Project Number: [739503]

Project Acronym: [E-RIHS PP]

Project title: [European Research Infrastructure for Heritage Science Preparatory Phase]

Periodic Technical Report

Part B

Period covered by the report: from [01/08/2018] to [30/09/2020]
Periodic report: [2nd and final]

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1. **Explanation of the work carried out by the beneficiaries and Overview of the progress**

The activities of the **Preparatory Phase of the European Research Infrastructure for Heritage Science, E-RIHS PP**, were completed as planned and the objectives of the project were achieved.

1.1. Objectives and Deliverables

E-RIHS PP worked for preparing the establishment of a unique European research infrastructure for Heritage Science. It was decided by the project consortium at the kick-off meeting to submit the **proposal for E-RIHS ERIC** (European Research Infrastructure Consortium), thus, along with the planned deliverables, the base documents for the application of the Step 1 submission were also prepared, and precisely: the Statutes, the Scientific and Technical Description and the Financial Annex. For this latter, a specific Costbook was derived from the Financial Plan.

The two major objectives of E-RIHS PP in view of its mission were:

A. to develop a sound business case, including a sustainable financial plan, for implementing an inclusive E-RIHS ERIC with the support of as many as possible founders from Member States and Associated Countries, addressing all the issues highlighted by ESFRI in their evaluation report of 2016;
B. to produce a strong implementation plan for the E-RIHS ERIC.

Objective A was achieved as described in D11.1, the **E-RIHS ERIC Business Plan** version 1.0.
Objective B was achieved as described in D11.2, the **E-RIHS ERIC Implementation Plan** version 1.0.

Other specific objectives were to:

1. design a suitable governance including the roles of National Hubs and the relationship between E-RIHS Central Hub and National Hubs. This was achieved and is described in deliverables D2.1 and D2.4;
2. develop E-RIHS statutes (deliverable D4.2);
3. develop an access policy and user strategy and a central system for applying for (and granting of) access and services (deliverables 5.1 and D8.1);
4. define common data policies and procedures for data management (deliverables D3.3, D5.2 and D5.3);
5. define common open-access policies to data and publications (deliverables D4.4 and D5.3);
6. define a sound policy for human resource acquisition and management (deliverable D3.2);
7. implement a strong communication and advocacy plan to help collecting stable financial commitments from all potential partners (deliverables D6.1, D6.4 and D10.1);
8. develop investment strategies based on gap analyses of existing capabilities and on a common strategic vision of the sector (deliverables D8.1, D8.3, D9.1, D9.2, D9.3 and D9.4);
9. draw up a comprehensive risk analysis and risk mitigation strategy for E-RIHS (D2.5);
10. develop a quality management system with adequate monitoring capacities and efficient KPIs (D2.2);
11. develop synergies with other ESFRI RIs and EU relevant initiatives and with e-infrastructures (D6.3);
12. promote the inclusion of scholars and of new communities of users (D8.3);
13. provide a training plan and training policies for E-RIHS (D7.1 and D7.2).

1.2. Overview of the activities

The activities of the third period of E-RIHS PP span from 2018, August 1st to 2020, September 30th (M19-M44), comprising the granted extension of eight months to the original planned schedule.
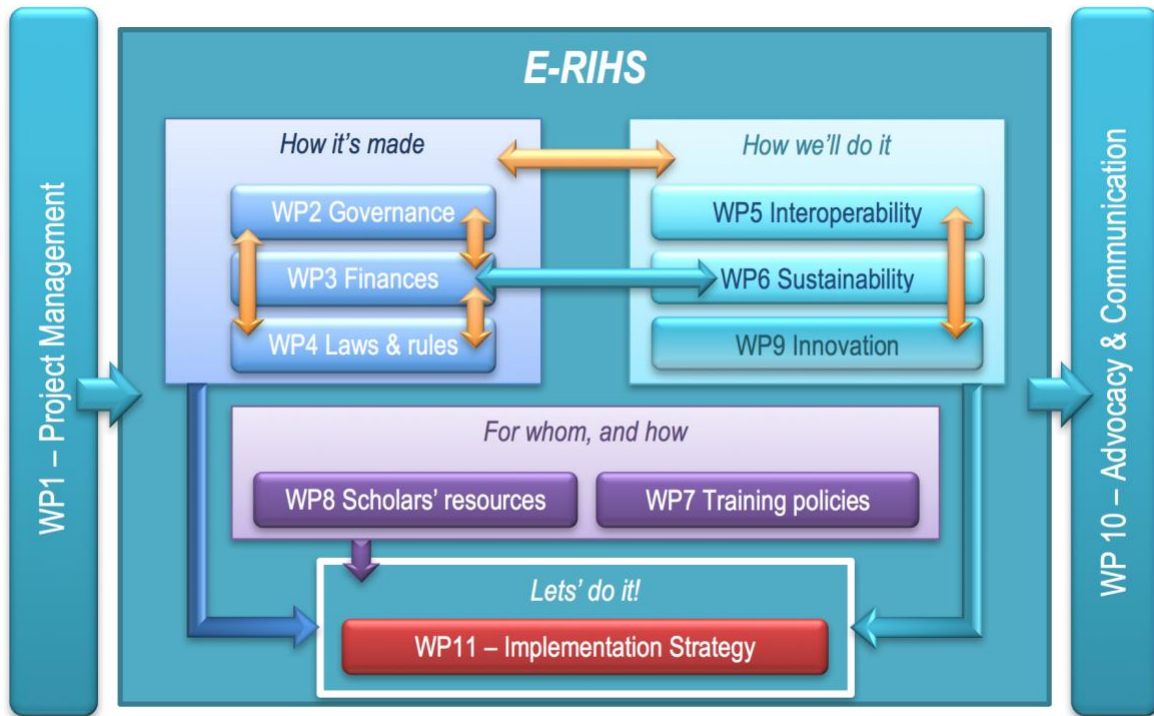
Figure 1: E-RIHS PP Work Packages and their relationships

Concerning the establishment of E-RIHS ERIC, which is the core mission of E-RIHS PP, the most relevant success of the project has been, in December 2019, the establishment of **the interim General Assembly (iGA)** of E-RIHS ERIC. The iGA was created upon the initiative of the Italian Ministry of Research following the experience of the **Stakeholders Advisory Board (SAB)**, created by the E-RIHS PP project as an advisory group to review the preparatory documents and to maintain contacts with the potential founding members of the ERIC. According to its Terms of Reference, the iGA is a group of governmental representatives supporting the submission of the Step 1 proposal for E-RIHS to be established as an ERIC. Seventeen potential founding countries of E-RIHS joined (as of today) the iGA by appointing to it national ministry-level delegates. The Intergovernmental Organisation ICCROM joined the iGA too, being a potential founding member or permanent observer of E-RIHS ERIC. Since its creation, the iGA started periodic meetings to **discuss, negotiate and adopt** the base documents needed to apply for Step 1 for E-RIHS ERIC. As such, it clearly superseded the SAB of the project, where such documents were only discussed. The SAB activities were then discontinued.

