <p>To confirm standard factual findings 6-9 listed in the next column, the Auditor:</p> <ul style="list-style-type: none"> ○ reviewed relevant documents provided by the Beneficiary (legal form, legal/statutory 	<p>6) The Beneficiary paying "additional remuneration" was a non-profit legal entity.</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>obligations, the Beneficiary's usual policy on additional remuneration, criteria used for its calculation, the Beneficiary's usual remuneration practice for projects funded under national funding schemes...);</p> <ul style="list-style-type: none"> ○ recalculated the amount of additional remuneration eligible for the action based on the supporting documents received (full-time or part-time work, exclusive or non-exclusive dedication to the action, usual remuneration paid for projects funded by national schemes) to arrive at the applicable FTE/year and pro-rata rate (see data collected in the course of carrying out the procedures under A.2 'Productive hours' and A.4 'Time recording system'). <p><i>'ADDITIONAL REMUNERATION' MEANS ANY PART OF THE REMUNERATION WHICH EXCEEDS WHAT THE PERSON WOULD BE PAID FOR TIME WORKED IN PROJECTS FUNDED BY NATIONAL SCHEMES.</i></p> <p><i>IF ANY PART OF THE REMUNERATION PAID TO THE EMPLOYEE QUALIFIES AS "ADDITIONAL REMUNERATION" AND IS ELIGIBLE UNDER THE PROVISIONS OF ARTICLE 6.2.A.1, THIS CAN BE CHARGED AS ELIGIBLE COST TO THE ACTION UP TO THE FOLLOWING AMOUNT:</i></p> <p>(A) <i>IF THE PERSON WORKS FULL TIME AND EXCLUSIVELY ON THE ACTION DURING THE FULL YEAR: UP TO EUR 8 000/YEAR;</i></p> <p>(B) <i>IF THE PERSON WORKS EXCLUSIVELY ON THE ACTION BUT NOT FULL-TIME OR NOT FOR THE FULL YEAR: UP TO THE CORRESPONDING PRO-RATA AMOUNT OF EUR 8 000, OR</i></p> <p>(C) <i>IF THE PERSON DOES NOT WORK EXCLUSIVELY ON THE ACTION: UP TO A PRO-RATA AMOUNT CALCULATED IN ACCORDANCE TO ARTICLE 6.2.A.1.</i></p>	<p>7) The amount of additional remuneration paid corresponded to the Beneficiary's usual remuneration practices and was consistently paid whenever the same kind of work or expertise was required.</p>	
		<p>8) The criteria used to calculate the additional remuneration were objective and generally applied by the Beneficiary regardless of the source of funding used.</p>	
	<p><i>Additional procedures in case "unit costs calculated by the Beneficiary in accordance with its usual cost accounting practices" is applied:</i></p> <p>Apart from carrying out the procedures indicated above to confirm standard factual findings 1-5 and, if applicable, also 6-9, the Auditor carried out following procedures to confirm standard</p>	<p>9) The amount of additional remuneration included in the personnel costs charged to the action was capped at EUR 8,000 per FTE/year (up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work exclusively on the action).</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>factual findings 10-13 listed in the next column:</p> <ul style="list-style-type: none"> ○ obtained a description of the Beneficiary's usual cost accounting practice to calculate unit costs;; ○ reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS; ○ verified the employees included in the sample were charged under the correct category (in accordance with the criteria used by the Beneficiary to establish personnel categories) by reviewing the contract/HR-record or analytical accounting records; ○ verified that there is no difference between the total amount of personnel costs used in calculating the cost per unit and the total amount of personnel costs recorded in the statutory accounts; ○ verified whether actual personnel costs were adjusted on the basis of budgeted or estimated elements and, if so, verified whether those elements used are actually relevant for the calculation, objective and supported by documents. 	<p>used in all H2020 actions.</p> <p>11) The employees were charged under the correct category.</p> <p>12) Total personnel costs used in calculating the unit costs were consistent with the expenses recorded in the statutory accounts.</p> <p>13) Any estimated or budgeted element used by the Beneficiary in its unit-cost calculation were relevant for calculating personnel costs and corresponded to objective and verifiable information.</p>	
	<p><u>For natural persons included in the sample and working with the Beneficiary under a direct contract other than an employment contract, such as consultants (no subcontractors).</u></p> <p>To confirm standard factual findings 14-17 listed in the next column the Auditor reviewed following information/documents provided by the Beneficiary:</p> <ul style="list-style-type: none"> ○ the contracts, especially the cost, contract duration, work description, place of work, ownership of the results and reporting obligations to the Beneficiary; ○ the employment conditions of staff in the same category to compare costs and; ○ any other document that supports the costs declared and its registration (e.g. invoices, accounting records, etc.). 	<p>14) The natural persons worked under conditions similar to those of an employee, in particular regarding the way the work is organised, the tasks that are performed and the premises where they are performed.</p>	
		<p>15) The results of work carried out belong to the Beneficiary, or, if not, the Beneficiary has obtained all necessary rights to fulfil its obligations as if those</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
		results were generated by itself.	
		16) Their costs were not significantly different from those for staff who performed similar tasks under an employment contract with the Beneficiary.	
		17) The costs were supported by audit evidence and registered in the accounts.	
	<p><u>For personnel seconded by a third party and included in the sample (not subcontractors)</u></p> <p>To confirm standard factual findings 18-21 listed in the next column, the Auditor reviewed following information/documents provided by the Beneficiary:</p> <ul style="list-style-type: none"> ○ their secondment contract(s) notably regarding costs, duration, work description, place of work and ownership of the results; ○ if there is reimbursement by the Beneficiary to the third party for the resource made available_(in-kind contribution against payment): any documentation that supports the costs declared (e.g. contract, invoice, bank payment, and proof of registration in its accounting/payroll, etc.) and reconciliation of the Financial Statement(s) with the accounting system (project accounting and general ledger) as well as any proof that the amount invoiced by the third party did not include any profit; ○ if there is no reimbursement by the Beneficiary to the third party for the resource made available (in-kind contribution free of charge): a proof of the actual cost borne by the Third Party for the resource made available free of charge to the Beneficiary such as a statement of costs incurred by the Third Party and proof of the registration in the Third Party's accounting/payroll; 	18) Seconded personnel reported to the Beneficiary and worked on the Beneficiary's premises (unless otherwise agreed with the Beneficiary).	
		19) The results of work carried out belong to the Beneficiary, or, if not, the Beneficiary has obtained all necessary rights to fulfil its obligations as if those results were generated by itself..	
		<p><i>If personnel is seconded against payment:</i></p> <p>20) The costs declared were supported with documentation and recorded in the</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<ul style="list-style-type: none"> ○ any other document that supports the costs declared (e.g. invoices, etc.). 	Beneficiary's accounts. The third party did not include any profit.	
		<i>If personnel is seconded free of charge:</i>	
A.2	<p>PRODUCTIVE HOURS</p> <p>To confirm standard factual findings 22-27 listed in the next column, the Auditor reviewed relevant documents, especially national legislation, labour agreements and contracts and time records of the persons included in the sample, to verify that:</p> <ul style="list-style-type: none"> ○ the annual productive hours applied were calculated in accordance with one of the methods described below, ○ the full-time equivalent (FTEs) ratios for employees not working full-time were correctly calculated. <p>If the Beneficiary applied method B, the auditor verified that the correctness in which the total number of hours worked was calculated and that the contracts specified the annual workable hours.</p> <p>If the Beneficiary applied method C, the auditor verified that the ‘annual productive hours’ applied when calculating the hourly rate were equivalent to at least 90 % of the ‘standard annual workable hours’. The Auditor can only do this if the calculation of the standard annual workable</p>	22) The Beneficiary applied method [choose one option and delete the others] [A: 1720 hours] [B: the ‘total number of hours worked’] [C: ‘standard annual productive hours’ used correspond to usual accounting practices]	
		23) Productive hours were calculated annually.	
