Proposal Part B: Technical description

European Collaborative Research Innovation and Technology Ecosystem

EUCRITE: A European Collaborative Cloud for Cultural Heritage

Participant No	Participant Organisation Name	Acronym	Country	Role
1	Materich, Berlin	DEB	DE	Coordinator
2	University of Sarajevo	BAS	BA	partner
3	Katholieke Universiteit Leuven	BEL	BE	Partner
4	Charles University Prague	CZP	CZ	Partner
5	Czech University of Agriculture and Life Sciences	CZU	CZ	Partner
6	Hungarian National Museum, Budapest	HUM	HU	Partner
7	Trinity College Dublin	IED	IE	Partner
8	University of Pisa	IEP	IT	partner
9	The American University of Rome	ITR	IT	Partner
10	University of Tuscia, Viterbo	ITV	IT	partner
11	Belgrade Metropolitan University	RSB	RS	partner
12	Slovak Academy of Sciences, Bratislava	SKB	SK	Partner
13	Museum of Sarajevo	BAM	BA	Affiliate
14	National Museum of Agriculture, Prague	CZM	CZ	Supporter
15	Museum of the Commune of Amelia, Umbria	ITM	IT	Supporter
16	Slovak National Gallery, Bratislava	SKG	SK	Supporter
17	The Ministry of Culture of the Slovak Republic	SKC	SK	Supporter
18	The Ministry of Education of the Slovak Republic	SKE	SK	Supporter
19	The Ministry of Agriculture of the Czech Republic	CZA	CZ	Supporter
20	Archaeological Superintendence of Umbria	ITU	IT	Observer

This work focuses on creating a cloud infrastructure that enables the acquisition, transformation, contextualisation, processing, analysis, and reuse of cultural heritage information through a set of intelligent algorithms and easy-to-configure tools converted into marketplace solutions and services in a secure, open, collaborative, interoperable, scalable, sustainable, and cost-effective manner. Our solution will facilitate the digital renaissance through a high-impact cloud ecosystem that integrates end-to-end research, innovation, education, and promotion activities using enabling technologies for art and 2D objects, architecture and 3D objects, and intangible cultural heritage in the form of old crafts, traditions, and agricultural practices. Developed in close collaboration with end-users of ECCCH, our intelligent tools and solutions will be rigorously tested and valorise before making them public through our open marketplace for cultural heritage.

1 Excellence

This is Excellence

2 Impact

2.1 Innovation potential

The unique contributions of this work are:

1. The Key Performance Indicators (KPI) to analyse impact of cultural heritage on digitalisation of museums, regional development, tourism, and enhanced learning abilities through a unique cloud-enabled solutions
2. Algorithms and tools for data gathering, processing, visualization, and intelligent analytics for script, images, 3D objects, and intangible heritage.
3. Open software for museum information management
4. Open software for knowledge management
5. Open software for material properties
6. Open software for enterprise Blockchain security
7. Number of open user friendly software apps based on the case studies developed
8. Highly functional and content rich web portal for secured information access, training, and relationship management.

2.2 Potential impact

The impact of this work to be in several areas:

- The proposed methodology will be open to the public by means of publications and events directly oriented to the public; we will cover both the channels of scientific dissemination and dissemination to the wider public with different media and actions. Finally, the Consortium will endorse as much as possible the open source policy and will make efforts for granting use of the basic technology developed within this project to the external world. This will become a concrete possibility for external potential users both at the level of the basic assets and of the tools developed for the design and implementation of VR installations. We expect the impact to the works for multidisciplinary researchers from computer science, visual arts, literature, film directing, psychology, communicology and human computer interaction. We believe that this work could be used also in other areas of life, such as education and journalism. The workflows developed can be reused in various other applications of cultural heritage carried out in this project and beyond.

1. This study will improve the short and long term efficiency of the ECCCH platform and provide a tool for immediate feedback . 2. The survey study will also contribute to making the stakeholders be aware of, have access to and use the ECCCH platform, its tools and services for the study, digitization, conservation, valorization and access to cultural heritage artifacts and related data, in particular for the sharing and preservation of such data, and are involved in its validation and assessment, in view of continuously improving the ECCCH's performance and use. The impact will consider gender aspects. 3. These efforts would help to establish a pan-European network of key stakeholders from cultural heritage institutions, including a robust scientific and professional community and ensure openness to the cooperative efforts of a wide community of users. The results of the study will be disseminated to the stakeholders and research community.

2.2.1 Target groups

The target groups for the work undertaken are:

1. Education and research institutions (academic community)
2. Galleries, Libraries, Archives, and Museums (GLAM) institutions
3. Creative and cultural industry, NGOs
4. Churches and other religious institutions
5. Municipalities, government ministries and policymakers,
6. Tourists, especially interested in intangible cultural heritage
7. Citizens, residents, communities Digital and media content users, consumers
8. Young generations, students.
9. government agencies

2.2.2 Academic impact

This project will encourage academics adapt proposed skill development techniques and assessment frameworks in their own practice. Academic researchers will be able to further evolve proposed cloud framework and architecture developed in this work to develop similar systems for other areas or develop tools that can be

deployed in the Eucrite cloud ecosystem.

2.2.3 Societal impact

The rural community like the Amelia where the proposed work carried out will have a significant impact in its overall aspect of regional economic development including promotion of tourism, skill development, and youth empowerment. This community and Umbria region of Italy will be directly impacted by this project. The international workshop hosted in this rural community will bring this region to the international spotlight and help grow the local economy, thus bring direct socioeconomic benefit to the local population.

2.3 Scale and measure of impact

Using WP1 Task 1.6 we will review currently available best practices as measures of Key Performance Indicators. This will be carried out via a systematic bibliometric analysis and pan-European empirical study. Next, we will develop benchmarks and use those measures to benchmark our target groups listed in section 2.2.1. in at least four low-to middle-income countries Bosnia, Czechia, Slovakia, Hungary we aim to demonstrate a significant improvements in these numbers to set a new benchmark as we improve our knowledge delivery mechanisms. We will train at least 100 young students, 50 teachers, 50 researchers, 100 museum staff, 10 cultural ministry administrators, through the workshops and activities carried out in WP5. Based on merit we will be awarding at least 40 new scholarships to students across Europe, especially yough girls and students from disadvantaged backgrounds. We will also be publishing scholarly publications to report our findings. The number of users as traffic on our state-of-the-art software platform will add intellectual and promotional value to our work.

2.3.1 Measures to maximise impact

We will adapt agile project development strategy to maximise impact. By utilizing adaptive learning methods we will focus on improving the quality of our instructions and course material. In addition, some of the following aspects will further help us maximize impact:

1. A wider review of best practices and better understanding to enhanced knowledge base required to monitor and assess impact including forward looking approaches aimed to anticipate and prepare for future or emerging technology challenges.
2. Apply effective risk assessment and risk management strategies to deliver project outcomes.
3. Increasing the EU knowledge base and guidance on measures to manage quality and evidence for policy-making, planning and implementation.
4. Science and evidence-based implementation of the European Green Deal and the Sustainable Development Goals, notably the SDP 5: gender equality, SDP 10: reduced inequality.

2.4 Communication and Dissemination

2.4.1 Target beneficiaries

We have identified the following beneficiaries for the knowledge transfer:

1. Multidisciplinary academic researchers:
   (a) The art researchers will advance their understanding on how mathematical algorithms of art can be developed. They will learn to use techniques developed to undertake new CH research. Open cloud will also promote solution development for their specific problems.
   (b) The science and engineering researchers will be able to utilize and integrate the algorithms and tools in their analysis to create innovative cost effective solutions in their areas. For example, 3D Vision algorithm can be used by Industry 4.0 and robotics community. New material properties database can be used by industry to build new solutions for preservation, restoration, and reconstruction.
   2. Institutional stakeholders:
   (a) The data provided and software innovation carried out in this work will allow small entrepreneurial museums as well as large museums to develop and market new solutions, new exhibitions, designed to solve specific heritage problems.
2. Government agencies:
   (a) This project will promote European sense of belonging by achieving cultural cohesion and resiliency through a shared digitalisation journey
   (b) highly skilled workforce developed through evidence-based policy guidelines developed will contribute to the sustainable innovation potential of rural and urban communities.
   (c) The best practices and key performance indicators developed through this project will enable to predict potential areas of improvements and policy interventions. We believe that our proposed cloud

ecosystem will help government administrators and local agencies to visualise and communicate skill gap information more effectively, they will be able to integrate their museum collections and develop a national database in an hierarchical manner that goes all the way down to a rural community. Agencies role in the gender-responsive youth empowerment and rural development will be further strengthened by this work.