At the time of the writing of this report, the iGA is still negotiating the conditions to submit the Step 1 application for E-RIHS ERIC.

Another outstanding success of E-RIHS was being cited in the Paris declaration of the Ministries of Culture (2019, May 3rd).

Finally, E-RIHS was confirmed in the ESFRI Roadmap 2021 after successfully passing the monitoring evaluation (June 2020).

The **40 Tasks** of E-RIHS PP, assembled into 11 WPs (*see Figure 1*), produced **36 deliverables** describing E-RIHS ERIC structure, operation and policies. The deliverables were elaborated through an open and wide international discussion. The 36 E-RIHS PP deliverables propose agreed solutions to all the remarks made by ESFRI in the Recommendations to E-RIHS after its acceptance to the Roadmap 2016. Those recommendations were carefully considered in designing E-RIHS PP and as a result we can now use the project outcomes as answers to ESFRI's concerns about E-RIHS, as shown in the following Table 1.

ESFRI recommendations (2016)	Project results
E-RIHS must clarify how it, as an integrated distributed pan-European RI, will **add value** over and above being a network of facilities and centres with a transnational access programme	The outcomes of E-RIHS PP clearly demonstrate that this added value can be achieved by the **establishment of E-RIHS ERIC** (see the D.6.1 Cost Benefit Analysis and socioeconomic impact assessment)
To explore the **socio-economic impact** of E-RIHS	Done, see D6.1
Absence of a good **business plan**	The E-RIHS ERIC Business Plans is now existing, see D11.1
To develop a sound **financial plan**	Done, see D3.1 and D3.4
To develop a **common data policy**	Well on the way to it, see deliverables D3.3, D5.2 and D5.3
To secure more **financial support**	Starting with 2 in 2016, the number of potential founding members joining the iGA is now 17
To develop the **statutes** as soon as possible	Done, see D4.2
To draw up a comprehensive **risk analysis** and mitigation strategy	Done, see D2.3 and D2.5
To deliver on the promise made for an interdisciplinary project design that will **include humanities and social sciences**	E-RIHS preserved its original inclusiveness. WP8 was devoted to open ways to new communities. An **inclusive definition of Heritage Science** was developed by the project community and uploaded on Wikipedia.
ERIHS will need to deliver these formal documents: the **user access policy**, the **cost book**, **management structure**, **data policy**, **human resource policy**	Done. The relevant deliverables are D5.1 for access, D2.1 and D2.4 for the structure, D5.3for the data policy and D3.2 for HR policy. The Costbook is not a separate deliverable but it is included in D11.1, the business plan.

Table 1 – Project results against the ESFRI recommendations of 2016

The **success of E-RIHS PP** was certified by the final report of the reviewer, which claims that "*Project has fully achieved its objectives and milestones*" and *"Project has delivered exceptional results with significant immediate or potential impact (even if not all objectives mentioned in the Annex 1 to the GA were achieved)."*

Anyway, the project activities were not spared **critical points and delays**, starting from the 8-month extension obtained by the EC, justified by: "*the number of Countries interested in joining E-RIHS that jumped to 29 Countries, doubling the initial number of partners in the preparatory phase (16). This wide interest is of course to be considered as a success, but it also brings the need to achieve a wider alignment between potential founding members on the status and requirements of the ERIHS ERIC application. Indeed, we currently have 29 National Delegations attending the E-RIHS meetings, with 4 added in the last 6 months. Many Countries in this group are showing a keen interest and a sound potential as founding Members*".

Most unfortunately, the first weeks of the project extension period – started in 2020 February 1st – brutally coincided with the outburst of the COVID-19 emergency, which in the end caused further delays to the ERIC negotiations as face-to-face meetings are impossible since then. The emergency situation precluded, in particular:

- to have regular face-to-face negotiations between the governmental delegates in the interim General Assembly of E-RIHS ERIC
- to continue face-to-face discussions between the partners since the last project interim meeting (Évora, January 2020).
- to hold a face-to-face final review meeting
- to organise a face-to-face final event as it was scheduled.

More delays to the original schedule of were caused, in this final period, by the close interaction of the project with the ministry representatives of the potential founding members, first in the SAB and then (now) in the iGA. As the joint elaboration of the key deliverables (on structures and policies) were coming to an end within the project community, the intergovernmental discussion around (some of) them intensified. Issues were thus left open where agreements on them were yet to be sought, and some of those issues are still open, as the iGA negotiation is still ongoing.
As an initial approach, most of the deliverables were postponed, giving time to the negotiations on them to develop. In the end, the project community decided to deliver the results of the internal discussion as "state-of-the-art snapshots". All the E-RIHS PP deliverables thus included the disclaimer: "*This document reflects the state of advancement of preparatory work reached within the E-RIHS PP consortium at the time of its delivery. As such, its content may be subjected to further evolution*".

1.3. Final performance indicators (KPI)

The project delivered a proposal of KPIs for E-RIHS ERIC (in D2.2) but KPIs were also used in E-RIHS PP. it is interesting to confront the outcomes of the project against its expectations, written in the project proposal in 2016. Table 2 gives a summary of these relevant KPIs.

It is clear from the failure of the first three (to be monitored at M24) that the consortium expected an easier path to E-RIHS ERIC: none of those base documents were approved by the SAB, and actually they still have to be adopted by the iGA.