		24) For employees not working full-time the full-time equivalent (FTE) ratio was correctly applied.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>hours can be supported by records, such as national legislation, labour agreements, and contracts.</p> <p><i>BENEFICIARY'S PRODUCTIVE HOURS' FOR PERSONS WORKING FULL TIME SHALL BE ONE OF THE FOLLOWING METHODS:</i></p> <ul style="list-style-type: none"> <i>A. 1720 ANNUAL PRODUCTIVE HOURS (PRO-RATA FOR PERSONS NOT WORKING FULL-TIME)</i> <i>B. THE TOTAL NUMBER OF HOURS WORKED BY THE PERSON FOR THE BENEFICIARY IN THE YEAR (THIS METHOD IS ALSO REFERRED TO AS 'TOTAL NUMBER OF HOURS WORKED' IN THE NEXT COLUMN). THE CALCULATION OF THE TOTAL NUMBER OF HOURS WORKED WAS DONE AS FOLLOWS: ANNUAL WORKABLE HOURS OF THE PERSON ACCORDING TO THE EMPLOYMENT CONTRACT, APPLICABLE LABOUR AGREEMENT OR NATIONAL LAW PLUS OVERTIME WORKED MINUS ABSENCES (SUCH AS SICK LEAVE OR SPECIAL LEAVE).</i> <i>C. THE STANDARD NUMBER OF ANNUAL HOURS GENERALLY APPLIED BY THE BENEFICIARY FOR ITS PERSONNEL IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES (THIS METHOD IS ALSO REFERRED TO AS 'STANDARD ANNUAL PRODUCTIVE HOURS' IN THE NEXT COLUMN). THIS NUMBER MUST BE AT LEAST 90% OF THE STANDARD ANNUAL WORKABLE HOURS.</i> <p><i>'ANNUAL WORKABLE HOURS' MEANS THE PERIOD DURING WHICH THE PERSONNEL MUST BE WORKING, AT THE EMPLOYER'S DISPOSAL AND CARRYING OUT HIS/HER ACTIVITY OR DUTIES UNDER THE EMPLOYMENT CONTRACT, APPLICABLE COLLECTIVE LABOUR AGREEMENT OR NATIONAL WORKING TIME LEGISLATION.</i></p>	<p><i>If the Beneficiary applied method B.</i></p> <p>25) The calculation of the number of 'annual workable hours', overtime and absences was verifiable based on the documents provided by the Beneficiary.</p> <p>25.1) The Beneficiary calculates the hourly rates per full financial year following procedure A.3 (method B is not allowed for beneficiaries calculating hourly rates per month).</p> <p><i>If the Beneficiary applied method C.</i></p> <p>26) The calculation of the number of 'standard annual workable hours' was verifiable based on the documents provided by the Beneficiary.</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
		27) The 'annual productive hours' used for calculating the hourly rate were consistent with the usual cost accounting practices of the Beneficiary and were equivalent to at least 90 % of the 'annual workable hours'.	
A.3	<p>HOURLY PERSONNEL RATES</p> <p><u>I) For unit costs calculated in accordance to the Beneficiary's usual cost accounting practice (unit costs):</u></p> <p>If the Beneficiary has a "Certificate on Methodology to calculate unit costs" (CoMUC) approved by the Commission, the Beneficiary provides the Auditor with a description of the approved methodology and the Commission's letter of acceptance. The Auditor verified that the Beneficiary has indeed used the methodology approved. If so, no further verification is necessary.</p> <p>If the Beneficiary does not have a "Certificate on Methodology" (CoMUC) approved by the Commission, or if the methodology approved was not applied, then the Auditor:</p> <ul style="list-style-type: none"> ○ reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; ○ recalculated the unit costs (hourly rates) of staff included in the sample following the results of the procedures carried out in A.1 and A.2. <p><u>II) For individual hourly rates:</u></p> <p>The Auditor:</p> <ul style="list-style-type: none"> ○ reviewed the documentation provided by the Beneficiary, including manuals and internal guidelines that explain how to calculate hourly rates; 	<p>28) The Beneficiary applied [<i>choose one option and delete the other</i>]:</p> <p>[Option I: "Unit costs (hourly rates) were calculated in accordance with the Beneficiary's usual cost accounting practices"]</p> <p>[Option II: Individual hourly rates were applied]</p> <p><i>For option I concerning unit costs and if the Beneficiary applies the methodology approved by the Commission (CoMUC):</i></p> <p>29) The Beneficiary used the Commission-approved methodology to calculate hourly rates. It corresponded to the organisation's usual cost accounting practices and was applied consistently for all</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<ul style="list-style-type: none"> ○ recalculated the hourly rates of staff included in the sample (recalculation of all hourly rates if the Beneficiary uses annual rates, recalculation of three months selected randomly for every year and person if the Beneficiary uses monthly rates) following the results of the procedures carried out in A.1 and A.2; ○ (only in case of monthly rates) confirmed that the time spent on parental leave is not deducted, and that, if parts of the basic remuneration are generated over a period longer than a month, the Beneficiary has included only the share which is generated in the month. <p><u>"UNIT COSTS CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH ITS USUAL COST ACCOUNTING PRACTICES":</u> <i>IT IS CALCULATED BY DIVIDING THE TOTAL AMOUNT OF PERSONNEL COSTS OF THE CATEGORY TO WHICH THE EMPLOYEE BELONGS VERIFIED IN LINE WITH PROCEDURE A.1 BY THE NUMBER OF FTE AND THE ANNUAL TOTAL PRODUCTIVE HOURS OF THE SAME CATEGORY CALCULATED BY THE BENEFICIARY IN ACCORDANCE WITH PROCEDURE A.2.</i></p> <p><u>HOURLY RATE FOR INDIVIDUAL ACTUAL PERSONAL COSTS:</u> <i>IT IS CALCULATED FOLLOWING ONE OF THE TWO OPTIONS BELOW:</i></p> <p>A) <i>[OPTION BY DEFAULT] BY DIVIDING THE ACTUAL ANNUAL AMOUNT OF PERSONNEL COSTS OF AN EMPLOYEE VERIFIED IN LINE WITH PROCEDURE A.1 BY THE NUMBER OF ANNUAL PRODUCTIVE HOURS VERIFIED IN LINE WITH PROCEDURE A.2 (FULL FINANCIAL YEAR HOURLY RATE);</i></p> <p>B) <i>BY DIVIDING THE ACTUAL MONTHLY AMOUNT OF PERSONNEL COSTS OF AN EMPLOYEE VERIFIED IN LINE WITH PROCEDURE A.1 BY 1/12 OF THE NUMBER OF ANNUAL PRODUCTIVE HOURS VERIFIED IN LINE WITH PROCEDURE A.2.(MONTHLY HOURLY RATE).</i></p>	activities irrespective of the source of funding.	
		<i>For option I concerning unit costs and if the Beneficiary applies a methodology not approved by the Commission:</i> 30) The unit costs re-calculated by the Auditor were the same as the rates applied by the Beneficiary.	
		<i>For option II concerning individual hourly rates:</i> 31) The individual rates re-calculated by the Auditor were the same as the rates applied by the Beneficiary. 31.1) The Beneficiary used only one option (per full financial year or per month) throughout each financial year examined. 31.2) The hourly rates do not include additional remuneration.	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
A.4	<p>TIME RECORDING SYSTEM</p> <p>To verify that the time recording system ensures the fulfilment of all minimum requirements and that the hours declared for the action were correct, accurate and properly authorised and supported by documentation, the Auditor made the following checks for the persons included in the sample that declare time as worked for the action on the basis of time records:</p> <ul style="list-style-type: none"> ○ description of the time recording system provided by the Beneficiary (registration, authorisation, processing in the HR-system); ○ its actual implementation; ○ time records were signed at least monthly by the employees (on paper or electronically) and authorised by the project manager or another manager; ○ the hours declared were worked within the project period; ○ there were no hours declared as worked for the action if HR-records showed absence due to holidays or sickness (further cross-checks with travels are carried out in B.1 below) ; ○ the hours charged to the action matched those in the time recording system. <p><i>ONLY THE HOURS WORKED ON THE ACTION CAN BE CHARGED. ALL WORKING TIME TO BE CHARGED SHOULD BE RECORDED THROUGHOUT THE DURATION OF THE PROJECT, ADEQUATELY SUPPORTED BY EVIDENCE OF THEIR REALITY AND RELIABILITY (SEE SPECIFIC PROVISIONS BELOW FOR PERSONS WORKING EXCLUSIVELY FOR THE ACTION WITHOUT TIME RECORDS).</i></p> <p><u>If the persons are working exclusively for the action and without time records</u></p> <p>For the persons selected that worked exclusively for the action without time records, the Auditor verified evidence available demonstrating that they were in reality exclusively dedicated to the action and that the Beneficiary signed a declaration confirming that they have worked exclusively for the action.</p>	<p>32) All persons recorded their time dedicated to the action on a daily/ weekly/ monthly basis using a paper/computer-based system. (<i>delete the answers that are not applicable</i>)</p> <p>33) Their time-records were authorised at least monthly by the project manager or other superior.</p> <p>34) Hours declared were worked within the project period and were consistent with the presences/absences recorded in HR-records.</p> <p>35) There were no discrepancies between the number of hours charged to the action and the number of hours recorded.</p> <p>36) The exclusive dedication is supported by a declaration signed by the Beneficiary and by any other evidence gathered.</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
B	COSTS OF SUBCONTRACTING		
B.1	<p>The Auditor obtained the detail/breakdown of subcontracting costs and sampled [REDACTED] cost items selected randomly (full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest).</p> <p>To confirm standard factual findings 37-41 listed in the next column, the Auditor reviewed the following for the items included in the sample:</p> <ul style="list-style-type: none"> ○ the use of subcontractors was foreseen in Annex 1; ○ subcontracting costs were declared in the subcontracting category of the Financial Statement; ○ supporting documents on the selection and award procedure were followed; ○ the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the subcontract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment). <p>In particular,</p> <ol style="list-style-type: none"> i. if the Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC (or 2014/24/EU) or of Directive 2004/17/EC (or 2014/25/EU), the Auditor verified that the applicable national law on public procurement was followed and that the subcontracting complied with the Terms and Conditions of the Agreement. ii. if the Beneficiary did not fall under the above-mentioned category the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement.. 	<p>37) The use of claimed subcontracting costs was foreseen in Annex 1 and costs were declared in the Financial Statements under the subcontracting category.</p> <p>38) There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. Subcontracts were awarded in accordance with the principle of best value for money. <i>(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the caption "Exceptions" of the Report. The Commission will analyse this information to evaluate whether these costs might be accepted as eligible)</i></p> <p>39) The subcontracts were not awarded to other Beneficiaries</p>	