2.4.2 Dissemination

We will have regular progress reports updates on the project which will immediately be made available to a larger audience via our online Platform. Additionally, we will be publishing scientific papers and presenting our findings through conference presentations delivered on a wide variety of topics to both European and international audiences. Through our onsite workshops as well as various online mediums we will be disseminating our new knowledge to have a maximum impact for the cultural heritage and literacy.

The outcomes of this work will be widely disseminated among all relevant stakeholders to achieve impact at national and European level. Periodic quality monitoring to track progress towards achieving all the agreed EU-level targets and indicators will also take place through the meetings among the project participants and relevant stakeholders. At the end of the first cycle/year, we revisit the set of priority areas in order to adjust them or set new ones for the following cycle/year, based on current challenges and to reflect on the progress made. We will publish regular progress reports taking stock and evaluating the achievements made. In the mid cycle we will also organise a mid- term review event.

Education and training have a vital role to play in shaping the future of European landscape. It is widely recognised that there are many barriers to effective adaptation of climate mitigation strategies that we must overcome. Some of these aspects include awareness of climate risks and the complexity of adapting to future technology solutions. In order to bring down barriers to learning and improve access to quality education, to help develop workforce skills in a rapidly changing technology landscape, we intend to develop and offer technology and knowledge transfer programme in WP3 in the form “micro-credentials” to the targeted individuals. Our training shall involve flexible acquisition and recognition of knowledge, skills and competencies to meet new and emerging needs in society and labour market as a compliment to traditional means of learning. We intend to provide training using many different formats: formal, non-formal and informal learning settings so as to enable learner acquire the knowledge, skills and competencies they need to thrive in an changing labour market, adapting to and using newly discovered breakthroughs carried out in this project.

2.4.3 Communication

We plan to make all results conducted in this project openly available by publishing them in scholarly publications. The overall aim is to increase social awareness and understanding of role of art in computer education. We want to educate a new generation of artists, scientists, academics, involved in the art of computer programming and the computer programming of art. We dedicated the whole WP5 for the preparation of appropriate teaching materials and for communication promoting the project findings to relevant stakeholders via workshops. Along with our proposed information platform in WP5, and by using various other social/professional media platforms, we will make our content and newly discovered knowledge available to wider audience

The COVID-19 pandemic has brought unprecedented challenges and opportunities for education and training systems. Utilizing the impact of digital technologies we aim to bridge the connectivity gaps within urban-rural settings, while also highlighting the potential of education and training to build resilience and foster sustainable and inclusive growth. Thus contributing to the society and economy become more cohesive, inclusive, digital, sustainable, green and resilient, and for citizens to find personal fulfilment and well-being, to be prepared to adapt and perform on a changing labour market and to engage in active and responsible citizenship.

The periodic monitoring of progress towards the set objectives through systematic collection and analysis of internationally comparable data will be utilised to provide high end classroom type and hands-on learning by doing skills. Towards that aim, digital technologies play an important part in making learning environments, learning materials and teaching methods adaptable and suitable to diverse learners. They can promote genuine inclusion – provided that digital gap issues, both in terms of infrastructure and of digital skills, are addressed in parallel. This very issue is at the heart of our proposed digital learning management and technology platform ecosystem developed in WP1 and WP5. The impact of WP2 is to make training systems become more flexible, resilient, future-proof and appealing, reaching out to a more diverse groups by providing upskilling and reskilling training opportunities in making the green and digital transitions to an environmentally sustainable, circular and climate-neutral economy.

2.4.4 Exploitation

Although our newly discovered knowledge will be made available in an open format to many of our stakeholders, we believe that there is a appetite for its commercial exploitation through our industrial partners. We will commercially exploit developed knowledge to be passed on to industry professionals via paid training workshops. We believe there will be interest across the industry sectors since art, architecture and data visualization plays significant role in multiple industry sectors. In addition, other avenues for commercial exploitation will be finalized in the early months of the project. Finally, through a multi-tier membership model we will charge annual membership fees for museums and other actors to join the foundation and avail the benefits at a reduced rate. Assuming 4 levels of memberships with fees anywhere between EUR 0 and EUR 20k we can provide technology solutions are affordable rates to museums big and small.

2.5 Impact summary

SPECIFIC NEEDS	EXPECTED RESULTS	D & E & C MEASURES
• Foster the uptake of cloud technology solutions and approaches to promote CH activities • Increased understanding about the benefits of integrating technological, cultural and social science approaches of CH research, innovation, and education. • Increased interest in new technologies. • Conduct technology and knowledge activities through cultural and creative approaches. • Develop a Pilot for the demonstration and valorisation of the Eucrite cloud using case studies developed.	• Review and analyse best practices in cloud technology and its adaptation to cultural and creative arts sector at the different stages of research, innovation and education. • Experimentally validate intelligent algorithms and tools using the various case studies; in some cases duplication of the case studies to validate the methods developed. • Successfully demonstrate the technology, tools, and solutions developed through innovations in exhibitions at partnering museums. • Utilize and test teaching methodology built on the technology enhanced learning and recommender system for personalised education that are easy to learn and master. • Promote young students especially girls and women by developing their interest in new technologies by awarding them travel grants to attend the hands-on training workshops. Scholarships or travel grants based on merit. • In an engaging manner promote inclusion of multidisciplinary actors and stakeholders, especially those from the disadvantaged groups and minorities into the cultural and social life. • Develop innovative evidence based policy guidelines to increase cultural literacy and wider adaptation of ECCCH	• **Dissemination:** ◦ Cultural art and technology ecosystem will be demonstrated to the stakeholders during the workshop. ◦ Knowledge will be disseminated to conferences and using scholarly peer reviewed publications ◦ Training through workshops, activity sessions that will be fully supported by expert instructors. • **Communication** ◦ Through online platform a large audience will be targeted for creating cultural literacy and digital awareness. ◦ Social/professional media will be utilized for communication. ◦ Webinars, seminars and activity sessions will be organized. ◦ Regular project progress with stakeholders will be communicated. • **Exploitation:** ◦ Sponsors/supporters will be engaged for the exploitation and commercialisation of the key findings of this work. ◦ Workshops for institutional stakeholders will be hosted to train young professionals ◦ For public at large developed software ecosystem will be open source but for commercial use of Software as a Service will be offered at commercial rates. ◦ Tier based membership fee model will be developed to bring revenue for management. Licensing mechanism of software will be developed to make the project sustainable beyond project funding

TARGET GROUPS	OUTCOMES	IMPACTS
• School students • Academic researchers • Young artists/scientists • Institutional stakeholders • Government agencies • Public including tourists	• Scholarly publications • Learning materials • Workshops and activities • Algorithmic tools • Software solutions • Cloud data platform	• Promotion of cultural heritage • Digitalisation of museums • New high skilled workforce • Tools, products, and solutions • Empowerment of girls and women • Rural economic development

3 Quality and efficiency of the implementation

3.1 Consortium

Our consortium is made up of multidisciplinary researchers from art, science, and engineering background all synergistically working together towards solving some of the problems described in this project. Our closely knit team members will spend time with each other during the project development as well as during the workshops to review and monitor each others progress. Teams will exchange their expertise and ideas with each other for early discussions on joint vision, build strong working relationships to unlock multidisciplinary collaborations with clearly specified roles, responsibilities in open and transparent manner. The brief description of this consortium members and their subject matter experts is as follows:

