Proposal Evaluation Form

EUROPEAN COMMISSION

Horizon 2020 - Research and Innovation Framework Programme

Evaluation Summary Report - Research and innovation actions

Call: H2020-FETOPEN-2018-2019-2020-01
Type of action: RIA
Proposal number: 965080
Proposal acronym: ROBHOOT
Duration (months): 36
Proposal title: Knowledge Discovery in Eco-Evolutionary Diversification-Inspired Federated Networks
Activity: FETOPEN-RIA-2020.01

N.	Proposer name	Country	Total Cost	%	Grant Requested	%
1	EIDGENOESSISCHE ANSTALT FUER WASSERVERSORGUNG ABWASSERREINIGUNG UND GEWAESSERSCHUTZ	CH	396,658.75	16.66%	396,658.75	16.66%
2	AGENCIA ESTATAL CONSEJO SUPERIOR DEINVESTIGACIONES CIENTIFICAS	ES	590,615	24.81%	590,615	24.81%
3	Scitation - Science Communication Lda	PT	240,055	10.08%	240,055	10.08%
4	TARTU ULIKOOL	EE	206,250	8.66%	206,250	8.66%
5	ECOLE POLYTECHNIQUE FEDERALE DE LAUSANNE	CH	318,698.75	13.39%	318,698.75	13.39%
6	TECHNISCHE UNIVERSITAET GRAZ	AT	185,000	7.77%	185,000	7.77%
7	INSTITUTO ESPANOL DE OCEANOGRAFIA	ES	121,250	5.09%	121,250	5.09%
8	UNIVERSITAT ROVIRA I VIRGILI	ES	157,432.5	6.61%	157,432.5	6.61%
9	STOCKHOLMS UNIVERSITET	SE	165,000	6.93%	165,000	6.93%
	Total:		2,380,960		2,380,960	

Abstract:
In the last decades, we have experienced an exponential growth in the capacity to generate and store data of diverse nature, thanks in part to the electronic devices connected to the Internet, and in the capacity to analyze them with Big Data analytics and Artificial Intelligence techniques. And curiously, the complex and global challenges that we are facing in our digitalized societies show how vulnerable we are. Nature has been adapting and evolving in its struggle for survival with other species and the environment. Biological interactions and traits diversify across multiple scales of organization, from neurons to populations and space-time scales, maintaining a complex ecological balance. This endless eco-evolutionary arms race inspires a new Artificial Intelligence approach for a sustainable knowledge-based global society. The signs of identity are evolution and interaction and are substantiated by federated networks, that is, heterogeneous networks with internal nodal structure, in which many different groups of species, humans and technologies coexist to exploit resources in complex ecosystems. Our mission is to lay the foundations of an open and cooperative science ecosystem that help us to face the challenges of global sustainability. We validate our approach with a case study focusing on the sustainability of the Oceans, the largest ecosystem on the planet and a major player in the climate balance.

Evaluation Summary Report

Evaluation Result

Total score: 2.70 (Threshold: 0)

Form information

SCORING

Scores must be in the range 0-5, except 0.5.

Interpretation of the score:

0 *The* ***proposal fails to address the criterion*** *or cannot be assessed due to missing or incomplete information.*

1 Poor. *The criterion is inadequately addressed, or there are serious inherent weaknesses.*

2 Fair. *The proposal broadly addresses the criterion, but there are significant weaknesses.*

3 Good. *The proposal addresses the criterion well, but a number of shortcomings are present.*

4 Very good. *The proposal addresses the criterion very well, but a small number of shortcomings are present.*

5 Excellent. *The proposal successfully addresses all relevant aspects of the criterion.Any shortcomings are minor.*

*** The asterisk means mandatory field**

Panel comments on proposal

This Evaluation Summary Report contains the final scores, endorsed by the FET-Open final Panel review. The Panel based its conclusions on the prior individual evaluations, conducted by four independent evaluators. The comments from the individual evaluators, or extracts from them, are included below in this report. They are collated per sub-criterion, so in the report the comments on each sub-criterion reflect the

opinions from all four evaluators.
While not necessarily subscribing to each and every opinion expressed, the Panel finds that to a certain extent the comments from the evaluators provide a fair overall assessment, indicating both essential strengths and weaknesses identified in the proposal.