The fourth was labeled "Countries signing the MoU" as that was the foreseen approach to founding members. The consortium expected to join these members by having them individually signing a Memorandum of Understanding possibly preceded by and a letter of interest. Nothing like this happened, as it was decided to directly found the iGA. By changing the scopes of the two deliverables, we note that the project expectations were pessimistic: 17 countries (instead of 3) formally reached the stage of **potential founding members**.

Also, the number of **established national nodes** (now participating to the IPERION HS Integrating Activity) boosted to 20 (plus additional 4 in the Americas) almost doubling the expectations.

KPI	Applied to…	Unit of measure	Possible target value(s)	Outcomes
Objectives 1 and 2 achieved (see section 1.1.1)	WP2 and WP4	Statutes approved by SAB at M24	Y/N	N
Objective 3 achieved	WP5	Access policy approved by SAB at M24	Y/N	N
Objective 4 achieved	WP3	Data policy approved by SAB at M24	Y/N	N
Countries joining the iGA (*was: Countries signing the MoU*)	Whole project	Number at M44	>= 3	17
National Hubs formally instituted	Whole project	Number at M44	>= 12	20
Countries joining the iGA *(was: Countries sending letter of interest for E-RIHS including those already received)*	Whole project	Number at M36	>16	17
Global outreach and interest	Whole project	Number of non-EU countries interested to participate in E-RIHS by M36	>10	9
Cooperation agreements signed with ESFRI RIs, e-infrastructures and other EU initiatives	WP6	Number by M44	>5	3
Dissemination intensity	WP10	Number of EU countries represented at E-RIHS events by M44	>18	19

Table 2 – E-RIHS PP results vs. performance indicators

The **global outreach** did not produce the expected number (even if it nearly did), but in at least 3 cases there is now more than simple interest in E-RIHS, as formal E-RIHS hubs (as the one in Brazil) were established.

About the **cooperation**, there were less formalized bilateral agreements than expected, also due to the lack of a formal identity for E-RIHS, but very important ones were signed: a statement of cooperation with ICCROM and a joined declaration with the JPI CH. In place of more formal agreements, E-RIHS is cooperating in EU project consortia with all the ERICs in the social sciences and humanities (in the cluster SSHOC), in the EU project RESINFRA LAC for international cooperation between RIs, in the EHRI PP, in the EGI-ACE project. Informal cooperation is ongoing with CERIC ERIC, DISSCo, DARIAH and with the Time Machine Organisation.

Finally, concerning the **dissemination intensity** the target was achieved, and considering the non-EU countries the final number reached 29 participants to E-RIHS events.

1.4. Explanation of the work carried per WP

1.4.1. Work Package 1 – Project Management

WP leader: CNR – *Luca Pezzati*
Work carried out and achievements
The activities of WP1 during the last reporting period were in line with the planned work. The management structure proved to be effective: all the bodies established (the **Governing Board**, the **Steering Committee**, the **Stakeholder Advisory Board** and the **Coordination Office**) were functional to the development of the project activities and to the efficient management of the project. All the project bodies operated in a smooth and coordinated way thanks to the intense activities of the Coordination Office, which continuously supported all the partners in their financial, organizational, reporting and communication activities and updated the E-RIHS PP website and its social media profiles. As said before, a Zenodo community for E-RIHS was created and the public deliverables were uploaded therein.

T1.1 Establishment and operation of the project management bodies
Task leader: CNR – *Luca Pezzati*
Task 1.1 was focused on establishing a robust project management structure. All the project bodies were established as scheduled and their management was secured by the Coordination Office.

Ten project meetings were organized in the period, of which two were virtual due to the pandemic, and the milestone MS12 (Final meeting) was achieved according to (the new) schedule. Details related to the meetings in the period are described in the following table:

Meeting	Date	Organized by	Place
5th Interim	2018/09/05	NCU	Warsaw, PL
6th Interim	2018/10/19	CNR	Florence, IT
Mid-term Review	2018/12/12	KIK-IRPA	Brussels, BE
2nd Annual	2019/02/19	CSIC	Madrid, ES
7th Interim	2019/04/10	RWTH	Aachen, DE
8th Interim	2019/09/11	UCL	London, UK
NCC meeting	2019/10/24	C2RMF	Paris, FR
9th Interim	2020/01/28	UEVORA	Evora, PT
Final meeting	2020/09/22	CNR	Florence, IT and virtual
Final review	2020/09/25	CNR	virtual

Table 3 – List of the project meetings

During the 5th interim meeting one further project body, as foreseen in the GA at WP11, was established with the scope of helping the activities in WP11 by sharing the responsibility of T11.1 and T11.2 with the Project Coordinator. This body was named the **E-RIHS Interim Governance**, composed of an Interim **Executive Board** and an Interim **Access Board**. The selection of members to these two bodies were completed during the 2nd annual meeting. After completing its work, the E-RIHS interim Governance was discontinued on September 30th 2020, at the formal end of E-RIHS PP.

T1.2 (Project monitoring and reporting)
Task leader: CNR – *Laura Benassi*
T1.2 was devoted to the management of daily activities from a technical and financial point of view. Under the supervision of the project coordinator (PC) and the SC, the CO took care of all the relevant aspects of the project and monitored its state and progresses. T1.2 secured the management of the internal communication between the management bodies and the partners. To facilitate the flow of communication, specific tools for internal communication were used (D4science, Basecamp, Zoom).
T1.2 also timely managed all the project reporting.

T1.3 (Quality control of deliverables)
Task leader: CNR – *Jana Striova*
T1.3 took care of the quality of the deliverables by encompassing both the administrative aspects and the quality of their content. In the first 18 months, few (4) deliverables were submitted slightly late.
In general, no relevant problems about the quality arose.

Criticalities
As previously said, the project required an extension of 8 months, which was duly asked to the EC in October 2019 and entered in force on November 11th.
Following the amendment, almost all the project deliverables not yet delivered were postponed. Most of these were timely delivered. A few still carried significant delays due to the ongoing discussion at the interim GA. Two were severely delayed due to misfortunate events concerning severe illness of the responsible, in one case (D11.2), and unexpected death of the responsible in the other (D4.4). Finally, those latter were both completed and submitted within the month of November 2020.