Ref	Procedures	Standard factual finding	Result (C / E / N.A.)
	<p>For the items included in the sample the Auditor also verified that:</p> <ul style="list-style-type: none"> ○ the subcontracts were not awarded to other Beneficiaries in the consortium; ○ there were signed agreements between the Beneficiary and the subcontractor; ○ there was evidence that the services were provided by subcontractor; 	of the consortium.	
	40) All subcontracts were supported by signed agreements between the Beneficiary and the subcontractor.		
	41) There was evidence that the services were provided by the subcontractors.		
C	COSTS OF PROVIDING FINANCIAL SUPPORT TO THIRD PARTIES		
C.1	<p>The Auditor obtained the detail/breakdown of the costs of providing financial support to third parties and sampled _____ cost items selected randomly (full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest).</p> <p>The Auditor verified that the following minimum conditions were met:</p> <ul style="list-style-type: none"> a) the maximum amount of financial support for each third party did not exceed EUR 60 000, unless explicitly mentioned in Annex 1; b) the financial support to third parties was agreed in Annex 1 of the Agreement and the other provisions on financial support to third parties included in Annex 1 were respected. 	42) All minimum conditions were met	

D	OTHER ACTUAL DIRECT COSTS	
D.1 COSTS OF TRAVEL AND RELATED SUBSISTENCE ALLOWANCES <p>The Auditor sampled _____ cost items selected randomly (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest</i>).</p> <p>The Auditor inspected the sample and verified that:</p> <ul style="list-style-type: none"> ○ travel and subsistence costs were consistent with the Beneficiary's usual policy for travel. In this context, the Beneficiary provided evidence of its normal policy for travel costs (e.g. use of first class tickets, reimbursement by the Beneficiary on the basis of actual costs, a lump sum or per diem) to enable the Auditor to compare the travel costs charged with this policy; ○ travel costs are correctly identified and allocated to the action (e.g. trips are directly linked to the action) by reviewing relevant supporting documents such as minutes of meetings, workshops or conferences, their registration in the correct project account, their consistency with time records or with the dates/duration of the workshop/conference; ○ no ineligible costs or excessive or reckless expenditure was declared (see Article 6.5 MGA). 	43) Costs were incurred, approved and reimbursed in line with the Beneficiary's usual policy for travels. 44) There was a link between the trip and the action. 45) The supporting documents were consistent with each other regarding subject of the trip, dates, duration and reconciled with time records and accounting. 46) No ineligible costs or excessive or reckless expenditure was declared.	
D.2 DEPRECIATION COSTS FOR EQUIPMENT, INFRASTRUCTURE OR OTHER ASSETS <p>The Auditor sampled _____ cost items selected randomly (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is the highest</i>).</p> <p>For “equipment, infrastructure or other assets” [from now on called “asset(s)’] selected in the sample the Auditor verified that:</p> <ul style="list-style-type: none"> ○ the assets were acquired in conformity with the Beneficiary's internal guidelines and procedures; 	47) Procurement rules, principles and guides were followed. 48) There was a link between the grant agreement and the asset charged to the action. 49) The asset charged to the action was traceable to the accounting records and the underlying documents.	

	<ul style="list-style-type: none"> <input type="radio"/> they were correctly allocated to the action (with supporting documents such as delivery note invoice or any other proof demonstrating the link to the action) <input type="radio"/> they were entered in the accounting system; <input type="radio"/> the extent to which the assets were used for the action (as a percentage) was supported by reliable documentation (e.g. usage overview table); <p>The Auditor recalculated the depreciation costs and verified that they were in line with the applicable rules in the Beneficiary's country and with the Beneficiary's usual accounting policy (e.g. depreciation calculated on the acquisition value).</p> <p>The Auditor verified that no ineligible costs such as deductible VAT, exchange rate losses, excessive or reckless expenditure were declared (see Article 6.5 GA).</p>	50) The depreciation method used to charge the asset to the action was in line with the applicable rules of the Beneficiary's country and the Beneficiary's usual accounting policy. 51) The amount charged corresponded to the actual usage for the action. 52) No ineligible costs or excessive or reckless expenditure were declared.	
D.3	<p>COSTS OF OTHER GOODS AND SERVICES</p> <p>The Auditor sampled _____ cost items selected randomly (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest.</i>)</p> <p>For the purchase of goods, works or services included in the sample the Auditor verified that:</p> <ul style="list-style-type: none"> <input type="radio"/> the contracts did not cover tasks described in Annex 1; <input type="radio"/> they were correctly identified, allocated to the proper action, entered in the accounting system (traceable to underlying documents such as purchase orders, invoices and accounting); <input type="radio"/> the goods were not placed in the inventory of durable equipment; <input type="radio"/> the costs charged to the action were accounted in line with the Beneficiary's usual accounting practices; <input type="radio"/> no ineligible costs or excessive or reckless expenditure were declared (see Article 6 GA). <p>In addition, the Auditor verified that these goods and services were acquired in conformity with</p>	53) Contracts for works or services did not cover tasks described in Annex 1. 54) Costs were allocated to the correct action and the goods were not placed in the inventory of durable equipment. 55) The costs were charged in line with the Beneficiary's accounting policy and were adequately supported. 56) No ineligible costs or excessive or reckless expenditure were declared. For internal invoices/charges only the cost element was charged, without any mark-ups.	