According to the predefined scoring scale the proposal is good (overall score above 2.5 up to 3.5 included). However, it is below one or more thresholds as defined in the FET-Open Work programme 2018-2020.

The Panel agrees with the evaluators that the proposed project is ambitious with a pertinent and potentially fruitful application to the marine ecosystems. The proposed research is novel on data knowledge discovery, causal knowledge discovery and discovery in federated networks. However, the Panel endorses the opinion of some of the evaluators that the objectives and the state of the art of the proposal have not been described with adequate detail. Even more, the proposal insufficiently explains how it differentiates from an extension of existing theories between Artificial Intelligence (AI) and evolutionary approaches.

Criterion 1 - Excellence

Score: **2.00** (Threshold: 4/5.00 , Weight: 60.00%)

Note: The following aspects will be taken into account, to the extent that the proposed work corresponds to the topic description in the work programme. If a proposal is partly out of scope, this must be reflected in the scoring, and explained in the comments.
Adherence to the "FET gatekeepers" as described in the call text:

Clarity of the radical vision of a science-enabled technology and its differentiation from current paradigms.

Evaluator 1
The vision sustaining the project relies on the proposal and use of evolutionary (diversification-inspired) solutions to compute knowledge discovery. Even if such a vision is interesting and potentially adapted to the targeted issue, this aspect presents several weaknesses. A significant issue is that it corresponds rather to an extension of existing theories in between AI and evolutionary approaches and it is therefore not radical as a vision nor different from those existing paradigms. Moreover, another significant issue is that the description is too general and partly unclear, overusing newly elaborated terms to describe the solution proposed (e.g. evolutionary neural diversification-inspired federated networks) that are not sufficiently explicit nor sufficiently detailed.

Evaluator 2
The vision proposed is radical and it advances scientific development in environmental computing. Differentiation from current paradigms is well articulated. The proposed individual computer science elements, such as ESA and EEDA, are individually important and lead to an impressive holistic impact in application to a rich ocean ecosystem data set. The potential for new discoveries, in this existing data, is significant.

Evaluator 3
The vision covers the goal, impacts and technological aspects of the project, but lacks clarity in a number of aspects. First, several not-well-established terms are used (e.g. "discovery computation") without explanation, which hinders the interpretation of the proposal content and leads to misconceptions (serious inherent weakness). Second, it is not specified enough whether the focus is on the application of AI-based tools for decision support in the management of ecological systems, or on the design of biologically inspired AI tools (significant issue). The differentiation from current paradigms is vaguely described (significant issue).

Evaluator 4
The project's aim is to create novel discovery computation solutions for natural ecosystems facing sustainability challenges using the Oceans as a case study where harvesting renewable resources are at the point of diminishing returns for many species. However, it is unclear whether this can be considered as a clear and radical vision of science-enabled technology since similar research is already developing in this area. In other words, the proposal lacks a clear differentiation from current paradigms.
In addition, because of the diversity and lack of specificity of the different aims, it is unclear whether a clear focus exists and whether valuable results will be obtained.

Novelty and ambition of the proposed science-to-technology breakthrough that addresses this vision.

Evaluator 1
The science-to-technology breakthrough presented is originally built upon three pillars, namely data knowledge discovery, causal knowledge discovery and discovery in federated networks. . Strengths of the project are that on each one of these three pillars, the proposed research is ambitious and novel. The application of the approach to the sustainability of marine ecosystems is pertinent and potentially fruitful. Although a significant issue is that the dependency of the approach to the sustainability of the Oceans database identified may constrain the proposed solutions.

Evaluator 2
The novel elements of this project include the individual developments in computer science and the larger vision. The ambition to tie these elements together to examine a massive data set represents an advance in the state-of-the-art. Both the individual developments proposed and the overarching project objective are novel and ambitious.

Evaluator 3
The proposal suggests resolving ecological (sustainable resource exploitation) and modelling/computational (fast and reproducible AI tools) challenges that have been around for decades. Together with a high relevance of the topic, this justifies the high ambition of the project. However, the novelty is rather low because the concept of diversification is not new (e.g., crop rotation is actively used since the early days of agriculture), AI tools are also being actively developed and used (serious inherent weakness). The SotA analysis is based to a large extent on publications of questionable quality: lack of references to top-ranked journals (significant issue).