      1.4.2.   Work package 2 – Governance

WP leader: RCE – *Jan van't Hof*
Led by Jan van't Hof (*Dutch Cultural Heritage Agency*), the WP2 provides the basis for E-RIHS structure, together with WP3 on finances and WP4 on legal work.
WP 2 is divided in four tasks, of which the governance structure is the first. Task 2.1 describes the Governance Structure of E-RIHS ERIC, task 2.2 is about Governance and roles of central and national hubs, task 2.3 is about Quality Systems and KPI's, task 2.4 is about Risk Management. The deliverables are stated below.
The work done in WP2, together with WP3 and WP4, feeds directly into the next episode of E-RIHS, since the deliverables are already used by E-RIHS' interim General Assembly for the step 1 submission; they can also be of use for the Committee of National Nodes, which will be the linking pin between E-RIHS' central structure and the scientific communities per country.

D2.1 Governance structure - The governance structure was written by Jan van 't Hof in collaboration with Marjolijn Weterings and Rémi Petitcol. It describes the future governance structure of E-RIHS ERIC and the roles and tasks of different bodies of E-RIHS ERIC and the decision-making procedures they follow. The deliverable D2.1 intends to show the management structure of E-RIHS ERIC and

how it is designed to provide good representation to all stakeholders while fulfilling its scientific objectives.

The description of the Governance Structure of E-RIHS ERIC is based on the draft Statutes of E-RIHS ERIC (provided by Isabelle Pallot-Frossard in WP4), the draft Scientific & Technical Description and the draft Access Policy (WP5). These documents were used to describe the bodies of E-RIHS ERIC, their roles, their functioning, and their links in between. They were all drafted jointly with WP2 members. More detailed aspects of the procedures of these governance bodies will be laid out in the Rules of Procedure that are being drafted in WP4. This governance structure was elaborated with due consideration to the European legal and strategic framework related to ERICs. Statutes of existing ERICs were used as inspiration.

The governance in the transition phase is structured with an interim Governing Board and an interim General Assembly based upon a decided upon Terms of Reference that regulates amongst other things the voting rights. Maintaining the cohesion created by the Preparatory Phase and funding and securing the needed expertise might be a challenge.

D2.2 E-RIHS quality manual and KPIs was written by João-Manuel Mimoso with contributions from Franco Nicolucci, Costanza Milliani, Jan van 't Hof, Luca Pezzati and Hilde De Clercq. The deliverable describes the quality system proposed to be adopted by E-RIHS for the quality assessment of prospective new partners and their services and the quality audit of existing E-RIHS partners and their services. It also outlines the process to grant external organizations, services, projects and proposals the affiliation to E-RIHS, or its support. All such procedures are based on a modular operation: the evaluation of the candidate's internal processes, of its scientific excellence and the quality of its services and eventual suitability for E-RIHS.
Extra attention is needed for finetuning of the KPI's, which is done among other things in the Scientifical and Technical Description. The recommendations of the report dated December 2019, of the ESFRI working group on monitoring of research infrastructures performance need to be considered.

D2.3 Risk management framework - The Risk management framework was written by Clive Billenness with contributions from professor Janet Anderson, Jan van't Hof and Marjolijn Weterings. For the scope of E-RIHS ERIC, it is necessary to establish an Enterprise-Wide Risk Management Framework (ERM) to design, implement, monitor and improve risk management consistently and efficiently across all aspects of E-RIHS activities using quantitative and qualitative measures in a way which is compatible with existing Risk Management arrangements within partner institutions.
This Framework has been created by reference to the Best Practice contained in ISO standards and is designed to be compatible with and capable of integration with existing Risk Management procedures and regulations already in place within partner organisations. It takes account of national health and safety regulations as well as the EU General Data Protection Regulation 2016/679 and any local considerations arising from local Freedom of Information legislation.
The Framework addresses practical Risk Management from the perspectives of the different levels of the hierarchical Research Infrastructure (International, National and Individual) as well as from the perspectives of risks inherent within specific artefacts and defined preservation procedures. The overall objective is to create a consistent approach to risk management which enables all participants to share and learn from others' experience. The Framework also considers Opportunity Management as a positive aspect of Risk Management.

The Framework will be developed into a full Corporate Risk Management Function (D2.5) as part of the creation of the overall Corporate Governance Function within WP2.

The next step is adjusting the framework to specific E-RIHS needs. A major action will be to appoint a risk management officer, to guarantee risk management during E-RIHS' lifecycle.

D2.4 Governance of central and national hubs - The Governance of central and national hubs was written by Isabelle Pallot-Frossard and Rémi Petitcol with contributions from Jana Striova, Polona Ropret, Matija Strlic and Wolfgang Schmidle.

The relationship between the central European level of governance and the National Nodes (previously referred in the project to as "Hubs") is crucial, as E-RIHS will provide integrating access to research facilities and expertise currently scattered throughout Europe.

This deliverable describes the complete interaction and decision-making processes of the infrastructure and the National Nodes with the interactions between the two.

The allocation of competences and the accountability framework were designed to abide by the subsidiarity principle, according to which issues should be dealt with at the most immediate or local level that is consistent with their resolution. This means that the National Nodes will deal with most issues directly involving the facilities and national matters, whereas European, strategic and cross-cutting issues will be dealt with at the European level.

The European level is organised in three main bodies: the General Assembly for the decision-making on statutes, finances and appointing the Director-General, the Central Hub (the Director-General and the Head Office) for the implementation of the decisions and the running of the infrastructure, and the Committee of National Nodes for the coordination and the oversight of the National Nodes.