	<p>the Beneficiary's internal guidelines and procedures, in particular:</p> <ul style="list-style-type: none"> ○ if Beneficiary acted as a contracting authority within the meaning of Directive 2004/18/EC (or 2014/24/EU) or of Directive 2004/17/EC (or 2014/25/EU), the Auditor verified that the applicable national law on public procurement was followed and that the procurement contract complied with the Terms and Conditions of the Agreement. ○ if the Beneficiary did not fall into the category above, the Auditor verified that the Beneficiary followed their usual procurement rules and respected the Terms and Conditions of the Agreement. <p>For the items included in the sample the Auditor also verified that:</p> <ul style="list-style-type: none"> ○ the Beneficiary ensured best value for money (key elements to appreciate the respect of this principle are the award of the contract to the bid offering best price-quality ratio, under conditions of transparency and equal treatment. In case an existing framework contract was used the Auditor also verified that the Beneficiary ensured it was established on the basis of the principle of best value for money under conditions of transparency and equal treatment); <p><i>SUCH GOODS AND SERVICES INCLUDE, FOR INSTANCE, CONSUMABLES AND SUPPLIES, DISSEMINATION (INCLUDING OPEN ACCESS), PROTECTION OF RESULTS, SPECIFIC EVALUATION OF THE ACTION IF IT IS REQUIRED BY THE AGREEMENT, CERTIFICATES ON THE FINANCIAL STATEMENTS IF THEY ARE REQUIRED BY THE AGREEMENT AND CERTIFICATES ON THE METHODOLOGY, TRANSLATIONS, REPRODUCTION.</i></p>	<p>57) Procurement rules, principles and guides were followed. There were documents of requests to different providers, different offers and assessment of the offers before selection of the provider in line with internal procedures and procurement rules. The purchases were made in accordance with the principle of best value for money.</p> <p><i>(When different offers were not collected the Auditor explains the reasons provided by the Beneficiary under the caption "Exceptions" of the Report. The Commission will analyse this information to evaluate whether these costs might be accepted as eligible)</i></p>	
D.4 AGGREGATED CAPITALISED AND OPERATING COSTS OF RESEARCH INFRASTRUCTURE	<p>The Auditor ensured the existence of a positive ex-ante assessment (issued by the EC Services) of the cost accounting methodology of the Beneficiary allowing it to apply the guidelines on direct costing for large research infrastructures in Horizon 2020.</p>	<p>58) The costs declared as direct costs for Large Research Infrastructures (in the appropriate line of the Financial Statement) comply with the methodology described in the positive ex-ante assessment report.</p>	

	<p>In the cases that a positive ex-ante assessment has been issued (see the standard factual findings 58-59 on the next column),</p> <p>The Auditor ensured that the beneficiary has applied consistently the methodology that is explained and approved in the positive ex ante assessment;</p> <p>In the cases that a positive ex-ante assessment has NOT been issued (see the standard factual findings 60 on the next column),</p> <p>The Auditor verified that no costs of Large Research Infrastructure have been charged as direct costs in any costs category;</p> <p>In the cases that a draft ex-ante assessment report has been issued with recommendation for further changes (see the standard factual findings 60 on the next column),</p> <ul style="list-style-type: none"> • The Auditor followed the same procedure as above (when a positive ex-ante assessment has NOT yet been issued) and paid particular attention (testing reinforced) to the cost items for which the draft ex-ante assessment either rejected the inclusion as direct costs for Large Research Infrastructures or issued recommendations. 	<p>59) Any difference between the methodology applied and the one positively assessed was extensively described and adjusted accordingly.</p> <p>60) The direct costs declared were free from any indirect costs items related to the Large Research Infrastructure.</p>	
D.5	<p>Costs of internally invoiced goods and services</p> <p>The Auditor sampled cost items selected randomly (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest</i>).</p> <p>To confirm standard factual findings 61-65 listed in the next column, the Auditor:</p> <ul style="list-style-type: none"> ○ obtained a description of the Beneficiary's usual cost accounting practice to calculate costs of internally invoiced goods and services (unit costs); ○ reviewed whether the Beneficiary's usual cost accounting practice was applied for the Financial Statements subject of the present CFS; ○ ensured that the methodology to calculate unit costs is being used in a consistent manner, based on objective criteria, regardless of the source of funding; ○ verified that any ineligible items or any costs claimed under other budget categories, in particular indirect costs, have not been taken into account when calculating the costs of 	<p>61) The costs of internally invoiced goods and services included in the Financial Statement were calculated in accordance with the Beneficiary's usual cost accounting practice.</p> <p>62) The cost accounting practices used to calculate the costs of internally invoiced goods and services were applied by the Beneficiary in a consistent manner based on objective criteria regardless of the source of funding.</p> <p>63) The unit cost is calculated using the actual costs for the good or service recorded in the Beneficiary's accounts, excluding any ineligible cost or costs included in other</p>	

	<ul style="list-style-type: none"> ○ internally invoiced goods and services (see Article 6 GA); ○ verified whether actual costs of internally invoiced goods and services were adjusted on the basis of budgeted or estimated elements and, if so, verified whether those elements used are actually relevant for the calculation, and correspond to objective and verifiable information. ○ verified that any costs of items which are not directly linked to the production of the invoiced goods or service (e.g. supporting services like cleaning, general accountancy, administrative support, etc. not directly used for production of the good or service) have not been taken into account when calculating the costs of internally invoiced goods and services. ○ verified that any costs of items used for calculating the costs internally invoiced goods and services are supported by audit evidence and registered in the accounts. 	<p>budget categories.</p> <p>64) The unit cost excludes any costs of items which are not directly linked to the production of the invoiced goods or service.</p> <p>65) The costs items used for calculating the actual costs of internally invoiced goods and services were relevant, reasonable and correspond to objective and verifiable information.</p>	
E	USE OF EXCHANGE RATES		
E.1	<p>a) For Beneficiaries with accounts established in a currency other than euros</p> <p>The Auditor sampled _____ cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement (full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest):</p> <p><i>COSTS RECORDED IN THE ACCOUNTS IN A CURRENCY OTHER THAN EURO SHALL BE CONVERTED INTO EURO AT THE AVERAGE OF THE DAILY EXCHANGE RATES PUBLISHED IN THE C SERIES OF OFFICIAL JOURNAL OF THE EUROPEAN UNION (https://www.ecb.int/stats/exchange/eurofxref/html/index.en.html), DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.</i></p> <p><i>IF NO DAILY EURO EXCHANGE RATE IS PUBLISHED IN THE OFFICIAL JOURNAL OF THE EUROPEAN UNION FOR THE CURRENCY IN QUESTION, CONVERSION SHALL BE MADE AT THE AVERAGE OF THE MONTHLY ACCOUNTING RATES ESTABLISHED BY THE COMMISSION AND PUBLISHED ON ITS WEBSITE (http://ec.europa.eu/budget/contracts_grants/info_contracts/inforeuro/inforeuro_en.cfm),</i></p>	<p>66) The exchange rates used to convert other currencies into Euros were in accordance with the rules established of the Grant Agreement and there was no difference in the final figures.</p>	

<p><i>DETERMINED OVER THE CORRESPONDING REPORTING PERIOD.</i></p>		
<p>b) For Beneficiaries with accounts established in euros</p> <p>The Auditor sampled _____ cost items selected randomly and verified that the exchange rates used for converting other currencies into euros were in accordance with the following rules established in the Agreement (<i>full coverage is required if there are fewer than 10 items, otherwise the sample should have a minimum of 10 item, or 10% of the total, whichever number is highest</i>):</p> <p><i>COSTS INCURRED IN ANOTHER CURRENCY SHALL BE CONVERTED INTO EURO BY APPLYING THE BENEFICIARY'S USUAL ACCOUNTING PRACTICES.</i></p>	<p>67) The Beneficiary applied its usual accounting practices.</p>	

[legal name of the audit firm]

[name and function of an authorised representative]

[dd Month yyyy]

<Signature of the Auditor>

ANNEX 6

MODEL FOR THE CERTIFICATE ON THE METHODOLOGY

- For options [*in italics in square brackets*]: choose the applicable option. Options not chosen should be deleted.
- For fields in [grey in square brackets]: enter the appropriate data.