1. DEB: Materich is a private commercial company (SME) based in Brandenburg, Germany, led by Sabina Ziemian as founder CEO and Amit Manthanwar as founder CTO. Sabina has expertise in material chemistry with over 20 years of academic and industrial research experience gained at Imperial College London, University of Nottingham and Bayer. Amit has expertise in process systems engineering with over 20 years of academic and industrial research, development, teaching, and technology transfer experience gained at Imperial College London, Texas A&M University, Illinois Institute of Technology, College of Engineering Pune, the US Smart Manufacturing Institute, Invensys (now Schneider Electric), and RasGas Qatar. He has commercially developed advanced process automation algorithms, tools, and software solutions for economically and environmentally conscious industrial process operations. He has received a number of multidisciplinary consortium-led research grants from the US Department of Energy, the UK Engineering and Physical Sciences Research Council, and the Government of India. Notable awards relevant to this project include the US DOE programme on smart manufacturing. He is the lead investigator for this project. Materich brings a vast amount of experience and expertise to coordinate the project and carry out a number of tasks proposed in this project.
2. BAS: University of Sarajevo is a public research university of Bosnia and Herzegovina. Selma Rizvić is a professor of computer graphics at the university. Her research group focuses on applications of digital technologies to cultural heritage preservation and presentation through Virtual and Augmented Reality, combined with interactive digital storytelling. Selma and her research team will contribute to developing high quality virtual reconstructions of the intangible cultural heritage proposed in WP3.
3. BEL: Katholieke Universiteit Leuven is a research university in Belgium. Katrien Verbert is a professor of computer science at the university. Her research focuses on interactive recommender systems, visual analytics, explainable AI and applications in learning analytics, healthcare, precision agriculture, media consumption and digital humanities. Robin De Croon is a researcher of intelligent user interfaces. He has developed a suite of information visualization tools for understanding, exploring, explaining and disclosing health information. Katrien and her research group will develop a number of tasks proposed in WP1 and WP2.
4. CZP: Charles University was founded in 1348, making it one of the oldest universities in the world. Yet it is also renowned as a modern, dynamic, cosmopolitan and prestigious institution of higher education. Daniel Říha is an academic researcher active in the field of interactive media since 1998. He is an award-winning interactive media designer (Kunst am Bau, Germany), author and editor in the field of human-computer interaction, computer game studies, interactive media and digital art. He is co-organizer of scientific conference lines for Cyber Hub, Inter-Disciplinary.Net, Oxford, UK (2009-2016) and HCI in Games, HCI International (2019-2024). Hermann Prossinger is a biostatistician who innovated multiple scientific fields by involving analytical methods taken from different field i.e. physics. He is a co-developer of the geometric morphometry and in recent collaboration with Jakub Binter, Silvia Boschetti and Tomas Hladky developed novel methods of analyzing questionnaire data using artificial intelligence. He also uses the visual analysis to evaluate the stimuli to find connections with human perceptual systems.
5. CZU: Czech University is a public research university of Czech Republic. Lubos Smutka, prof., Ing., Ph.D.: The vice for science and research; Head of Department of Trade and Finance; Head of International Center for Rural development Studies, Faculty of Economics and management, Czech university of Life Sciences Prague. An author of more than 372 papers (world trade, European foreign trade, Czech foreign trade, world agricultural production and consumption, agricultural trade etc.), which were presentenced and published in the Czech Republic (local conferences, journals and books) and abroad (conferences, books and journals in Hungary, Ukraine, India, Indonesia, Mexico, Slovakia, France). About 192 respectively 209 papers are recorded in SCOPUS (H-index 17, 1021 citation) respectively WoS database (H-index 16, 682 citations). Participation at eight international conferences and two international seminars as an invited session keynote speaker or invited plenary session keynote speaker. Principal investigator or co-investigator of more than 20 national or international projects.
6. HUM: The Hungarian National Museum founded in 1802 is the national museum for the history, art, and archaeology of Hungary. The archaeological collections of the Museum gather finds from across the whole of historical Hungary and from most of the main archaeological excavations conducted in Hungarian territory.

Several Hungarian museums are affiliated to HUM. A number of researchers of the museum as direct beneficiary and in-kind contribution led by their international project coordinator Klaudia Klára Tvergyák will contribute in delivering a number of tasks proposed in this project.

7. IED: Trinity College Dublin is a public research university in Dublin, Ireland. Zuleika Rodgers is Associate Professor in Jewish Studies in the Dept of Near and Middle Eastern Studies and Curator of the Weingreen Museum, Trinity College Dublin. She is a cultural historian who has worked with text and object and whose research spans both antiquity as well as the modern period. Her publications include interdisciplinary edited volumes focussing on text, object, archaeological studies and reception history. She has been curator of the Weingreen Museum since 1999 and has run workshops with the collection for school students, university students and the public. She has organised a number of exhibitions and also directed a project on digitising the museum's catalogue. Relevant to this project is her museum work, her teaching of the Near East and Mediterranean World from antiquity to the present and her work as a cultural historian who examines antiquity and its reception. Christine Morris is the Andrew A David Professor of Greek Archaeology and History in the Department of Classics, Trinity College Dublin. She is a specialist in Mediterranean archaeology, working in particular on Crete and Cyprus. Her current projects include the Atsipadhes Archaeological Project; East Cretan Peak Sanctuaries Project (ECPSP) (both with Alan Peatfield), and she is co-PI on the interdisciplinary project, 'The Many Lives of a Snake Goddess'. Her co-edited books include Ancient Goddesses (1998), An Archaeology of Spiritualities (2009), Unlocking Sacred Landscapes: Spatial Analysis of Ritual and Cult (2019). Relevant to this project is her expertise in ceramic studies (pottery and figurines); object biography; museum cataloguing; and her collaborative work on 3D scanning and printing in relation to Cretan Bronze Age figurines. Zuleika and Christine will focused on the digitalisation of the Weingreen Museum through this project by delivering a number of proposed tasks.

8. ITP: University of Pisa is a public research university in Pisa, Italy. Marco Lezzerini is a Professor of mineralogy. He and his research group focuses on the mineralogical-petrographic analysis for the environment and cultural heritage. The group deliver WP2.

9. ITR: The American University of Rome is a private Liberal Arts college offering Bachelors and Masters degrees accredited by Middle States Commission on Higher Education. The program in Cultural Heritage, forms part of the Graduate School, and offers high quality, postgraduate education comprising the latest skills to students aiming to work as cultural heritage professionals. The program has a particular emphasis on community work, sustainability, development, conflict and post conflict heritage protection and peacebuilding and antiquities crime prevention. Valerie Higgins is Program Director for Cultural Heritage and Associate Professor of Archaeology. Her research covers the areas of antiquities crime prevention, community engagement, heritage tourism and conflict and post-conflict heritage protection. She is widely published in these areas and in addition has taught courses and chaired meetings with a wide variety of international partners including International Organizations, NGOs, EU, and military organizations charged with Cultural Property Protection. She and her research team will be developing WP5.

10. ITV: University of Tuscia is a young university in Viterbo, Italy. Alessandra Bravi is a classical archaeologist. She studied archaeology in Rome and Heidelberg. She has carried out research at the Universities of Heidelberg, where she qualified in Classical Archaeology, and Perugia, and for the past three years has been working as a scientist and researcher at Tuscia University. Her research focusses on six larger areas: 1) Interaction between written and visual culture; 2) cultural transfer of visual and material culture; 3) resistance against Greco-Roman imperialism and the cultural identity of 'marginal' societies: Diaspora, Asia Minor, Roman Egypt etc. 3) pragmatic interpretation of art based on the interaction between artwork and the society of user-viewers; 4) Changes in late antique society and its visual culture and the process of de-sacralizing of classical art; 5) the social role of art and material culture as indicators of status, cultural distinction, and prestige 6) The role and function of the Classical Cultural Heritage in Byzantine culture. She will be delivering digitalisation of the museum of Amelia.