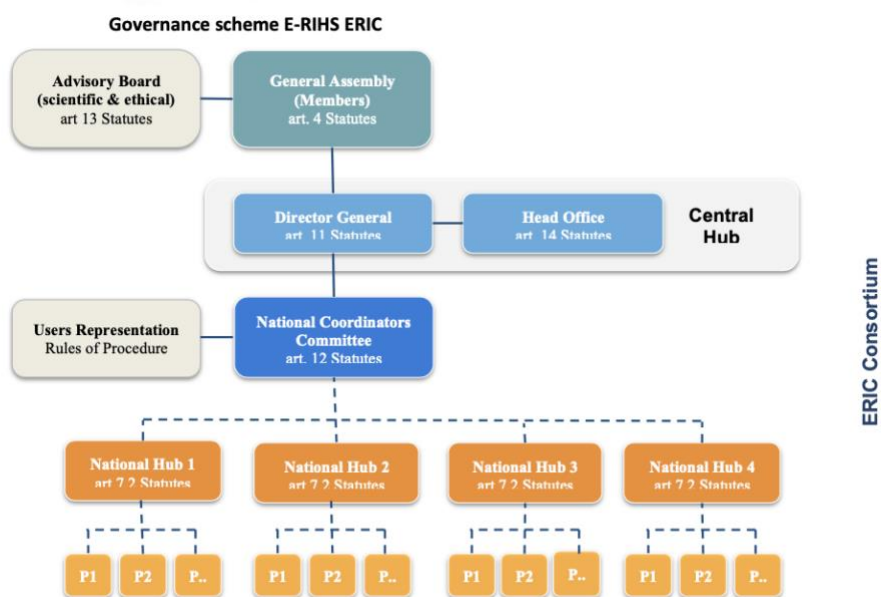*Figure 2: Governance scheme of ERIC ERIC (as described in D2.1 – Jan. 2020)*

D2.5 Corporate Risk management function - Corporate Risk management function was written by Clive Billenness with contributions from Siobhan O'Dowd and Jan van't Hof.

This document is integrated with the above-mentioned Risk Management Framework (D2.3). It defines the Risk Management Function by setting out the Risk Management Policy under which the

Central Hub of E-RIHS will be operated. It also provides a model which is suitable for adoption by any other regional hub or individual member organisation within E-RIHS.

The Policy specifies how E-RIHS will promote Risk Management with other member organisations throughout the entire ERIC. The Policy defines the criteria which will be used for measuring Probability, Impact and Proximity of Risk.

1.4.3. Work package 3 – Financial Planning

WP leader: LNEC – *Joao Mimoso*
State of the work and problems met
Work was carried to the satisfaction of the WP Leader and delays incurred in the development of Task 3.2 (Human Resources strategic planning) were corrected by the Task Leaders.

All deliverables were submitted to the Coordinator's office in due time, before the deadline.

There are no particular problems to mention. However, two notes follow.

Within Task 3.1 (Finance and budget) it was sought to deliver a final table of cash contributions expected from the future Members of the ERIC. Several proposals were submitted by the Task Leader to the Stakeholders Advisory Board (SAB) which always returned an appraisal of being too expensive. However, the same SAB considered most of the individual budget items reasonable (the opposition concentrated on the costs with human resources) and was undecided on what should be excluded, so as to cut costs. A possible offer of personnel in-kind by partner organizations met with a comment that a negative foreseeable consequence would be that such personnel would primarily depend on their employer and not of the ERIC management. In the end the deliverable contained the final proposed table, still open for future negotiation.

Task 3.3 (Financial aspects of data policy and management) aimed also to identify possible manners to make the digital database of the ERIC (DIGILAB) partially auto-sufficient in a manner compatible with the FAIR principles. The most promising manner (revenue through promotional exploitation of the site) does not seem financially viable in this field, at least initially.

Achievements by Task
Task 3.1 (Finance and Budget)
Task leader: LNEC – *Joao Mimoso*
- Financial model for E-RIHS, following the original proposal positively evaluated by ESFRI;
- Guiding principles for the financial sustainability and future management of E-RIHS ERIC;
- Enumeration of externally-funded potential activities together with their funding sources;
- Funding models at partner level and at the central hub level;
- Costbook- developed by a consultant based on original work under this Task;
- Proposed table of cash contributions expected from partners;
- Proposal of the hosting fee by the host country.

Task 3.2 (Human Resources strategic planning)
Task leader: DARIAH – *Mike Mertens*
- List of all key roles in the future E-RIHS ERIC associated with responsibilities and required skills;
- Analysis of the different forms of employment in existing ERICs and recommendations of those best suited to the needs of E-RIHS;

- Design of a fair and transparent recruitment process tailored to the specifics of E-RIHS;
- Analysis of remuneration models and levels in multiple research and European organizations and recommendation of a salary and benefit policy for future E-RIHS ERIC employees;
- Conception of an evaluation grid to collect information needed to build a sustainable human resources policy: training needs, career development, improve communication between management and staff, etc.;
- Development of strategies for creating motivation and engagement among staff members (autonomy, transparency, mobility, etc.);
- Identification of possible risks likely to have a negative impact on the human resources policy and provision of a risk mitigation strategy.
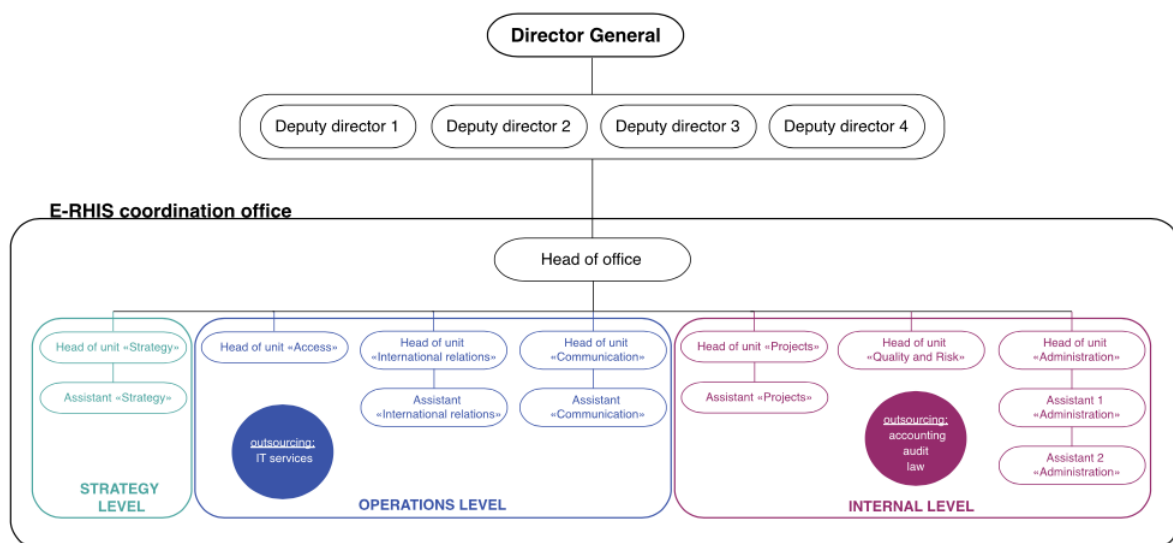
Figure 3: Organisational chart of E-RIHS (D3.2 – Jan. 2020)