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TERMS OF REFERENCE FOR AN AUDIT ENGAGEMENT FOR A METHODOLOGY CERTIFICATE IN CONNECTION WITH ONE OR MORE GRANT AGREEMENTS FINANCED UNDER THE HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME

INDEPENDENT REPORT OF FACTUAL FINDINGS ON THE METHODOLOGY CONCERNING GRANT AGREEMENTS FINANCED UNDER THE HORIZON 2020 RESEARCH AND INNOVATION FRAMEWORK PROGRAMME



**Terms of reference for an audit engagement for a methodology certificate
in connection with one or more grant agreements financed
under the Horizon 2020 Research and Innovation Framework Programme**

This document sets out the ‘**Terms of Reference (ToR)**’ under which

[OPTION 1: [insert name of the beneficiary] (‘the Beneficiary’)] [OPTION 2: [insert name of the linked third party] (‘the Linked Third Party’), third party linked to the Beneficiary [insert name of the beneficiary] (‘the Beneficiary’)]

agrees to engage

[insert legal name of the auditor] (‘the Auditor’)

to produce an independent report of factual findings (‘the Report’) concerning the *[Beneficiary’s] [Linked Third Party’s]* usual accounting practices for calculating and claiming direct personnel costs declared as unit costs (‘the Methodology’) in connection with grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme.

The procedures to be carried out for the assessment of the methodology will be based on the grant agreement(s) detailed below:

[title and number of the grant agreement(s)] (‘the Agreement(s)’)

The Agreement(s) has(have) been concluded between the Beneficiary and *[OPTION 1: the European Union, represented by the European Commission (‘the Commission’)]* *[OPTION 2: the European Atomic Energy Community (Euratom,) represented by the European Commission (‘the Commission’)]* *[OPTION 3: the [Research Executive Agency (REA)] [European Research Council Executive Agency (ERCEA)] [Innovation and Networks Executive Agency (INEA)] [Executive Agency for Small and Medium-sized Enterprises (EASME)] (‘the Agency’), under the powers delegated by the European Commission (‘the Commission’).]*

The *[Commission] [Agency]* is mentioned as a signatory of the Agreement with the Beneficiary only. The *[European Union] [Euratom] [Agency]* is not a party to this engagement.

1.1 Subject of the engagement

According to Article 18.1.2 of the Agreement, beneficiaries *[and linked third parties]* that declare direct personnel costs as unit costs calculated in accordance with their usual cost accounting practices may submit to the *[Commission] [Agency]*, for approval, a certificate on the methodology (‘CoMUC’) stating that there are adequate records and documentation to prove that their cost accounting practices used comply with the conditions set out in Point A of Article 6.2.

The subject of this engagement is the CoMUC which is composed of two separate documents:

- the Terms of Reference (‘the ToR’) to be signed by the *[Beneficiary] [Linked Third Party]* and the Auditor;
- the Auditor’s Independent Report of Factual Findings (‘the Report’) issued on the Auditor’s letterhead, dated, stamped and signed by the Auditor which includes; the standard statements (‘the Statements’) evaluated and signed by the *[Beneficiary] [Linked Third Party]*, the agreed-upon procedures (‘the Procedures’) performed by the Auditor and the standard factual findings

(‘the Findings’) assessed by the Auditor. The Statements, Procedures and Findings are summarised in the table that forms part of the Report.

The information provided through the Statements, the Procedures and the Findings will enable the Commission to draw conclusions regarding the existence of the *[Beneficiary’s] [Linked Third Party’s]* usual cost accounting practice and its suitability to ensure that direct personnel costs claimed on that basis comply with the provisions of the Agreement. The Commission draws its own conclusions from the Report and any additional information it may require.

1.2 Responsibilities

The parties to this agreement are the *[Beneficiary] [Linked Third Party]* and the Auditor.

The *[Beneficiary] [Linked Third Party]*:

- is responsible for preparing financial statements for the Agreement(s) ('the Financial Statements') in compliance with those Agreements;
- is responsible for providing the Financial Statement(s) to the Auditor and enabling the Auditor to reconcile them with the *[Beneficiary’s] [Linked Third Party’s]* accounting and bookkeeping system and the underlying accounts and records. The Financial Statement(s) will be used as a basis for the procedures which the Auditor will carry out under this ToR;
- is responsible for its Methodology and liable for the accuracy of the Financial Statement(s);
- is responsible for endorsing or refuting the Statements indicated under the heading ‘Statements to be made by the Beneficiary/ Linked Third Party’ in the first column of the table that forms part of the Report;
- must provide the Auditor with a signed and dated representation letter;
- accepts that the ability of the Auditor to carry out the Procedures effectively depends upon the *[Beneficiary] [Linked Third Party]* providing full and free access to the *[Beneficiary’s] [Linked Third Party’s]* staff and to its accounting and other relevant records.

The Auditor:

- *[Option 1 by default: is qualified to carry out statutory audits of accounting documents in accordance with Directive 2006/43/EC of the European Parliament and of the Council of 17 May 2006 on statutory audits of annual accounts and consolidated accounts, amending Council Directives 78/660/EEC and 83/349/EEC and repealing Council Directive 84/253/EEC or similar national regulations].*
- *[Option 2 if the Beneficiary or Linked Third Party has an independent Public Officer: is a competent and independent Public Officer for which the relevant national authorities have established the legal capacity to audit the Beneficiary].*
- *[Option 3 if the Beneficiary or Linked Third Party is an international organisation: is an [internal] [external] auditor in accordance with the internal financial regulations and procedures of the international organisation].*

The Auditor:

- must be independent from the Beneficiary *[and the Linked Third Party]*, in particular, it must not have been involved in preparing the Beneficiary’s *[and Linked Third Party’s]* Financial Statement(s);
- must plan work so that the Procedures may be carried out and the Findings may be assessed;
- must adhere to the Procedures laid down and the compulsory report format;
- must carry out the engagement in accordance with these ToR;
- must document matters which are important to support the Report;
- must base its Report on the evidence gathered;
- must submit the Report to the *[Beneficiary] [Linked Third Party]*.

The Commission sets out the Procedures to be carried out and the Findings to be endorsed by the Auditor. The Auditor is not responsible for their suitability or pertinence. As this engagement is not an assurance engagement the Auditor does not provide an audit opinion or a statement of assurance.

1.3 Applicable Standards

The Auditor must comply with these Terms of Reference and with¹:

- the International Standard on Related Services ('ISRS') 4400 *Engagements to perform Agreed-upon Procedures regarding Financial Information* as issued by the International Auditing and Assurance Standards Board (IAASB);
- the *Code of Ethics for Professional Accountants* issued by the International Ethics Standards Board for Accountants (IESBA). Although ISRS 4400 states that independence is not a requirement for engagements to carry out agreed-upon procedures, the Commission requires that the Auditor also complies with the Code's independence requirements.

The Auditor's Report must state that there was no conflict of interests in establishing this Report between the Auditor and the Beneficiary [*and the Linked Third Party*] that could have a bearing on the Report, and must specify – if the service is invoiced - the total fee paid to the Auditor for providing the Report.

1.4 Reporting

The Report must be written in the language of the Agreement (see Article 20.7 of the Agreement).

Under Article 22 of the Agreement, the Commission, [*the Agency*], the European Anti-Fraud Office and the Court of Auditors have the right to audit any work that is carried out under the action and for which costs are declared from [*the European Union*] [*Euratom*] budget. This includes work related to this engagement. The Auditor must provide access to all working papers related to this assignment if the Commission[, *the Agency*], the European Anti-Fraud Office or the European Court of Auditors requests them.

1.5 Timing

The Report must be provided by [dd Month yyyy].

1.6 Other Terms

[The [Beneficiary] [Linked Third Party] and the Auditor can use this section to agree other specific terms, such as the Auditor's fees, liability, applicable law, etc. Those specific terms must not contradict the terms specified above.]

[legal name of the Auditor]
 [name & title of authorised representative]
 [dd Month yyyy]
 Signature of the Auditor

[legal name of the [Beneficiary] [Linked Third Party]]
 [name & title of authorised representative]
 [dd Month yyyy]
 Signature of the [Beneficiary] [Linked Third Party]

¹ Supreme Audit Institutions applying INTOSAI-standards may carry out the Procedures according to the corresponding International Standards of Supreme Audit Institutions and code of ethics issued by INTOSAI instead of the International Standard on Related Services ('ISRS') 4400 and the Code of Ethics for Professional Accountants issued by the IAASB and the IESBA.