11. RSB: Belgrade Metropolitan University is a research university in Belgrade, Serbia. Nemanja Zdravković completed his M.Sc. in electrical engineering and computer science, scientific field telecommunications, at the Faculty of Electronic Engineering, University of Niš in 2012, and his Ph.D. studies at the Norwegian University of Science and Technology (NTNU) in Trondheim, Norway, in 2017, as well as at the University of Niš in 2017, for which he has received a dual Ph.D. degree. Dr. Zdravković has been an Assistant Professor at the Faculty of Information Technologies at Belgrade Metropolitan University and since 2020 head of the Blockchain Technology Laboratory at BMU, and since April 2023 he is the Dean of the Faculty of Information Technology at BMU. Besides teaching activities in the field of computer networks, blockchain technology and computer architecture, he conducts research which includes the application of blockchain technology in healthcare, cooperative and distributed network analysis, RF and optical telecommunication systems analysis and information theory. Dr. Zdravković is a member of the Institute of Electrical and Electronics Engineers (IEEE) and serves as a reviewer of the flagship conferences in wireless telecommunication systems.

12. SKB: The Institute of Ethnology and Social Anthropology at the Slovak Academy of Sciences in Bratislava is a prominent institution for ethnological, socio-anthropological, and religious research in Slovakia and Central

Europe. This research team will be led by Tatiana Podolinska who is the director of the Institute director. Her research work focuses on contemporary religiosity and spirituality, with a focus on Romani studies and Marian devotion in Europe. The Academy has a vast collection of cultural heritage some of which has already been digitalised. This project will extend the work carried out by Tatiana and her colleagues Elena Marushiakova, Lubica Volanska, and Andrej Gogora. They will contribute in developing various tasks in this project. Elena Marushiakova works at the Institute of Ethnology and Social Anthropology of the SAS from 2023. For the past eight years, she worked at St Andrews University (UK), initially for one year as a Leverhulme visiting professor and then as a research professor and Principal Investigator of the ERC Advanced Grant 2015, Nr. 694656 "Roma Civic Emancipation Between the Two World Wars". From 2001 to 2004, she worked at the Institute of Ethnology of Leipzig University in Germany as part of the SFB Difference and Integration project. Economical Symbiosis and Cultural Separation: Service Nomads in Rural and Urban Contexts. She was also employed at the Institute of Ethnology and Folklore Studies with the Ethnographic Museum of the Bulgarian Academy of Sciences. Andrej Gogora is a researcher at Institute and Head of the Scientific Collections Department. His research focuses on the methodological foundations of digital humanities. Currently, he is involved in building digital text and image resources in humanities, in particular, digital collections of ethnological research reports. He is the coordinator on behalf of the IESA SAS as a cooperating partner of the European research infrastructure DARIAH-EU.

3.2 Work Plan and Resources

3.3 Work Plan and Resources

Table 3.3a: List of Work Packages

Work Package	Work Package Title	Lead Participant Number	Lead Participant Short Name	Person Months	Start Month	End Month
WP1	Infrastructure Development	1	DEB	464	1	36
WP2	Digitalisation of Art	4	CZP	268	1	36
WP3	Digitalisation of Architecture	7	IED	278	3	36
WP4	Digitalisation of Intangible Heritage	12	SKB	176	3	36
WP5	Knowledge Transfer	9	ITR	100	3	36
WP6	Project Management	5	CZU	162	1	36
			Total Person Months:	**1448**		

3.3.1 Description WP1 - Infrastructure Development

Table 3.3b1: WP1

Work Package Number	**WP1**		**Lead Participant:**		**DEB**	
Work Package Title	Infrastructure Development					
Participant Number	1	5	5	7	11	12
Participant Short Name	DEB	BEL	CZU	IED	RSB	SKB
Person Months Per Participant	16	114	96	62	108	68
Start Month	**1**		**End Month**		**36**	

Objectives

The cultural heritage research is information, event and context driven activity to gain valuable insights for restoration, discovery, and promotion of artefacts. Our proposed cloud provides ability to create, update, restore, reuse, move, migrate, transform, contextualise, and manage data and information in a secured manner with ease and affordability. It enables on-demand reusability of component and services. Above all it is flexible, fast, high-performance, resilient, reliable, always available from anywhere on any device with a network access. Thus bringing people and systems together to work collaboratively in an environmentally sustainable manner across the cultural heritage value chain. The ultimate goal of our Eucrite cloud ecosystem offering and the proposed research efforts is to significantly reduce the cost and complexity of digitalisation of cultural heritage to drive research and innovation in a collaborative, open, and pre-competitive manner with deeper engagement of actors and stakeholders. To achieve this goal of democratisation of technology, our cloud solution also fosters unique personalised skill development with technology enhanced learning analytics and context-aware recommender system to stimulate interest for wider adaptation of these cutting-edge technologies all built into one Eucrite Cloud. In this WP we will develop necessary infrastructure, tools, products, solutions and services with by following a principle: create once, reuse everywhere so others do not have to reinvent the wheel and they can focus on solving their problems as against fiddling with the complex cloud computing technologies.

Description of work

Task 1.1 (Deliverables: D1, D2; Milestones: M1, M2)

Title: *Development of Cloud Platform Ecosystem Tools and Solutions*

Lead: DEB Contributors: BEL, CZU, IED, RSB, SKB Start: M1 End: M20

In this task we will build the containerised applications and images of necessary back-end infrastructure comprising of high performance compute, network, and storage server nodes that are specifically customised for the cultural heritage actors. These nodes can then be easily initiated and configured by the end-user. In addition, we will develop integrated data visualisation and composable analytics to manage the cultural heritage data and its smart retrieval through vendor agnostic application programming interfaces. Since, some of these types of dataspaces in a variety of forms are already available, e.g. Europeana, DARIAH, ARIADNE, and ARIADNEPlus, etc., we will effectively use them. However, they manage basic data types and lack the advanced cloud-enabled algorithmic tools that we aim to deliver through this work package. These data services are more like basic data of a person including photographs. What we need is a biometric information too to uniquely identify a person. Along these lines we plan to create a unique material property database of frescos in WP2. In this task we will also develop necessary infrastructure to facilitate creation and management of a DNA database of cultural heritage objects.

Task 1.2 (Deliverables: D1)

Title: *Development of Context-Aware Cultural Informatics*

Lead: SKB Contributors: DEB, BEL, CZU, IED, RSB Start: M1 End: M36

As discussed earlier, context-driven activities are of paramount importance to cultural heritage research. Take an example of a study carried out in WP4 involving pictures of Virgin Mary shown in Figure ?? in a number of contextual references which can be broadly classified as religiosity-driven spiritual healing, non-religiosity-driven aesthetics, and pragmatic economic or political context. Another example is a study of objects from

Biblical antiquities carried out in WP3 where original context, geo-spatiotemporal space-time, historical interpretations,biography of objects, its material properties, human-animal relations, authenticity, integrity, depth, political, and ethical dimensions, etc., In this task, we will focus on contextualising images and develop context-aware cultural informatics that can be easily modified to either analysing Marian hyperdulia in WP4 or pictures from Iraq in WP3. Our methodology will be based on development of document databases with contextual metadata search and retrieval capabilities that are augmented with either intelligent image processing algorithms developed in WP2 or intelligent analytics for recommender system in Task 1.4 below.

Task 1.3 (Deliverables: D1)

Title: *Development of Enterprise Blockchain Security System*

Lead: RSB Contributors: DEB, BEL, CZU, IED, SKB Start: M1 End: M36

In this task, we will develop a enterprise level blockchain system for securing cultural heritage assets based on open-source Hyperledger platform. Development will be done at RSB's Blockchain Technology Laboratory. The blockchain-based system will be private, and therefore does not require high processing power, as computationally-heavy consensus mechanisms can be avoided with Hyperledger. This system will firstly be tested and deployed at partnering cultural heritage institutions, e.g. IED, HUM. Successfully valorised solutions will be made available through open Eucrite cloud marketplace software and application programming interface for securely interconnecting cultural institutions, and using the immutability property of blockchain to correctly track all activities for items connected to the blockchain. Thus, build a mechanism that will ensure trust between different cultural heritage actors and stakeholders.