Evaluator 4
The project is ambitious and will develop spatio-temporal causal inference in systems containing large heterogeneity and dimensionality. The proposed science-to-technology transfer will represent an extension of deep process-based learning networks including traits and interactions driven by evolutionary changes to understand patterns in these systems. This, it is suggested, will provide a novel, sustainability-driven

knowledge-based technology though it is unclear how new technologies will be developed from the research.

Range of and added value from interdisciplinarity for opening up new areas of research; non-incrementality of the research proposed.

Evaluator 1
The proposed interdisciplinarity in the project is twofold, on the one hand it plays on the design of the computational solutions proposed for knowledge discovery, in this case a shortcoming is that the contribution of evolutionary biologists to evolutionary computing is rather metaphorical and not grounded into concrete collaboration. On the other hand, and it is a strength of the project, concerning the application of the designed algorithms to the sustainability of oceanic ecosystems, such interdisciplinarity in between computational approaches and field experts is more than necessary and may open new research areas. Concerning the proposal of new evolutionary approaches, a significant issue is that the proposed research is rather incremental and broadly extends existing paradigms in the domain.

Evaluator 2
There is added value in the computer science developments, such as ESA and EEDA. These could apply to many other environmental disciplines, not simply the proposed ocean data set. The effort to address the ocean data set is highly interdisciplinary in that the science involved crosses numerous domains. In addition, the application of sophisticated computing techniques brings another element of interdisciplinarity given how rarely these two diverse communities collaborate at the level proposed. This project is quite likely to open new areas of research in both the ocean environmental and computer science domains.

Evaluator 3
The project is inherently multi-discipline. The added value of combining several disciplines constitutes the major part of the value of the project as a whole. The disciplines involved complement each other in a good way by providing tools for answering certain questions within the project, but they do not converge into a solid inter-discipline framework. So, the interdisciplinarity is not sufficiently addressed (shortcoming). The non-incrementality is not achieved because an analysis of the existing database (essentially, a case study) and combining (modifications of) several existing methods are positioned as going beyond the state-of-the-art (serious inherent weakness).

Evaluator 4
The proposal does not sufficiently identify a clear added value in opening up new areas of research and it is unclear how it will satisfy the condition of non-incrementality since similar work is already being undertaken in protecting the sustainability of the environment including in the use of modelling programmes.
In addition, it is difficult to determine whether the research in the specific test case of Oceans is only being used as a popular justification to examine different computational approaches.

High-risk, plausibility and flexibility of the research approach.

Evaluator 1
Globally the project does not take high-risk concerning the methodologies and approaches adopted. As a shortcoming, the application case (sustainability of oceanic ecosystems) may avoid the full development of the proposed solutions but it is therefore rather a constraint than a risk. As such, following the proposed research, the risk is rather moderated by the flexibility of the global solutions proposed and the availability of a large existing database built since quite a long time, that constitutes one of the strengths of the project.

Evaluator 2
The individual project elements focused on computer science, such as ESA and EEDA, appear at first glance to be low-risk and highly plausible. But when viewed in the context of the larger objective/project the risk increases significantly. This is a case of the whole being greater than the sum of its parts. This is a notable challenge to both ocean and computer science.The research approach is flexible in that the core work packages (data knowledge discovery, causal knowledge discovery, and discovery in federated networks), are designed for both individual outcomes and contributions to the larger project. Thus, the project's internal linkages are likely to lead to adaptive efforts and the potential for emerging technical uncertainties to be overcome.

Evaluator 3
It is a high-risk project due to the high complexity of the object of study and the computational challenges associated with AI techniques. The plausibility and flexibility are reasonable due to a wide variety of tools that can be employed, the described simple-to-complex pathway and an availability of a rich dataset.