Task 3.3 (Financial aspects of data policy and management)
Task leader: UCL – *Holly Wright*
- Assessment of how organisations and institutions in heritage science across Europe understand the types of funding / costing models available, the state of the current landscape with regard to funding / costing models across the sector, and how participation in E-RIHS can contribute to Open Data, ending with specific recommendations;
- Recommendation that eventual development of a primary repository for E-RIHS data should be approached with care, and will likely require at least € 200,000.00 of initial annual financial investment;
- Recommendation that funding be directed towards the creation of a metadata aggregation infrastructure, supporting data providers with curation of their data within own chosen repositories, made discoverable within DIGILAB. Data is best preserved within national and regional responsibilities and expertise, and there are difficulties with data preserved outside national borders.
- Recommendation to begin with implementation of the aggregation infrastructure, assess impediments for participation encountered by data providers. If capacity building support

insufficient, and/or orphan data may be lost, a primary repository should be explored and additional funding sought.

Task 3.4 (In-kind contribution (IKC): evaluation and accounting strategy)
Task leader: CERIC – *Andrea Santelli / Ornela De Giacomo*
- Proposal of a methodology for evaluating and accounting IKCs aiming to provide a consistent and formal representation of the activities performed (including the IKCs) in the annual accounts of the ERIC including:
  i. identification of the types of IKCs (goods, services, right to use assets – access costs);
  ii. definition and adoption of the criteria for the IKCs evaluation;
  iii. definition of the processes and provision of tools to plan/collect and represent the IKCs within the annual accounts.

Deliverables submitted in the period
D3.1 Preliminary Financial Plan
D3.2 Human resources policy
D3.3 Data management policy
D3.4 Financial plan for implementation
D3.5. Scenarios for in-kind contributions and criteria for their evaluation.

1.4.4. Work package 4 – Legal Work

WP leader: CNRS – *Isabelle Pallot-Frossard*
State of the work carried out
The aim of this Work Package was to prepare a set of necessary documents for the submission of a request to the European Commission for E-RIHS to become an ERIC, and for the optimal functioning of the research infrastructure. This means that the end goal of the work carried out within this WP lies beyond the Preparatory Phase of E-RIHS. Our objective of producing documents that will be directly useful to E-RIHS ERIC required our work to reflect to the fullest extent possible the state of the discussion carried out both within E-RIHS PP and at the stakeholders (usually ministerial) level. This collaboration between the scientific community represented within the consortium and the stakeholders' community represented within the Stakeholders Advisory Board (SAB) and in the E-RIHS interim General Assembly (iGA). In practice, this collaboration was structured around frequent meetings. In this reporting period, the meetings were WP4 work was discussed were:

- 3rd SAB meeting (Warsaw, 7th September 2018): statutes and MoU
- 4th SAB meeting (Brussels, 13th December 2018): statutes
- 5th SAB meeting (Madrid, 22nd January 2019): statutes
- 6th SAB meeting (London, 13th September 2019): statutes
- 1st iGA meeting (remote meeting, 17th March 2020): statutes
- 2nd iGA meeting (remote meeting, 8th May 2020): statutes
- 1st iGA "Statutes Working Group" meeting (remote meeting, 12th June 2020)
- 3rd iGA meeting (remote meeting, 24th June 2020): statutes
- 4th iGA meeting (remote meeting, 2nd September 2020): statutes

Figure 4: SAB members (2018)

The meeting listed above only include formal discussions of the WP4 documents. Many other meetings took place either during E-RIHS plenary sessions or remotely by phone or videoconferencing. Apart from the Intellectual Property Management Plan, all the documents produced within WP4 were directly or indirectly discussed and applied the following workflow:

- Preliminary study of other comparable documents and when possible discussion with experts from the studied infrastructures or people who contributed to building such infrastructures or international organisation.
- Presentation of the structure and of the driving ideas of the documents to WP4 members and other relevant persons involved in E-RIHS PP either through plenary or dedicated meeting.
- Creation of a new draft and discussion of its key elements in both plenary and SAB meetings.
- Implementation of the comments and suggestions. When no clear consensus was reach on a certain point, the authors proposed a way forward a lead the discussion in subsequent meetings.
- After a variable number of meetings (few for the MoU, several for the statutes and thus for also for the RoP), the authors drafted a final version of the deliverable and submitted them after a final round of comments from WP4 members.

The case of the Intellectual Property Management Plan was a bit different. Although it followed the same participative spirit, partners from outside WP4 were not directly involved in drafting the document. The driving ideas behind the documents were presented and in discussed twice in E-RIHS PP plenary meetings (Warsaw 2018 and Evora 2020), but the drafting of the document was restricted to fewer people to keep a more operative form. This distinction between the deliverable was made on the basis of the expected nature and use of the documents: while the MoU, the Statutes, and the RoP serve a regulatory purpose and thus must be understood and agreed upon by all, the IPR Management Plan is targeted to the future operators of E-RIHS ERIC. It must be directly useful to instruct and guide the future personnel and other people involved in the operational phase of the ERIC.

Problems

The main problem that we had to face in implementing the objectives of WP4 was due to the very deep interconnection of WP4 documents with other documents within and outside E-RIHS PP and with both the scientific and political discussions around Heritage Science in general and E-RIHS in particular. Reaching consensus in a rapidly growing consortium of countries with well-established cultural and scientific traditions requires a constant attention to the needs and the interests of the scientific community and their national stakeholders.

In particular, some key terms required lengthy discussion and cross work packages actions to be defined and understood in a common way. The delays of both D4.3 and D4.4 can partly explained by a need to fine-tune the documents in order to better reflect the evolution of the scientific and institutional consensus expressed in numerous forums. Although the scientific strategy and remit of E-RIHS is now much clearer, some detailed points of discussion remain open at the end of E-RIHS PP and will require the E-RIHS iGA to reach a final consensus.