Task 1.4 (Deliverables: D1, D2)

Title: *Development of Intelligent Analytics for Technology Enhanced Learning*

Lead: BEL Contributors: DEB, CZU, IED, RSB, SKB Start: M1 End: M36

Technology enhanced learning analytics in the form of learning dashboards as a specific class of personalised informatics of recommender systems can increase motivation, awareness, reflection, sense-making autonomy, effectiveness, and efficiency of learners and teachers alike, [18]. Dashboards typically capture and visualise traces of learning activities and to enable learners to define goals and track progress towards these goals. Such dashboards provides graphical representations of the current and historical state of a learner or a course to enable flexible decision making either used in traditional face-to-face teaching, online learning, or blended learning settings. However, such recommender systems still have not found major usage in K12 education, [1], and in cultural heritage sector because of unique challenges when used by diverse population and multidisciplinary nature of the cultural heritage. These challenges are further compounded by the increasing role of digital technologies such as developed through various work packages 1 to 4 of this project.

Deliverables

- *Deliverable 1.1 D1* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M12
  Technical report on cloud ecosystem submitted to project coordinator. Verification: (1) pdf of report, (2) email approval from project coordinator.

- *Deliverable 1.1 D2* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M12
  Scholarly publication on the architecture of the infrastructure. Verification: (1) pdf of manuscript, (2) email from journal acknowledging receipt of the submitted manuscript.

- *Deliverable 1.2 D1* Lead: SKB Contributors: DEB, BEL, CZU, IED, RSB Date: M12
  Technical report on informatics tool submitted to project coordinator. Verification: (1) pdf of report, (2) email approval from project coordinator.

- *Deliverable 1.3 D1* Lead: RSB Contributors: DEB, BEL Date: M12
  Technical report on Blockchain security submitted to project coordinator. Verification: (1) pdf of report, (2) email approval from project coordinator.

- *Deliverable 1.4 D1* Lead: BEL Contributors: DEB, CZU, IED, RSB, SKB Date: M13
  Scholarly publication on technology enhanced learning. Verification: (1) pdf of manuscript, (2) email from journal acknowledging receipt of the submitted manuscript.

- *Deliverable 1.4 D2* Lead: BEL Contributors: DEB, CZU, IED, SKB Date: M14
  Scholarly publication on context-aware recommendation system. Verification: (1) pdf of report, (2) email approval from project coordinator.

Milestoness

- *Milestone 1.1 M1* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M6
  Portal Published Verification: Minutes of WP1

- *Milestone 1.1 M2* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M6
  Sofware developed Verification: Minutes of WP1

3.3.2 Description WP2 - Digitalisation of Art

Table 3.3b2: WP2

Work Package Number	**WP2**		**Lead Participant:**		**CZP**	
Work Package Title	Digitalisation of Art					
Participant Number	1	6	6	8	10	
Participant Short Name	DEB	CZP	HUM	ITP	ITV	
Person Months Per Participant	16	96	48	36	72	
Start Month	**1**		**End Month**		**36**	

Objectives

This work package will focus on developing two techniques for the analysis of art: (1) experimental analysis of fresco by non-invasive methods; and (2) intelligent algorithms for script and image processing. Frescoes, which are paintings created on wet plaster surfaces, have been a significant form of artistic expression for centuries, dating back to ancient civilizations. They adorn the walls of churches, temples, tombs, and historical sites, offering a glimpse into the artistic and cultural heritage of the past. The preservation and restoration of frescoes are essential to maintaining these valuable artifacts for future generations. Non-invasive diagnostic techniques have become indispensable tools for conservators and art historians in understanding and preserving frescoes. Script is essentially the graphic form of a writing system capable of transcribing any and all utterances of a particular known or unknown language, broadly classified into structure-based and visual-appearance-based techniques. (We do not, for this project, deal with cuneiform scripts, where style is difficult to define.) For theoretical analysis we will rely on the statistical approaches that are mathematically sound, and deliver computing significance of neural network based outcomes, evaluated via the Bayesian statistical approach, via clustering algorithms, and via KDE (kernel density estimation) distributions, [3, 2].

Description of work

Task 2.1 (Deliverables: D1)

Title: *Development of Non-invasive Diagnostic Techniques for Frescos*

Lead: ITP Contributors: DEB Start: M1 End: M36

Frescoes, a renowned form of mural art, are delicate and often ancient creations that require meticulous preservation and restoration efforts. Non-invasive diagnostic techniques play a pivotal role in understanding the condition, composition, and underlying issues of frescoes without causing harm to these valuable artworks. Traditional analytical techniques, such as visual examination and manual probing, are often inadequate for unraveling the intricate layers of frescoes. Non-invasive diagnostic methods, including imaging techniques like infrared reflectography (IR) and X-ray radiography, are valuable tools for peering beneath the surface. These techniques can reveal hidden details, underdrawings, alterations, and layers of frescoes without physical intrusion.

Task 2.2 (Deliverables: D1, D2; Milestones: M1)

Title: *Data Sampling and Analysis of Roman Frescos*

Lead: ITV Contributors: DEB, ITP Start: M1 End: M36

Frescoes are typically composed of multiple layers, each serving a unique purpose. Frescoes can undergo significant changes due to environmental factors such as humidity, temperature fluctuations, pollution, and exposure to natural light. These environmental stressors can lead to surface deterioration, including cracks, delamination, and pigment fading. Such alterations further obscure the original composition, making it difficult to decipher the artist's intentions. Restoration efforts, although essential for preserving frescoes, can also introduce complexity. Well-intentioned conservators may apply new layers of plaster, paint, or adhesives to stabilize or repair damaged frescoes. These interventions, while necessary, can complicate the task of identifying and understanding the fresco's original layers and compositions. This task is similar to the Task 2.3. Here, we will collect the samples of Roman frescos from sites in Italy.

Task 2.3 (Deliverables: D1)

Title: *Data Sampling and Analysis of Byzantine Frescos*

Lead: HUM Contributors: DEB, ITP Start: M1 End: M12

Byzantine mosaics are more vibrant, more abstract, adorn walls instead of floors, and feature Christian subjects.

We will collect the samples of frescos from the HUM collection and other in the region to be sent to Team ITP for material characterisation in Task 2.1. We will use the application developed in Task 2.2 to then upload the analysed material property data into the material database. We will also carry out standardisation of material property database

Task 2.4 (Deliverables:)
Title: *Data Sampling and Analysis of Roman Frescos*
Lead: ITV Contributors: DEB, ITP Start: M1 End: M36
Frescoes are typically composed of multiple layers, each serving a unique purpose. Frescoes can undergo significant changes due to environmental factors such as humidity, temperature fluctuations, pollution, and exposure to natural light. These environmental stressors can lead to surface deterioration, including cracks, delamination, and pigment fading. Such alterations further obscure the original composition, making it difficult to decipher the artist's intentions. Restoration efforts, although essential for preserving frescoes, can also introduce complexity. Well-intentioned conservators may apply new layers of plaster, paint, or adhesives to stabilize or repair damaged frescoes. These interventions, while necessary, can complicate the task of identifying and understanding the fresco's original layers and compositions. This task is similar to the Task 2.3. Here, we will collect the samples of Roman frescos from sites in Italy.

Task 2.5 (Deliverables:)
Title: *Development of Algorithms for Scripts of Late Antiquity on Parchment*
Lead: CZP Contributors: DEB Start: M1 End: M32
As with many humanistic fields, the skills paleographers claim to have are drawn into question by statisticians, image processing programmers, etc. This the leverage point of our collaborative efforts. It is important to stress that well-known and reliably attributed manuscripts are needed for training the classifier(s). In the example described here, it would be ancient manuscripts such as P66 (a papyrus 2nd Century CE, now in the Bodmer Library, Geneva, Switzerland) or Codex Vaticanus (a vellum manuscript, 340 CE, now in the Vatican).

Deliverables

- *Deliverable 2.1 D1* Lead: ITP Contributors: DEB Date: M22
  Scientific publication on novel diagnostic techniques. Verification: (1) pdf of manuscript, (2) email from journal acknowledging receipt of the submitted manuscript.

- *Deliverable 2.2 D1* Lead: DEB Contributors: ITP Date: M12
  Internal report submitted to project coordinator. Verification: (1) pdf of report, (2) email approval from project coordinator.