Evaluator 4
The research approach is plausible in the development of computation in ecosystems. Indeed, the transfer of eco-evolutionary diversification-inspired principles onto fully reproducible and automated software, progressing towards a process-based discovery technology, will be a major qualitative high-risk project. The approach is also flexible since there will always be some data available to be processed. However, it is unclear whether the project's aims are realistic with such significant amounts of varying (and possibly irrelevant) data being accumulated. In addition, it is difficult to determine how the project will lay the foundation for future sustainability studies. It also fails to adequately explain what would happen if too much data is generated and whether it could be used in an appropriate way. Finally, it is unclear if the models generated would be useful and relevant to the proposed project results supporting the protection of the environment.

Criterion 2 - Impact

Score: **3.50** (Threshold: 3.5/5.00 , Weight: 20.00%)

Note: The following aspects will be taken into account, to the extent to which the outputs of the project should contribute at the European and/or International level:
The extent to which the outputs of the project would contribute to the expected impacts listed in the work programme under this topic.

Evaluator 1
The project may participate to the reinforcement of a yet existing premature future technology mixing evolutionary approaches and AI for knowledge discovery.
Concerning the potential for future impacts, as inherited from the global AI trend today it is rather important economically and may reinforce the existing market on those solutions. Socially the application of the proposed solutions to the oceanic ecosystems may lead to potentially very

important impacts in identifying sustainable solutions in the exploitation of the corresponding resources. Globally the project presents positive aspects concerning the expected impacts, one shortcoming is that the focused future technology has yet emerged and is currently structuring. Moreover, the project may enable to build leading research by the inclusion of first-time participants to FET together with experimented ones but also some young researchers and an SME in the consortium.

Evaluator 2
This work will produce meaningful impacts through the both the individual elements (data knowledge discovery, causal knowledge discovery, and discovery in federated networks) and the larger scale application of these developments to ocean science data sets. The underlying technology/scientific developments in computer science (such as EDA and EEDA) will be advanced alongside the potential for new discoveries in ocean environmental science. A ROBHOOT system would be a notable contribution to research and innovation capacity as it would be scalable to many other data sets across the environmental sciences. The value of this program to young researchers, SMEs and first-time participants primarily derives from both the individual technical developments and the overall data analysis. These can add to their career/market growth and are a notable contribution to these participants.

Evaluator 3
The contribution is vaguely described: it is not specified which scientific disciplines and what technologies will benefit from the outcomes (shortcoming). Regarding the future social/economical impact, it is claimed that the technology will help industries to overcome global sustainability challenges, but it is not clear why that would be economically viable and thus acceptable for the market (significant issue). The impact on building leading research and innovation capacity across Europe, is mostly reached because the consortium brings together experts from several fields and suggests making web-based tools that facilitate knowledge exchange and collaboration. However, the role of young researchers and first-time participants to FET under Horizon 2020 is not sufficiently addressed (shortcoming).

Evaluator 4
Since the project will seek to provide a new technology to improve ecosystem sustainability relevant to community-rich digital and natural ecosystems, it will represent a new development in current computation with direct application to the sustainability of ecosystems and beyond. The proposal will build leading research and innovation capacity across Europe through the involvement of key actors who can make a difference in the future. This is because it includes a number of first time young participants to the FET programme who will make a substantial contribution to the development of the project. However, it is unclear how the project would contribute to the foundation of a new future technology. Moreover, though it does have a potential for future social or economic impact, it is difficult to determine how the project would lead to market creation.

Effectiveness of measures and plans to disseminate and use the results (including management of IPR) and to communicate about the project to different target audiences.

Evaluator 1
The measures envisioned to disseminate and exploit the results are appropriate and effective, including a data management plan and benefiting from the existence of dedicated and experimented departments of some partners concerning the management of IPR. The targeted audiences for the communication of the results are broadly envisaged from scientific ones to NGOs and dedicated channels are foreseen for an efficient communication.

Evaluator 2
The plans to disseminate results are clear and directed at both the scientific and technical audiences and the broader public. The proposal provides an IPR strategy and addresses how the results would be disseminated for economic development. The exploitation and business plan components are well conceived and important to the overall impact. Some communication activities are conventional in their focus on conferences and workshops. The public focus elements, especially the hackathons, are not novel but are proven methods. The Testnet concept is novel. The overall plan is comprehensive and connects public and scientific audiences well.