Another problem that we could identify during both reporting periods relates to punctual misunderstandings due to the regulatory nature of the documents compared to other scientific documents. Legal drafting sometimes implies that a word does not convey the same meaning as in the scientific or common manner of speak. Regulatory documents translate into rules the driving ideas of the other documents of E-RIHS PP, and this translation sometimes prevents complete semantic alignment between all deliverables. Although this problem could be solved many times by discussion, it was difficult to prevent the apparition of these misunderstanding in the first place.

The last problem was due to personal health issues of a key participant of the Work Package. This caused some delay in the advancement of the work, but the partner eventually carried out the work in line with the WP4 objectives through supplementary efforts.

Achievements

The achievements of this work package also relate to the main problem encountered during this work. Because of the evolving nature of both the E-RIHS partnership and of the content of its planned activities, WP4 had to constantly adapt, react and overcome problems in order to forge consensus. Although there is no definite consensus on every topic covered by the E-RIHS PP and the documents produced in WP4, a stable consensus was achieved about the remit of the infrastructure, its governing structure and the detailed accountability relationship between its bodies, and several other topics that were not previously discussed and agreed upon.

The fact that the documents prepared in WP4 and in other E-RIHS PP Work Packages were used as a base for discussion in the E-RIHS iGA and in other instances is a remarkable achievement. The fact the E-RIHS iGA requested the personal implication of key WP4 personnel in drafting the final version of the documents also indicates that the work carried out in WP4 was well received by national stakeholders and that the legacy of E-RIHS PP will be well included into the Step 1 submission to become an ERIC.

1.4.5. Work package 5 – Access and Interoperability Policies

WP leader: PIN – *Franco Niccolucci*
State of the work

WP5 was in charge of defining the integrated service offer and the corresponding policies to be adopted by E-RIHS concerning access, integration and interoperability. It was also in charge to investigate and develop collaborations with other projects and infrastructures and follow closely the development of the EOSC.

The WP results were in line with such plans and the objectives were overall achieved.
The detailed description of the activities and of the results follows.

Task 5.1 - User strategy and access policies
Task Leader: CNRS – *Claire Pacheco*
The Task had to define the policies to be adopted for access to E-RIHS physical and virtual research facilities, i.e. its four LABs individually considered in the four subtasks. The results were reported in D5.1.
The access policy chosen includes two different modes according to the physical or virtual nature of the facilities involved.
The first one deals with the access to physical platforms such as E-RIHS ARCHLAB, E-RIHS FIXLAB and E-RIHS MOLAB. In this case access is "Excellence-driven", i.e. based on the scientific quality of the access project proposed by the user and its feasibility. The evaluation procedure is based on a peer reviewing process conducted by external experts assessing the scientific quality, while a local technical committee assesses the overall feasibility of the research proposal.
The second mode, "Wide access" concerns online access to digital tools and digital heritage research resources accessible via E-RIHS DIGILAB. This mode complies with the principles of open science, providing access to data as open as possible, but as closed as necessary. Its implementation will be defined more precisely when DIGILAB will be made available.
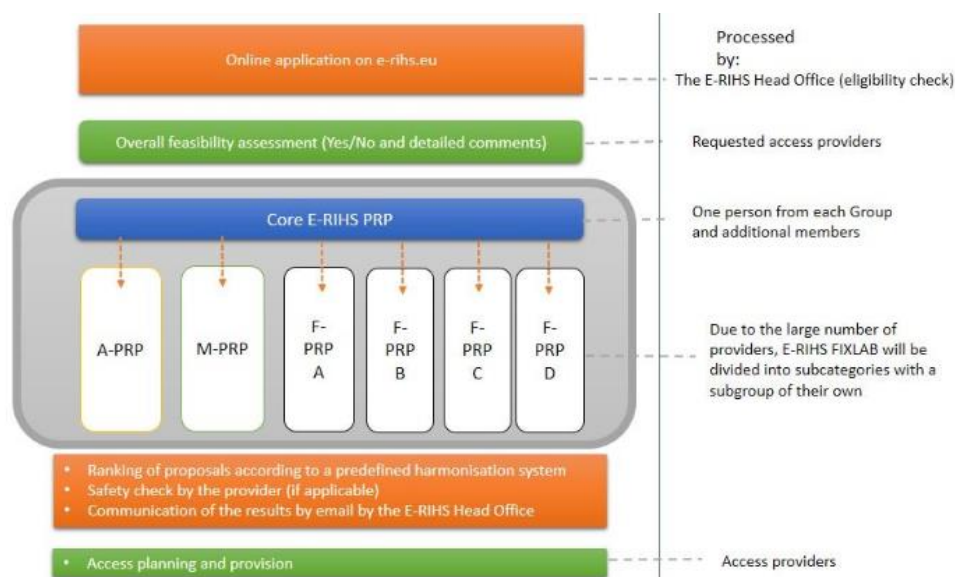
Figure 5: E-RIHS access: proposal flowchart (D5.1 – Jan 2020)

Task 5.2 - Complementarity and integration of E-RIHS
Task leader: NG – *Marika Spring*
The task identified partners' complementarity, competencies and expertise between/across the four platforms (ARCHLAB, DIGILAB, FIXLAB, MOLAB) but also within them, considering instrumentation, scientific expertise and experience, or specialization in specific cultural heritage applications. This analysis enabled E-RIHS to define strategic measures to ensure the match between user proposals and access providers.
The results were used both in Task 5.1 and Task 5.3, and they were reported in the respective deliverables.

Task 5.3 Standardization and interoperability

Task leader: DAI – *Wolfgang Schmidle*

The task addressed the standardization of procedures and the definition of common and shared metadata and data schemas. The two aspects were analyzed separately in two subtasks. The outcome was reported in D5.2.

It resulted that standardization of experimental procedures mostly relies on scientific good practices that are common – in practice – to all the laboratories involved, and on the comparability of instrumental results. This subject is expected to be further analyzed by the common quality system established under E-RIHS and through the use of common reference materials and the implementation of round-robins.