Independent report of factual findings on the methodology concerning grant agreements financed under the Horizon 2020 Research and Innovation Framework Programme

(To be printed on letterhead paper of the auditor)

To

[name of contact person(s)], [Position]
[[Beneficiary's] [Linked Third Party's] name]
[Address]
[dd Month yyyy]

Dear [Name of contact person(s)],

As agreed under the terms of reference dated [dd Month yyyy]

with [OPTION 1: [insert name of the beneficiary] ('the Beneficiary')] [OPTION 2: [insert name of the linked third party] ('the Linked Third Party'), third party linked to the Beneficiary [insert name of the beneficiary] ('the Beneficiary')],

we

[name of the auditor] ('the Auditor'),

established at

[full address/city/state/province/country],

represented by

[name and function of an authorised representative],

have carried out the agreed-upon procedures ('the Procedures') and provide hereby our Independent Report of Factual Findings ('the Report'), concerning the [Beneficiary's] [Linked Third Party's] usual accounting practices for calculating and declaring direct personnel costs declared as unit costs ('the Methodology').

You requested certain procedures to be carried out in connection with the grant(s)

[title and number of the grant agreement(s)] ('the Agreement(s)').

The Report

Our engagement was carried out in accordance with the terms of reference ('the ToR') appended to this Report. The Report includes: the standard statements ('the Statements') made by the [Beneficiary] [Linked Third Party], the agreed-upon procedures ('the Procedures') carried out and the standard factual findings ('the Findings') confirmed by us.

The engagement involved carrying out the Procedures and assessing the Findings and the documentation requested appended to this Report, the results of which the Commission uses to draw conclusions regarding the acceptability of the Methodology applied by the [Beneficiary] [Linked Third Party].



The Report covers the methodology used from [dd Month yyyy]. In the event that the [Beneficiary] [Linked Third Party] changes this methodology, the Report will not be applicable to any Financial Statement¹ submitted thereafter.

The scope of the Procedures and the definition of the standard statements and findings were determined solely by the Commission. Therefore, the Auditor is not responsible for their suitability or pertinence.

Since the Procedures carried out constitute neither an audit nor a review made in accordance with International Standards on Auditing or International Standards on Review Engagements, we do not give a statement of assurance on the costs declared on the basis of the [Beneficiary's] [Linked Third Party's] Methodology. Had we carried out additional procedures or had we performed an audit or review in accordance with these standards, other matters might have come to its attention and would have been included in the Report.

Exceptions

Apart from the exceptions listed below, the [Beneficiary] [Linked Third Party] agreed with the standard Statements and provided the Auditor all the documentation and accounting information needed by the Auditor to carry out the requested Procedures and corroborate the standard Findings.

List here any exception and add any information on the cause and possible consequences of each exception, if known. If the exception is quantifiable, also indicate the corresponding amount.

.....

Explanation of possible exceptions in the form of examples (to be removed from the Report):

- i. the [Beneficiary] [Linked Third Party] did not agree with the standard Statement number ... because...;
- ii. the Auditor could not carry out the procedure ... established because (e.g. due to the inability to reconcile key information or the unavailability or inconsistency of data);
- iii. the Auditor could not confirm or corroborate the standard Finding number ... because

Remarks

We would like to add the following remarks relevant for the proper understanding of the Methodology applied by the [Beneficiary] [Linked Third Party] or the results reported:

Example (to be removed from the Report):

Regarding the methodology applied to calculate hourly rates ...

Regarding standard Finding 15 it has to be noted that ...

The [Beneficiary] [Linked Third Party] explained the deviation from the benchmark statement XXIV concerning time recording for personnel with no exclusive dedication to the action in the following manner:

....

Annexes

Please provide the following documents to the auditor and annex them to the report when submitting this CoMUC to the Commission:

¹ Financial Statement in this context refers solely to Annex 4 of the Agreement by which the Beneficiary declares costs under the Agreement.

1. Brief description of the methodology for calculating personnel costs, productive hours and hourly rates;
2. Brief description of the time recording system in place;
3. An example of the time records used by the [Beneficiary] [Linked Third Party];
4. Description of any budgeted or estimated elements applied, together with an explanation as to why they are relevant for calculating the personnel costs and how they are based on objective and verifiable information;
5. A summary sheet with the hourly rate for direct personnel declared by the [Beneficiary] [Linked Third Party] and recalculated by the Auditor for each staff member included in the sample (the names do not need to be reported);
6. A comparative table summarising for each person selected in the sample a) the time claimed by the [Beneficiary] [Linked Third Party] in the Financial Statement(s) and b) the time according to the time record verified by the Auditor;
7. A copy of the letter of representation provided to the Auditor.

Use of this Report

This Report has been drawn up solely for the purpose given under Point 1.1 Reasons for the engagement.

The Report:

- is confidential and is intended to be submitted to the Commission by the [Beneficiary] [Linked Third Party] in connection with Article 18.1.2 of the Agreement;
- may not be used by the [Beneficiary] [Linked Third Party] or by the Commission for any other purpose, nor distributed to any other parties;
- may be disclosed by the Commission only to authorised parties, in particular the European Anti-Fraud Office (OLAF) and the European Court of Auditors.
- relates only to the usual cost accounting practices specified above and does not constitute a report on the Financial Statements of the [Beneficiary] [Linked Third Party].

No conflict of interest² exists between the Auditor and the Beneficiary [*and the Linked Third Party*] that could have a bearing on the Report. The total fee paid to the Auditor for producing the Report was EUR _____ (including EUR _____ of deductible VAT).

We look forward to discussing our Report with you and would be pleased to provide any further information or assistance which may be required.

Yours sincerely

[legal name of the Auditor]

[name and title of the authorised representative]

[dd Month yyyy]

Signature of the Auditor

² A conflict of interest arises when the Auditor's objectivity to establish the certificate is compromised in fact or in appearance when the Auditor for instance:

- was involved in the preparation of the Financial Statements;
- stands to benefit directly should the certificate be accepted;
- has a close relationship with any person representing the beneficiary;
- is a director, trustee or partner of the beneficiary; or
- is in any other situation that compromises his or her independence or ability to establish the certificate impartially.

Statements to be made by the Beneficiary/Linked Third Party ('the Statements') and Procedures to be carried out by the Auditor ('the Procedures') and standard factual findings ('the Findings') to be confirmed by the Auditor

The Commission reserves the right to provide the auditor with guidance regarding the Statements to be made, the Procedures to be carried out or the Findings to be ascertained and the way in which to present them. The Commission reserves the right to vary the Statements, Procedures or Findings by written notification to the Beneficiary/Linked Third Party to adapt the procedures to changes in the grant agreement(s) or to any other circumstances.

If this methodology certificate relates to the Linked Third Party's usual accounting practices for calculating and claiming direct personnel costs declared as unit costs any reference here below to 'the Beneficiary' is to be considered as a reference to 'the Linked Third Party'.

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<p>A. Use of the Methodology</p> <p>I. The cost accounting practice described below has been in use since [dd Month yyyy].</p> <p>II. The next planned alteration to the methodology used by the Beneficiary will be from [dd Month yyyy].</p>	<p>Procedure:</p> <ul style="list-style-type: none"> ✓ The Auditor checked these dates against the documentation the Beneficiary has provided. <p>Factual finding:</p> <ol style="list-style-type: none"> 1. The dates provided by the Beneficiary were consistent with the documentation.
<p>B. Description of the Methodology</p> <p>III. The methodology to calculate unit costs is being used in a consistent manner and is reflected in the relevant procedures.</p> <p><i>[Please describe the methodology your entity uses to calculate personnel costs, productive hours and hourly rates, present your description to the Auditor and annex it to this certificate]</i></p> <p><i>[If the statement of section "B. Description of the methodology" cannot be endorsed by the Beneficiary or there is no written methodology to calculate unit costs it should be listed here below and reported as exception by the Auditor in the main Report of Factual Findings:</i></p> <p>- ...]</p>	<p>Procedure:</p> <ul style="list-style-type: none"> ✓ The Auditor reviewed the description, the relevant manuals and/or internal guidance documents describing the methodology. <p>Factual finding:</p> <ol style="list-style-type: none"> 2. The brief description was consistent with the relevant manuals, internal guidance and/or other documentary evidence the Auditor has reviewed. 3. The methodology was generally applied by the Beneficiary as part of its usual costs accounting practices.