Evaluator 3
The dissemination measures and plans have a good potential to be effective due to a broad use of open access outlets (publications, software/data repositories), a variety of dissemination channels (press media, trade shows) and representations (publications, presentations, images, etc.). The management of IPR is addressed and will be reflected in the Consortium agreement.
The communication activities towards different audiences are only briefly described (minor shortcoming). Regarding results exploitation, the project aims at creating a startup, which is an impressive ambition, but no further details about the startup are given (shortcoming).

Evaluator 4
The effectiveness of the measures and plans to disseminate and use the results is unclear since such measures and plans will only be substantially developed and managed once the project is underway (under the specific Work Package 4) . A number of high-impact scientific publications are expected in Open Access format as well as the organisation of special sessions in international scientific and technological meetings which is well considered.
The project also aims to communicate to a wide-ranging audience supported by a scientific-based communication SME which is good. But the project fails to sufficiently indicate if any of the other partners have any past experience in this kind of communication.
Furthermore, the application indicates that support will be available to assist in the transformation of innovative ideas into business concepts, with the ultimate goal of creating Start-Ups, but this is not sufficiently developed in order to explain how this will take place.

Criterion 3 - Quality and efficiency of the implementation

Score: **4.00** (Threshold: 3/5.00 , Weight: 20.00%)

Note: The following aspects will be taken into account:
The following aspects are taken into account:
Coherence and effectiveness of the research methodology and work plan to achieve project objectives and impacts, including adequate allocation of resources to tasks and partners.

Evaluator 1
The research methodology built upon three main pillars is presented in a coherent way, although a shortcoming is that the cascade dependencies in between the different pillars may lead to some delays and inefficiency. Taken independently each one of the 3 main work-packages are efficiently designed and benefit from an adequate allocation of resources corresponding to the achievement of the

corresponding goals.
The allocation of resources among partners is somehow well balanced and justified to the exception of SCITE for which the allocation of 41 person months is not fully related to its activities inside the project and it represents a shortcoming of the project.

Evaluator 2
The labour, in person months, is well allocated to the WP elements and the roles of the partners are clear and appropriate. The program management plan, including milestones and risk mitigation, is reasonable and well developed. The project plan is suitable for the proposed objectives, though it lacks a focused element of quality control from the ocean environmental science side. The project plans to use ocean data, but does not include ocean science expert review as a dedicated element across the work program to ensure the computer science derived "discoveries" are validated by practitioners in the field.

Evaluator 3
There is a good coherence between the methodology and the work plan: a balanced division of tasks among partners and a realistic schedule, as given by a Gantt chart. All the WPs and their interrelations are clearly described. The WPs are coherently assigned to the objectives and to partners with matching expertise.
There is a disagreement between the methodology and the suggested impact: too much focus on studying patterns, relations, etc. and (tools for) predictions, while conflicts (competition for limited resources), and social, economical and regulatory aspects are not paid adequate attention (serious inherent weakness).

Evaluator 4
The consortium brings together different partners in the fields of computer science, neurobiology, complex systems, biology, social sciences, evolutionary ecology and one small and medium size enterprise. As such, the the research methodology and work plan to achieve project objectives is coherent and effective though the impact remains uncertain because of the lack of clear outcomes.The person months are satisfactorily balanced among partners according to their roles in the project and provides sufficient resources to complete the different tasks.

Role and complementarity of the participants and extent to which the consortium as a whole brings together the necessary expertise.

Evaluator 1
Each participant role in the project is well identified, in particular due to the dedication of some members of the consortium to a single well-identified work-package but also due to the reasonable number of participants to each work-package. The consortium as a whole is composed of leading scientists in their respective domains and brings together the necessary expertise to achieve the project objectives.

Evaluator 2
The team is well composed and presents the necessary skills to conduct the work. There is a blend of traditional university researchers and more applied non-profit institutions. All with relevant domain expertise. However, there is very limited commercial/industrial participation. There are no SMEs or startups engaged. Given the role such entities currently play in the computer science/big-data and AI sectors this is a notable weakness.

Evaluator 3
Overall, the consortium has adequate expertise to perform the proposed work: the aggregate expertise of all partners covers the theoretical (eco-evolutionary dynamics), numerical (data-driven modelling, neural networks) and applied (data collection, communication) aspects of the project to a large extent.
From the description, it is not explicit enough which partner(s) have enough expertise in machine learning (beyond neural networks) (shortcoming). There are overlaps in the expertise of some partners, as specified in section "Consortium as a whole". In particular, TARTU and TU Graz seem exchangeable (minor shortcoming) .