- *Deliverable 2.2 D2* Lead: DEB Contributors: ITP Date: M20
  First version of the portal published for testing. Verification: (1) pdf of report, (2) email approval from project coordinator.

- *Deliverable 2.3 D1* Lead: HUM Contributors: DEB Date: M12
  Data uploaded and internal report submitted to project coordinator. Verification: (1) pdf of report, (2) email approval from project coordinator.

Milestoness

- ♦ *Milestone 2.2 M1* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M22
  Algorithms developed Verification: Minutes of WP1

3.3.3 Description WP3 - Digitalisation of Architecture

Table 3.3b3: WP3

Work Package Number	**WP3**		**Lead Participant:**		**IED**	
Work Package Title	Digitalisation of Architecture					
Participant Number	1	5	5	6	7	9
Participant Short Name	DEB	CZP	CZU	HUM	IED	ITR
Person Months Per Participant	16	48	72	72	34	36
Start Month	**3**		**End Month**		**36**	

Objectives
The aim of this WP is to develop a 3D vision, 3D modelling and digital twinning algorithms and apply them to the digitalisation of small object. The work will be carried out in the following steps: 1. A small object for digitalization will be identified with the help of National Museum of Agriculture, Museum of Amelia, and the

Weingreen Museum. 2. The object will be scanned using the high precision as well as low-precision, low-cost scanning techniques. 3. Different 2D modelling and 3D twinning algorithm will be developed 4. Finally, the application will be demonstrated by carrying out the above steps using the cloud-enabled applications for 3D vision

Description of work

Task 3.1 (Deliverables: D1, D2; Milestones: M1, M2, M3)

Title: *Cloud Integration of Algorithms and Tools for Digital Twinning*

Lead: DEB Contributors: CZP, CZU, IED Start: M10 End: M36

In this task we will integrate the algorithms developed in this WP in the cloud and convert them into clouden-abled tools and interfaces for carrying out further research.

Deliverables

- *Deliverable 3.1 D1* Lead: DEB Contributors: CZU Date: M9
  Website launched Verification: (1) codes with technical manual, (2) email approval from project coordinator.

- *Deliverable 3.1 D2* Lead: DEB Contributors: CZU Date: M9
  Website launched AAA Verification: (1) codes with technical manual, (2) email approval from project coordinator.

- *Deliverable 3.2 D1* Lead: DEB Contributors: CZP Date: M30
  Algrithm developed and supbmitted to project coordinator. Verification: (1) codes with technical manual, (2) email approval from project coordinator.

- *Deliverable 3.3 D1* Lead: DEB Contributors: BEL Date: M32
  Software published and report submitted to project coordinator. Verification: (1) codes with technical manual, (2) email approval from project coordinator.

Milestoness

- ♦ *Milestone 3.1 M1* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M6
  Algorithms developed Verification: Minutes of WP1

- ♦ *Milestone 3.1 M2* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M9
  Algorithms developed Verification: Minutes of WP1

- ♦ *Milestone 3.1 M3* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M12
  Algorithms developed Verification: Minutes of WP1

3.3.4 Description WP4 - Digitalisation of Intangible Heritage

Table 3.3b4: WP4

Work Package Number	**WP4**		**Lead Participant:**		**SKB**	
Work Package Title	Digitalisation of Intangible Heritage					
Participant Number	1	5	5	12		
Participant Short Name	DEB	BAS	CZU	SKB		
Person Months Per Participant	16	54	6	100		
Start Month	**3**		**End Month**		**36**	

Objectives

In this work package we will digitalise intangible cultural heritage using the Eucrite cloud ecosystem tools.

Description of work

Task 4.1 (Deliverables: D1; Milestones: M1)

Title: *Cloud Integration of Intangible Cultural Heritage*

Lead: DEB Contributors: BAS CZU, SKB Start: M1 End: M36

This project will generate a vast amount of data coming from 3 distinct experimental test facilities taking part in this project investigating 3 different aspects at multiple length scales namely (a) material synthesis experiments carried out by MAT, (b) material characterisation experiments carried out by BTU, and (c) process plant testing performed by IEP. In this task we will develop a dynamic map of various data structures. Next, we will contextualize information schema for multidirectional integration of Operations Technology (OT) and Information Technology (IT) exchange also known as Smart Manufacturing in USA or Industry 4.0 in Europe

or Advanced Industrial Strategy in UK that will be secured and easily accessible via online systems through a variety of application programming interfaces. Finally, in this task we will develop various data processing, visualisation and analytic tools.

Task 4.2 (Deliverables:)

Title: *Marian Art in Contemporary Cultural Hyperdulia*

Lead: SKB Contributors: DEB Start: M1 End: M36

In the task, we will explore how the Virgin Mary has successfully become a pivotal figure of not only Catholic and Eastern Orthodox Christianity but also a broadly addressed agent in the Post-communist Europe. The project comes with the innovative hypothesis that the storytelling is central in successful transmission of Marian devotion, but it needs to be tested. By focusing on Marian storytelling, the project aims at clarifying more general processes, i.e. the nature of contemporary processes of (A1) making-the-history; and (A2) making-thereligion. Based on empirical research and exploratory design of the project a (A3) comprehensive theory and methodology will be developed transferable to other research topics and disciplines.

Task 4.3 (Deliverables:)

Title: *Virtual Storytelling of Extinct Bosnian Crafts*

Lead: BAS Contributors: DEB, CZU, SKB Start: M1 End: M36

This task focuses on the digitalisation of the old or extinct Bosnian crafts tradition by exploiting recent advances in AR/VR technologies and further contributing to their preservation. Recently, we developed a virtual museum of the Baščaršija crafts tradition that is facing extinction: četkar (brush maker), kazaz (tailor decorater) and bozadžija (maker of drink called boza) through Virtual Reality (VR) application. This project builds on these ideas to introduce other old or extinct crafts and integrates them in the Eucrite cloud platform ecosystem to extract the benefits of advanced visualization algorithms, integration of latest VR headsets, and develops better more engaging virtual storytelling with integrated innovations in museum aspects. The high immersivity of VR headsets can easily transfer the users into a different place and time, but they need to be offered content that can use the potential of this technology and recreate life in virtual environments. VR video overcomes classical video as a medium and breaks the rules of film language and grammar. As a result users can learn about the historical development of these crafts, get to know meanings of craft names that are not familiar anymore to the general public, and experience the crafts traditions in interactive and engaging VR.

Task 4.4 (Deliverables:)

Title: *Digitalisation of Bohemian Agricultural Heritage*

Lead: CZU Contributors: DEB, BAS SKB Start: M1 End: M36

We aim is to create an Augmented and Virtual Reality story of the unique ancestral wine production practices of the small family owned winery located in Moravia region which otherwise would be forgotten. The story will also cover the oral narratives and local traditions of wine utilization for the purposes of wine-based medicine and local cuisine, the community building aspects of wine production and the role of wine in rural festivals and traditions.

Task 4.5 (Deliverables:)

Title: *Digitalisation of Romani Cultural Heritage*

Lead: SKB Contributors: DEB, BAS Start: M1 End: M36

This task will duplicate aspects of Task 4.3 and 4.4 and reproduce the results in the context of Romani heritage of Slovakia.

Deliverables

- *Deliverable 4.1 D1* Lead: DEB Contributors: SKB Date: M11
  An online software platform with integrated data processing tools Verification: (1) codes with technical manual, (2) email approval from project coordinator.