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<p>C. Personnel costs</p> <p><u>General</u></p> <p>IV. The unit costs (hourly rates) are limited to salaries including during parental leave, social security contributions, taxes and other costs included in the remuneration required under national law and the employment contract or equivalent appointing act;</p> <p>V. Employees are hired directly by the Beneficiary in accordance with national law, and work under its sole supervision and responsibility;</p> <p>VI. The Beneficiary remunerates its employees in accordance with its usual practices. This means that personnel costs are charged in line with the Beneficiary's usual payroll policy (e.g. salary policy, overtime policy, variable pay) and no special conditions exist for employees assigned to tasks relating to the European Union or Euratom, unless explicitly provided for in the grant agreement(s);</p> <p>VII. The Beneficiary allocates its employees to the relevant group/category/cost centre for the purpose of the unit cost calculation in line with the usual cost accounting practice;</p> <p>VIII. Personnel costs are based on the payroll system and accounting system.</p> <p>IX. Any exceptional adjustments of actual personnel costs resulted from relevant budgeted or estimated elements and were based on objective and verifiable information. <i>[Please describe the 'budgeted or estimated elements' and their relevance to personnel costs, and explain how they were reasonable and based on objective and verifiable information, present your explanation to the Auditor and annex it to this certificate].</i></p> <p>X. Personnel costs claimed do not contain any of the following ineligible costs: costs related to return on capital; debt and debt service charges; provisions for future losses or debts; interest owed; doubtful debts; currency exchange losses; bank costs charged by the Beneficiary's bank for transfers from the Commission/Agency; excessive or reckless expenditure; deductible VAT or costs incurred during suspension of the implementation of the action.</p> <p>XI. Personnel costs were not declared under another EU or Euratom grant</p>	<p>Procedure:</p> <p><i>The Auditor draws a sample of employees to carry out the procedures indicated in this section C and the following sections D to F.</i> <i>[The Auditor has drawn a random sample of 10 employees assigned to Horizon 2020 action(s). If fewer than 10 employees are assigned to the Horizon 2020 action(s), the Auditor has selected all employees assigned to the Horizon 2020 action(s) complemented by other employees irrespective of their assignments until he has reached 10 employees.]</i> For this sample:</p> <ul style="list-style-type: none"> ✓ the Auditor reviewed all documents relating to personnel costs such as employment contracts, payslips, payroll policy (e.g. salary policy, overtime policy, variable pay policy), accounting and payroll records, applicable national tax , labour and social security law and any other documents corroborating the personnel costs claimed; ✓ in particular, the Auditor reviewed the employment contracts of the employees in the sample to verify that: <ul style="list-style-type: none"> i. they were employed directly by the Beneficiary in accordance with applicable national legislation; ii. they were working under the sole technical supervision and responsibility of the latter; iii. they were remunerated in accordance with the Beneficiary's usual practices; iv. they were allocated to the correct group/category/cost centre for the purposes of calculating the unit cost in line with the Beneficiary's usual cost accounting practices; ✓ the Auditor verified that any ineligible items or any costs claimed under other costs categories or costs covered by other types of grant or by other grants financed from the European Union budget have not been taken into account when calculating the personnel costs; ✓ the Auditor numerically reconciled the total amount of personnel costs used to calculate the unit cost with the total amount of personnel costs recorded in the statutory accounts and the payroll system.

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Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<p>(including grants awarded by a Member State and financed by the EU budget and grants awarded by bodies other than the Commission/Agency for the purpose of implementing the EU or Euratom budget in the same period, unless the Beneficiary can demonstrate that the operating grant does not cover any costs of the action).</p> <p><u>If additional remuneration as referred to in the grant agreement(s) is paid</u></p> <p>XII. The Beneficiary is a non-profit legal entity;</p> <p>XIII. The additional remuneration is part of the beneficiary's usual remuneration practices and paid consistently whenever the relevant work or expertise is required;</p> <p>XIV. The criteria used to calculate the additional remuneration are objective and generally applied regardless of the source of funding;</p> <p>XV. The additional remuneration included in the personnel costs used to calculate the hourly rates for the grant agreement(s) is capped at EUR 8 000 per full-time equivalent (reduced proportionately if the employee is not assigned exclusively to the action).</p>	<ul style="list-style-type: none"> ✓ to the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, the Auditor carefully examined those elements and checked the information source to confirm that they correspond to objective and verifiable information; ✓ if additional remuneration has been claimed, the Auditor verified that the Beneficiary was a non-profit legal entity, that the amount was capped at EUR 8 000 per full-time equivalent and that it was reduced proportionately for employees not assigned exclusively to the action(s). ✓ the Auditor recalculated the personnel costs for the employees in the sample. <p>Factual finding:</p> <ol style="list-style-type: none"> 4. All the components of the remuneration that have been claimed as personnel costs are supported by underlying documentation. 5. The employees in the sample were employed directly by the Beneficiary in accordance with applicable national law and were working under its sole supervision and responsibility. 6. Their employment contracts were in line with the Beneficiary's usual policy; 7. Personnel costs were duly documented and consisted solely of salaries, social security contributions (pension contributions, health insurance, unemployment fund contributions, etc.), taxes and other statutory costs included in the remuneration (holiday pay, thirteenth month's pay, etc.); 8. The totals used to calculate the personnel unit costs are consistent with those registered in the payroll and accounting records; 9. To the extent that actual personnel costs were adjusted on the basis of budgeted or estimated elements, those elements were relevant for calculating the personnel costs and correspond to objective and verifiable information. The budgeted or estimated elements used are: — (indicate the elements and their values). 10. Personnel costs contained no ineligible elements; 11. Specific conditions for eligibility were fulfilled when additional
<p><i>[If certain statement(s) of section "C. Personnel costs" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor in the main Report of Factual Findings:</i></p> <p>- ...]</p>	

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
	<p>remuneration was paid: a) the Beneficiary is registered in the grant agreements as a non-profit legal entity; b) it was paid according to objective criteria generally applied regardless of the source of funding used and c) remuneration was capped at EUR 8 000 per full-time equivalent (or up to up to the equivalent pro-rata amount if the person did not work on the action full-time during the year or did not work exclusively on the action).</p>
<p>D. Productive hours</p> <p>XVI. The number of productive hours per full-time employee applied is <i>[delete as appropriate]:</i></p> <ul style="list-style-type: none"> A. 1720 productive hours per year for a person working full-time (corresponding pro-rata for persons not working full time). B. the total number of hours worked in the year by a person for the Beneficiary C. the standard number of annual hours generally applied by the beneficiary for its personnel in accordance with its usual cost accounting practices. This number must be at least 90% of the standard annual workable hours. <p><u>If method B is applied</u></p> <p>XVII. The calculation of the total number of hours worked was done as follows: annual workable hours of the person according to the employment contract, applicable labour agreement or national law plus overtime worked minus absences (such as sick leave and special leave).</p> <p>XVIII. ‘Annual workable hours’ are hours during which the personnel must be working, at the employer’s disposal and carrying out his/her activity or duties under the employment contract, applicable collective labour agreement or national working time legislation.</p> <p>XIX. The contract (applicable collective labour agreement or national working time legislation) do specify the working time enabling to calculate the annual workable hours.</p>	<p>Procedure (same sample basis as for Section C: Personnel costs):</p> <ul style="list-style-type: none"> ✓ The Auditor verified that the number of productive hours applied is in accordance with method A, B or C. ✓ The Auditor checked that the number of productive hours per full-time employee is correct. ✓ If method B is applied the Auditor verified i) the manner in which the total number of hours worked was done and ii) that the contract specified the annual workable hours by inspecting all the relevant documents, national legislation, labour agreements and contracts. ✓ If method C is applied the Auditor reviewed the manner in which the standard number of working hours per year has been calculated by inspecting all the relevant documents, national legislation, labour agreements and contracts and verified that the number of productive hours per year used for these calculations was at least 90 % of the standard number of working hours per year. <p>Factual finding:</p> <p><u>General</u></p> <ol style="list-style-type: none"> 12. The Beneficiary applied a number of productive hours consistent with method A, B or C detailed in the left-hand column. 13. The number of productive hours per year per full-time employee was accurate. <p><u>If method B is applied</u></p> <ol style="list-style-type: none"> 14. The number of ‘annual workable hours’, overtime and absences was