Evaluator 4
The research will be undertaken by adequate multidisciplinary and complementary project partners including experts in evolutionary biology, ecology, computational neuroscience, data science, complex systems and experts in communication and field studies in biodiversity.
All consortium partners exhibit a long-standing experience in interdisciplinary research across the boundaries of the individual disciplines.
The role of the different partners is adequate and the proposal is appropriately organised by the Project Manager, with a Steering Board, an external Scientific Advisory Committee, and a Dissemination and Exploitation Board. The Steering Board will consist of one representative from each partner as well as the Project Manager and will meet at least once a year.

Scope of the proposal

Status: **Yes**

Comments (in case the proposal is out of scope)

Not provided

Operational Capacity

Status: **Operational Capacity: Yes**

If No, please list the concerned partner(s), the reasons for the rejection, and the requested amount.

Not provided

Exceptional funding of third country participants/international organisations

A third country participant/international organisation not listed in General Annex A to the Main Work Programme may exceptionally receive funding if their participation is essential for carrying out the project (for instance due to outstanding expertise, access to unique know-how, access to research infrastructure, access to particular geographical environments, possibility to involve key partners in emerging markets, access to data, etc.). (For more information, see the Online Manual)

Based on the information provided in the proposal, I consider that the following participant(s)/international organisation(s) that requested funding should exceptionally be funded:

(Please list the Name and acronym of the applicant, Reasons for exceptional funding and the Requested grant amount.)

Not provided

Based on the information provided in the proposal, I consider that the following participant(s)/international organisation(s) that requested funding should NOT be funded:
(Please list the Name and acronym of the applicant, Reasons for exceptional funding and the Requested grant amount.)

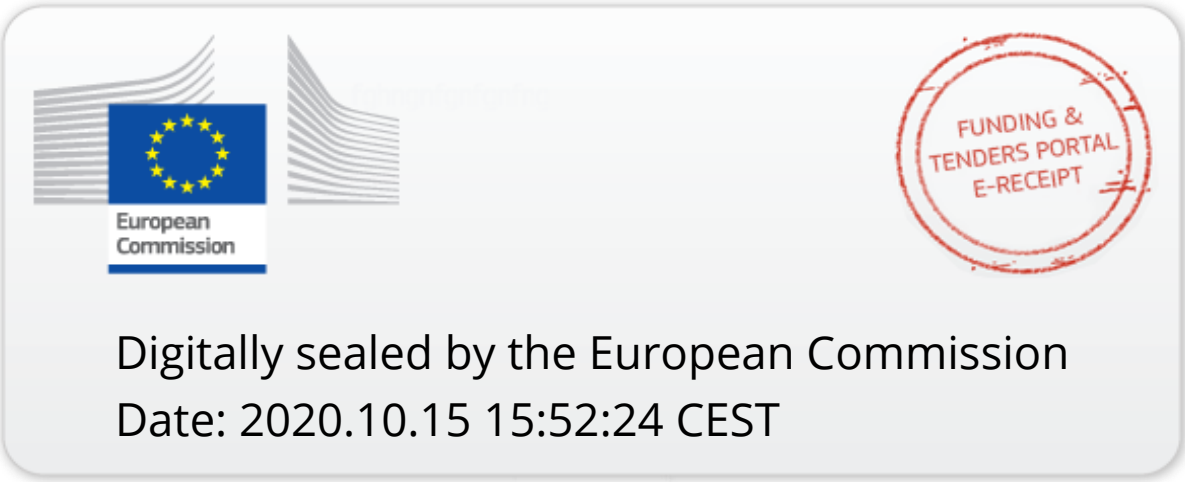
Use of human embryonic stem cells (hESC)

Does this proposal involve the use of hESC?

No

If yes, please state whether the use of hESC is, or is not, in your opinion, necessary to achieve the scientific objectives of the proposal and the reasons why. Alternatively, please also state if it cannot be assessed whether the use of hESC is necessary or not because of a lack of information.

Not provided



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