Milestoness

- ♦ *Milestone 4.1 M1* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M12
  Algorithms developed Verification: Minutes of WP1

3.3.5 Description WP5 - Knowledge Transfer

Objectives

Here we will deliver relevant course materials to impart essential skills that are required for the various stakeholders and target audiences (academic students and staff; institutional stakeholders; government agencies; next

Table 3.3b5: WP5

Work Package Number	**WP5**		**Lead Participant:**		**ITR**	
Work Package Title	Knowledge Transfer					
Participant Number	1	5	5	6	9	12
Participant Short Name	DEB	BAS	CZU	HUM	ITR	SKB
Person Months Per Participant	8	12	32	24	12	12
Start Month	**3**		**End Month**		**36**	

generation artist, scientists and engineers especially girls; and the public at large) considering their different levels of learning abilities to understand the basics of multidisciplinary aspects of cultural art. Towards that aim we will develop the following new curriculum: 1. Bosnian Intangible Heritage 2. Integration of Learning Management System 3. AI for Cultural Heritage 4. 3D Vision and Digital Twinning 5. Digitalisation of Bohemian Agricultural Heritage 6. Digitalisation Policy of Cultural Heritage 7. Curriculum on 3D Modelling and Digital Twinning 8. Cultural and Biblical Antiquities 9. Ethical Dimensions of Cultural Heritage 10. Non-invasive Diagnostic Techniques 11. Art Heritage and Cultural History of Amelia 12. Blockchain for Cultural Heritage 13. Digitalisation of Romani Cultural Heritage 14. Digitalisation of Marian Devotion.

Description of work

Task 5.1 (Deliverables: D1; Milestones: M1)

Title: *Workshop on Novel Diagnostic Techniques*

Lead: DEB Contributors: IEP Start: M30 End: M34

In this task we will deliver a training program for teachers and trainers who will learn to identify and analyse training needs of students. They will also learn to design and develop appropriate learning programs, deliver them and evaluate their effectiveness using the protocols developed in the WP1. Participants of this workshop will gain in depth knowledge of the tools, techniques and software used. This way participants shall holistically understand what goes in creating and delivering a successful training program.

Task 5.2 (Deliverables: D1)

Title: *Workshop Bosnian Cultural Heritage*

Lead: BAS Contributors: DEB Start: M22 End: M34

In this task we will deliver monthly student activities. Efforts of these knowledge transfer activities carried out in this task will be primarily targeted towards young girls and young adults. These activities will involve hands on onsite as well as online training to impart new cognitive skills. In order to engage with the public at large we will also target various school systems in Germany, Poland and the Netherlands.

Task 5.3 (Deliverables: D1)

Title: *Workshop Bohemian Agricultural Heritage*

Lead: CZU Contributors: DEB Start: M22 End: M34

In this task various team meetings will be organised to create the opportunity for knowledge transfer as well as to enhance the creative potential of the project team. Real-life meetings are preferred, nevertheless, hybrid meetings (i.e. partly real-life and online) are also taken into account due to the pandemic experience.

Task 5.4 (Deliverables: D1)

Title: *Workshop on Slovakian Cultural Heritage*

Lead: SKB Contributors: DEB Start: M22 End: M34

This task will host a week long workshop at SKB.

Task 5.5 (Deliverables: D1)

Title: *Workshop on Italian Cultural Heritage*

Lead: ITR Contributors: DEB Start: M22 End: M34

This task will host a week long workshop at ITR and ITV.

Task 5.6 (Deliverables: D1)

Title: *Workshop on Innovations in Exhibitions*

Lead: HUM Contributors: DEB Start: M22 End: M34

This task will host a week long workshop at HUM.

Task 5.7 (Deliverables: D1)

Title: *Workshop on European Cultural Heritage*

Lead: DEB Contributors: CZU, SKB Start: M28 End: M34

This task will host a week long workshop at DEB.

Deliverables

- *Deliverable 5.1 D1* Lead: DEB Contributors: ITP Date: M20
  Workshop report submitted to project coordinator Verification: (1) pdf of report, (2) email approval from project coordinator.
- *Deliverable 5.2 D1* Lead: BAS Contributors: DEB Date: M20
  Workshop report submitted to project coordinator Verification: (1) pdf of report, (2) email approval from project coordinator.
- *Deliverable 5.3 D1* Lead: CZU Contributors: DEB Date: M20
  Workshop report submitted to project coordinator Verification: (1) pdf of report, (2) email approval from project coordinator.
- *Deliverable 5.4 D1* Lead: SKB Contributors: DEB Date: M20
  Workshop report submitted to project coordinator Verification: (1) pdf of report, (2) email approval from project coordinator.
- *Deliverable 5.5 D1* Lead: ITR Contributors: DEB Date: M20
  Workshop report submitted to project coordinator Verification: (1) pdf of report, (2) email approval from project coordinator.
- *Deliverable 5.6 D1* Lead: HUM Contributors: DEB Date: M20
  Workshop report submitted to project coordinator Verification: (1) pdf of report, (2) email approval from project coordinator.
- *Deliverable 5.7 D1* Lead: DEB Contributors: CZU, SKB Date: M20
  Workshop report submitted to project coordinator Verification: (1) pdf of report, (2) email approval from project coordinator.

Milestoness

- ♦ *Milestone 5.1 M1* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M12
  Algorithms developed Verification: Minutes of WP1

3.3.6 Description WP6 - Project Management

Table 3.3b6: WP6

Work Package Number	**WP6**		**Lead Participant:**		**CZU**	
Work Package Title	Project Management					
Participant Number	1	7	7	12		
Participant Short Name	DEB	CZU	IED	SKB		
Person Months Per Participant	36	54	36	36		
Start Month	**1**		**End Month**		**36**	

Objectives

ThisWP will co-ordinate the project with a focus on dissemination, exploitation, internal and external communication, and overall efficient collaboration between work packages to achieve project deliverables and milestones. In addition according to the Figgure 5 and Figure 6 we will manage the project development activities. The new entity called The Eucrite Foundation will be registered and its operation management will be using the organisation structure shown in the Figure 7.

Description of work

Task 6.1 (Deliverables: D1; Milestones: M1)

Title: *Progress Monitoring, Reporting, and Organisation of Events*

Lead: DEB Contributors: CZU, SKB Start: M1 End: M22

In order to co-ordinate collaboration between partners, online and face-to-face meetings, as well as telephonic conversations will be organised. Exchange of knowledge, materials, datasets and results will be ensured to secure project goals on time. The status of work programmes from work packages will be collected and combined in reports. Project progress will be reported to relevant stakeholders at regular intervals including to EU. Organise

dissemination and communication by coordination of joint-publications, patents, presentations, workshops and summer school coordination. This task will ensure a set-up of online platform for the smooth working of various experimental and analytical activities. Reports on the quarterly project progress, status updates, project meetings, exchange with partners, supports, governmental bodies, and supporters. Reports on publications, patent applications, presentations, workshops. etc. will be performed.

Task 6.2 (Deliverables: D1)
Title: *Finance and Operation Management*
Lead: CZU Contributors: DEB Start: M1 End: M22
Team CZU will focus on delivering the objectives stated in this task title.

Task 6.3 (Deliverables:)
Title: *Membership Management*
Lead: SKB Contributors: DEB Start: M1 End: M22
Team SKB will focus on delivering the objectives stated in this task title.

Task 6.4 (Deliverables:)
Title: *Knowledge Management*
Lead: IED Contributors: DEB Start: M1 End: M22
Team IED will focus on delivering the objectives stated in this task title.

Task 6.5 (Deliverables:)
Title: *Technology Management*
Lead: DEB Contributors: BEL, CZU, IED, SKB Start: M1 End: M22
Team DEB will focus on delivering the objectives stated in this task title.

Task 6.6 (Deliverables:)
Title: *Project closure and finalreport*
Lead: DEB Contributors: CZU Start: M1 End: M22
All administrative work will be performed to close the project as per EU regulations.

Deliverables

- *Deliverable 6.1 D1* Lead: DEB Contributors: CZU, SKB Date: M3
  Project progress reports Verification: (1) pdf of report, (2) email acknowledgement from the EU.

- *Deliverable 6.2 D1* Lead: DEB Contributors: CZU, SKB Date: M36
  Annual reports and the final project report to the EU. Verification: (1) pdf of report, (2) email acknowledgement from the EU.