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary <u>If method C is applied</u> <p>XX. The standard number of productive hours per year is that of a full-time equivalent.</p> <p>XXI. The number of productive hours per year on which the hourly rate is based i) corresponds to the Beneficiary's usual accounting practices; ii) is at least 90 % of the standard number of workable (working) hours per year.</p> <p>XXII. Standard workable (working) hours are hours during which personnel are at the Beneficiary's disposal performing the duties described in the relevant employment contract, collective labour agreement or national labour legislation. The number of standard annual workable (working) hours that the Beneficiary claims is supported by labour contracts, national legislation and other documentary evidence.</p> <p><i>[If certain statement(s) of section "D. Productive hours" cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:</i></p> <ul style="list-style-type: none"> - ...] 	Procedures to be carried out and Findings to be confirmed by the Auditor verifiable based on the documents provided by the Beneficiary and the calculation of the total number of hours worked was accurate. <p>15. The contract specified the working time enabling to calculate the annual workable hours.</p> <p><u>If method C is applied</u></p> <p>16. The calculation of the number of productive hours per year corresponded to the usual costs accounting practice of the Beneficiary.</p> <p>17. The calculation of the standard number of workable (working) hours per year was corroborated by the documents presented by the Beneficiary.</p> <p>18. The number of productive hours per year used for the calculation of the hourly rate was at least 90 % of the number of workable (working) hours per year.</p>
<p>E. Hourly rates</p> <p>The hourly rates are correct because:</p> <p>XXIII. Hourly rates are correctly calculated since they result from dividing annual personnel costs by the productive hours of a given year and group (e.g. staff category or department or cost centre depending on the methodology applied) and they are in line with the statements made in section C. and D. above.</p> <p><i>[If the statement of section 'E. Hourly rates' cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:</i></p> <ul style="list-style-type: none"> - ...] 	<p>Procedure</p> <ul style="list-style-type: none"> ✓ The Auditor has obtained a list of all personnel rates calculated by the Beneficiary in accordance with the methodology used. ✓ The Auditor has obtained a list of all the relevant employees, based on which the personnel rate(s) are calculated. <p>For 10 employees selected at random (same sample basis as Section C: Personnel costs):</p> <ul style="list-style-type: none"> ✓ The Auditor recalculated the hourly rates. ✓ The Auditor verified that the methodology applied corresponds to the usual accounting practices of the organisation and is applied consistently for all activities of the organisation on the basis of objective criteria irrespective of the source of funding. <p>Factual finding:</p>

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<p>F. Time recording</p> <p>XXIV. Time recording is in place for all persons with no exclusive dedication to one Horizon 2020 action. At least all hours worked in connection with the grant agreement(s) are registered on a daily/weekly/monthly basis <i>[delete as appropriate]</i> using a paper/computer-based system <i>[delete as appropriate]</i>;</p> <p>XXV. For persons exclusively assigned to one Horizon 2020 activity the Beneficiary has either signed a declaration to that effect or has put arrangements in place to record their working time;</p> <p>XXVI. Records of time worked have been signed by the person concerned (on paper or electronically) and approved by the action manager or line manager at least monthly;</p> <p>XXVII. Measures are in place to prevent staff from:</p> <ul style="list-style-type: none"> i. recording the same hours twice, ii. recording working hours during absence periods (e.g. holidays, sick leave), iii. recording more than the number of productive hours per year used to calculate the hourly rates, and iv. recording hours worked outside the action period. <p>XXVIII. No working time was recorded outside the action period;</p> <p>XXIX. No more hours were claimed than the productive hours used to calculate the hourly personnel rates.</p> <p><i>[Please provide a brief description of the <u>time recording system</u> in place together with the measures applied to ensure its reliability to the Auditor and annex it to the</i></p>	<p>19. No differences arose from the recalculation of the hourly rate for the employees included in the sample.</p> <p>Procedure</p> <ul style="list-style-type: none"> ✓ The Auditor reviewed the brief description, all relevant manuals and/or internal guidance describing the methodology used to record time. <p>The Auditor reviewed the time records of the random sample of 10 employees referred to under Section C: Personnel costs, and verified in particular:</p> <ul style="list-style-type: none"> ✓ that time records were available for all persons with not exclusive assignment to the action; ✓ that time records were available for persons working exclusively for a Horizon 2020 action, or, alternatively, that a declaration signed by the Beneficiary was available for them certifying that they were working exclusively for a Horizon 2020 action; ✓ that time records were signed and approved in due time and that all minimum requirements were fulfilled; ✓ that the persons worked for the action in the periods claimed; ✓ that no more hours were claimed than the productive hours used to calculate the hourly personnel rates; ✓ that internal controls were in place to prevent that time is recorded twice, during absences for holidays or sick leave; that more hours are claimed per person per year for Horizon 2020 actions than the number of productive hours per year used to calculate the hourly rates; that working time is recorded outside the action period; ✓ the Auditor cross-checked the information with human-resources records to verify consistency and to ensure that the internal controls have been effective. In addition, the Auditor has verified that no more hours were charged to Horizon 2020 actions per person per year than the number of productive hours per year used to calculate the hourly rates, and verified that

Please explain any discrepancies in the body of the Report.	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
<p>Statements to be made by Beneficiary</p> <p>present certificate¹].</p> <p>[If certain statement(s) of section “F. Time recording” cannot be endorsed by the Beneficiary they should be listed here below and reported as exception by the Auditor:</p> <p>- ...]</p>	<p>no time worked outside the action period was charged to the action.</p> <p>Factual finding:</p> <ul style="list-style-type: none"> 20. The brief description, manuals and/or internal guidance on time recording provided by the Beneficiary were consistent with management reports/records and other documents reviewed and were generally applied by the Beneficiary to produce the financial statements. 21. For the random sample time was recorded or, in the case of employees working exclusively for the action, either a signed declaration or time records were available; 22. For the random sample the time records were signed by the employee and the action manager/line manager, at least monthly. 23. Working time claimed for the action occurred in the periods claimed; 24. No more hours were claimed than the number productive hours used to calculate the hourly personnel rates; 25. There is proof that the Beneficiary has checked that working time has not been claimed twice, that it is consistent with absence records and the number of productive hours per year, and that no working time has been claimed outside the action period. 26. Working time claimed is consistent with that on record at the human-resources department.

¹ The description of the time recording system must state among others information on the content of the time records, its coverage (full or action time-recording, for all personnel or only for personnel involved in H2020 actions), its degree of detail (whether there is a reference to the particular tasks accomplished), its form, periodicity of the time registration and authorisation (paper or a computer-based system; on a daily, weekly or monthly basis; signed and countersigned by whom), controls applied to prevent double-charging of time or ensure consistency with HR-records such as absences and travels as well as its information flow up to its use for the preparation of the Financial Statements.

<i>Please explain any discrepancies in the body of the Report.</i>	
Statements to be made by Beneficiary	Procedures to be carried out and Findings to be confirmed by the Auditor
[<i>official name of the [Beneficiary] [Linked Third Party]</i>]	[<i>official name of the Auditor</i>]
[<i>name and title of authorised representative</i>]	[<i>name and title of authorised representative</i>]
[<i>dd Month yyyy</i>]	[<i>dd Month yyyy</i>]
< <i>Signature of the [Beneficiary] [Linked Third Party]</i> >	< <i>Signature of the Auditor</i> >



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