Milestoness

- ♦ *Milestone 6.1 M1* Lead: DEB Contributors: BEL, CZU, IED, SKB Date: M12
  Algorithms developed Verification: Minutes of WP1

References

1. Hale, S. E. *et al. Introducing the EU project ZeroPM: zero pollution of persistent, mobile substances* 2022.
2. Hale, S. E. *et al.* Persistent, mobile and toxic PMT) and very persistent and very mobile (vPvM) substances pose an equivalent level of concern to persistent, bioaccumulative and toxic (PBT) and very persistent and very bioaccumulative (vPvB) substances under REACH. *Environmental Sciences Europe* (2020).
3. Zuccato, E. *et al.* Illicit drugs, a novel group of environmental contaminants. *Water res* (2008).
4. Zurek, M. B. *et al.* Linking scenarios across geographical scales in international environmental assessments. *Technological forecasting and social change* (2007).
5. Kolpin, D. W. *et al.* Pharmaceuticals, hormones, and other organic wastewater contaminants in US streams, 1999- 2000: A national reconnaissance. *Env sci tech* (2002).

Table 3.3c: List of Deliverables

Deliverable	Work Package Title	WP	Lead	Type	Level	In Months
3.3 D1	Software published and report submitted to project coordinator.	WP3	DEB	OTHER	PU	32
1.4 D2	Scholarly publication on context-aware recommendation system.	WP1	BEL	R	PU	14
1.4 D1	Scholarly publication on technology enhanced learning.	WP1	BEL	R	PU	13
5.5 D1	Workshop report submitted to project coordinator	WP5	ITR	DEM	PU	20
1.1 D2	Scholarly publication on the architecture of the infrastructure.	WP1	DEB	R	PU	12
1.3 D1	Technical report on Blockchain security submitted to project coordinator.	WP1	RSB	R	PU	12
6.1 D1	Project progress reports	WP6	DEB	R	SEN	3
4.1 D1	An online software platform with integrated data processing tools	WP4	DEB	OTHER	SEN	11
3.1 D1	Website launched	WP3	DEB	DEC	PU	9
3.1 D2	Website launched AAA	WP3	DEB	DEC	PU	9
2.3 D1	Data uploaded and internal report submitted to project coordinator.	WP2	HUM	DATA	PU	12
2.2 D1	Internal report submitted to project coordinator.	WP2	DEB	R	SEN	12
3.2 D1	Algrithm developed and supbmitted to project coordinator.	WP3	DEB	OTHER	SEN	30
2.1 D1	Scientific publication on novel diagnostic techniques.	WP2	ITP	R	PU	22
5.2 D1	Workshop report submitted to project coordinator	WP5	BAS	DEM	PU	20
2.2 D2	First version of the portal published for testing.	WP2	DEB	DEC	PU	20
5.1 D1	Workshop report submitted to project coordinator	WP5	DEB	DEM	PU	20
5.4 D1	Workshop report submitted to project coordinator	WP5	SKB	DEM	PU	20
1.2 D1	Technical report on informatics tool submitted to project coordinator.	WP1	SKB	R	PU	12
5.3 D1	Workshop report submitted to project coordinator	WP5	CZU	DEM	PU	20
1.1 D1	Technical report on cloud ecosystem submitted to project coordinator.	WP1	DEB	R	PU	12
5.7 D1	Workshop report submitted to project coordinator	WP5	DEB	DEM	PU	20
5.6 D1	Workshop report submitted to project coordinator	WP5	HUM	DEM	PU	20
6.2 D1	Annual reports and the final project report to the EU.	WP6	DEB	R	SEN	36

Table 3.3d: List of Milestones

Milestone	Title	Related WPs	In Months	Verification
1.1 M1	Portal Published	WP1	6	Minutes of WP1
1.1 M2	Sofware developed	WP1	6	Minutes of WP1
3.1 M2	Algorithms developed	WP3	9	Minutes of WP1
3.1 M3	Algorithms developed	WP3	12	Minutes of WP1
4.1 M1	Algorithms developed	WP4	12	Minutes of WP1
5.1 M1	Algorithms developed	WP5	12	Minutes of WP1
6.1 M1	Algorithms developed	WP6	12	Minutes of WP1
2.2 M1	Algorithms developed	WP2	22	Minutes of WP1
3.1 M1	Algorithms developed	WP3	6	Minutes of WP1

Table 3.3e: List of Critical Risks

Risk Description	Likelihood/Severity	Related WPs	Proposed Risk-Mitigation Measures
Work programme is suboptimal	Low/Medium	WP1-WP2	Literature will be studied thoroughly
Delay in software delivery	Low/Medium	WP2	Crowdsourcing model adopted
Poor financial control	Low/Low	WP1-WP4	Expert Admin/finance staff will be involved
Findings of risk assessments	Low/Medium	WP1-WP4	Any changes required will be notified to the EU

Table 3.3f: Summary of Staff Efforts

	WP1	WP2	WP3	WP4	WP5	WP6	Participant Person Months
01. DEB	16	16	16	16	8	36	108
02. BAS				54	12		66
03. BEL	114						114
04. CZP		96	48				144
05. CZU	96		72	6	32	54	260
06. HUM		48	72		24		144
07. IED	62		34			36	132
08. ITP		36					36
09. ITR			36		12		48
10. ITV		72					72
11. RSB	108						108
12. SKB	68			100	12	36	216
Total Efforts	464	268	278	176	100	162	**1448**

Table 3.3f2: Justification of Staff Efforts

Resource	Task Assigned/Months	Months
01. DEB	1.1/19, 3.1/26, 4.1/35, 5.1/4, 5.7/6, 6.1/21, 6.5/21, 6.6/21	153
02. BAS	4.3/35, 5.2/12	47
03. BEL	1.4/35	35
04. CZP	2.5/31	31
05. CZU	4.4/35, 5.3/12, 6.2/21	68
06. HUM	2.3/11, 5.6/12	23
07. IED	6.4/21	21
08. ITP	2.1/35	35
09. ITR	5.5/12	12
10. ITV	2.2/35, 2.4/35	70
11. RSB	1.3/35	35
12. SKB	1.2/35, 4.2/35, 4.5/35, 5.4/12, 6.3/21	138
	Total Person Months	**668**

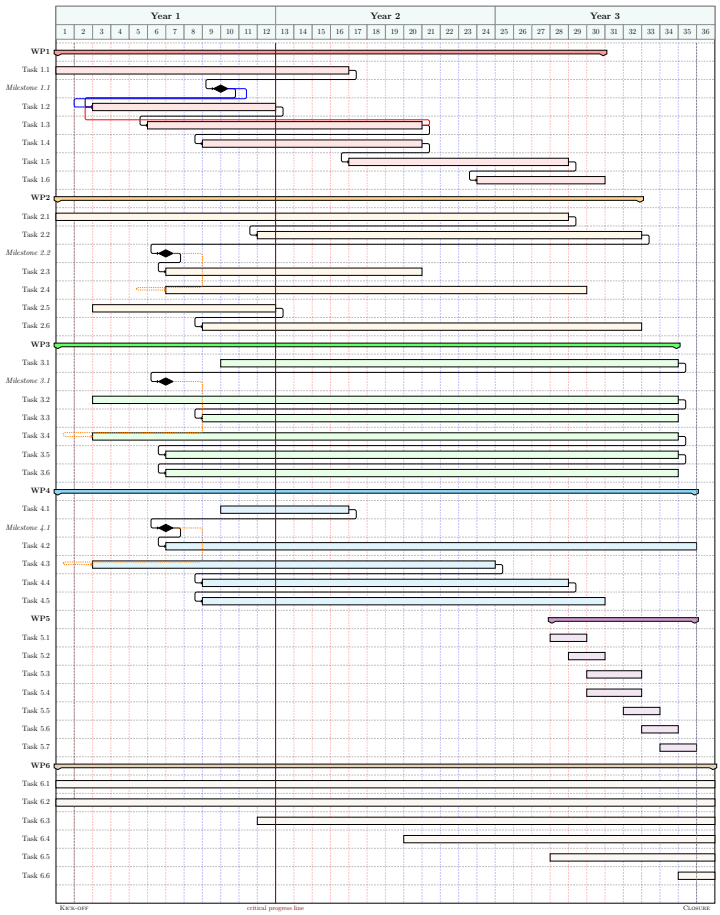

Figure 1: Project Gantt chart.