As concerns data interoperability, it appeared to be necessary the creation of a typology and map of data and metadata standards, also including data and metadata mapping. A survey was carried out on the current developments in Europe, comparing initiatives about the establishment of conceptual models, controlled vocabularies and data management systems. This will eventually pave the way for the definition of a similar system for DIGILAB:

Task 5.4 Data curation

Task leader: UCL – *Holly Wright*

T5.4 concerned data curation for heritage science, defining policies for – among others – data quality assurance, the data life-cycle, data management and preservation and supporting such policies with guidelines for researchers. The results were included into D5.3.

The work reviewed the issues concerning data curation for heritage science, in order to provide the required policy framework to be implemented by E-RIHS. It moreover addressed a wider framework, to be of use to all those with interests in data within the heritage science domain. The global structure of such policies follows the structure of the FAIR principles (Findable, Accessible, Interoperable and Re-usable), interpreting them in the context of heritage science. Such results indicated the necessity of ensuring the long-term preservation and increased re-use of heritage science data within broader European frameworks. Among other recommendations, all reported in the deliverable, the usage of a Data Management Plan is recognized as a necessary completion of research activities and must therefore be required as a condition of support for their usage of an E-RIHS facility.

Task 5.5 Synergies with RDA, EOSC and e-infrastructures

Task leader: PIN – *Franco Niccolucci*

The Task was in charge of monitoring and liaising with activities in the overall European (and global) open data panorama, with a particular attention to the collaboration and harmonization with the RDA (Research Data Alliance) and the EOSC (European Open Science Cloud) initiatives, in order to exploit synergies and avoid divergent solutions to similar problems. The Task results were summarized in D5.4.

As regards RDA, liaising took place with a kick-off workshop at the 2017 RDA plenary and then focused on the active participation in the GEDE (Group of European Data Experts, https://www.rd-alliance.org/groups/gede-group-european-data-experts-rda) RDA working group.

As regards EOSC, the liaison was supported by the presence of some E-RIHS partners as key partners in EOSC-related projects. Other partners were in charge of specific tasks within such projects and had therefore the opportunity of evidencing the importance of EOSC for heritage science.

A dedicated workshop aimed to bring together experts from complementary domains to discuss what core services should be provided within EOSC to facilitate collaborative research activities and to identify the services that e-Infrastructures should make available to support them.

1.4.6. Work package 6 - Sustainability

WP leader: ITAM – *Milos Drdácky*

State of the work

In the relevant period all relevant parties - ITAM, CNR, KIK-IRPA, DAI, CSIC, CNRS, FORTH, DP, RCE, NCU, LNEC, IPCHS, UCL – cooperated on the work package tasks in various forms from a more focused work on the deliverables to softer discussion contributions. The given milestones were successfully achieved under the CNR supervision and all four planned deliverables of the WP6 have been finished and submitted to the project results´ depository. They were shortly introduced and discussed during the final project meeting which was very well organized by the CNR in the hard Covid situation. ITAM served as the WP leader. The achieved results are briefly reported in the next paragraphs.

The Deliverable 6.2 "Sustainability document for the business plan" presented as a confidential report was delivered in January 31, 2019. (The report was prepared mainly by ITAM (LP), KIK IRPA and LNEC). Because E-RIHS represents a RIs for research which has no straightforward industrial applications, the generally identified sustainability issues have been studied in the report from the point of view of the vision and mission of the E-RIHS. As a best practice example, the business plan for the European Marine Biological Resource Centre (EMBRIC) has been studied in detail and its structure exploited for the final recommendations. Further, the international outreach of E-RIHS was reflected in its plan for achievement sustainable pan-European coverage through inclusion of Central and East European countries, Baltic states and Scandinavia where new centres of excellence are emerging due to European structural funds (ERDF) and specific national funding possibilities.

The Deliverable 6.3 restricted report on "Strategy related to the integration of E-RIHS in EU funding instruments and JPI" was issued in August 21, 2019. (The report was prepared mainly by KIK IRPA (LP) and ITAM). This deliverable identifies and reviews EC funding and financial instruments supporting the implementation and operation E-RIHS. Synergies between H2020-Horizon Europe, European Structural and Investment Funds and E-RIHS, as well as between Joint Programming Initiative Cultural Heritage and Global Change, H2020, ESIF and E-RIHS were analysed. They offer potentialities contributing to the long- term sustainability of E-RIHS as a research infrastructure on one hand and to the fostering of Heritage Science research and innovation in general on the other hand. As examples of synergy possibilities let us mention e.g. stimulating the use of E-RIHS services within JPI CH projects or launching calls that are open for research projects aiming the development or improvement of facilities that might be integrated into E-RIHS.

The confidential report of the Deliverable 6.4 "Sustainability plan for E-RIHS implementation" was prepared mainly by CNR and delivered in September 2020. The present deliverable considers seven interrelated conditions that enable RIs to be sustainable over the entire RI life-cycle, which have been outlined in the EC Staff Working Document on Research Infrastructures Long-Term Sustainability (SWD (2017) 323 final). It is focused on the sustainability of E-RIHS during its transition

and implementation phases (2020-2026). It builds upon the other deliverables of the E-RIHS PP, the planned activities of the project IPERION HS, taking into account the monitoring remarks of the reviewers of the 2020 ESFRI monitoring and the recommendations of the High-Level Expert Group appointed by EC-DG RTD to assess the progress of ESFRI and other world class research infrastructure towards implementation and long- term sustainability.

The most important Deliverable 6.1 "Cost Benefit Analysis and socioeconomic impact assessment" was delivered as a public report in the month 36. The two analysis of this task have been outsourced and, following a public tender, the procurer organization was Centre for Industrial Studies (CSIL), located in Milano, Italy. CNR and ITAM prepared the public tender and contributed to this deliverable. This report presents results of the ex-ante impact assessment of E-RIHS ERIC by discussing the expected direct and indirect impacts in three different scenarios of development – the pessimistic, baseline and optimistic. It also discusses the conditions and mechanisms for impact materialization. This report aims at providing decision making support tool for E-RIHS managers, funding agencies and all stake holders involved in its set-up and implementation. The methodology combines a cost-benefit analysis (CBA) aiming at quantifying direct impacts through the estimation of a willingness to pay of potential users and a qualitative discussion of wider long-term impacts.
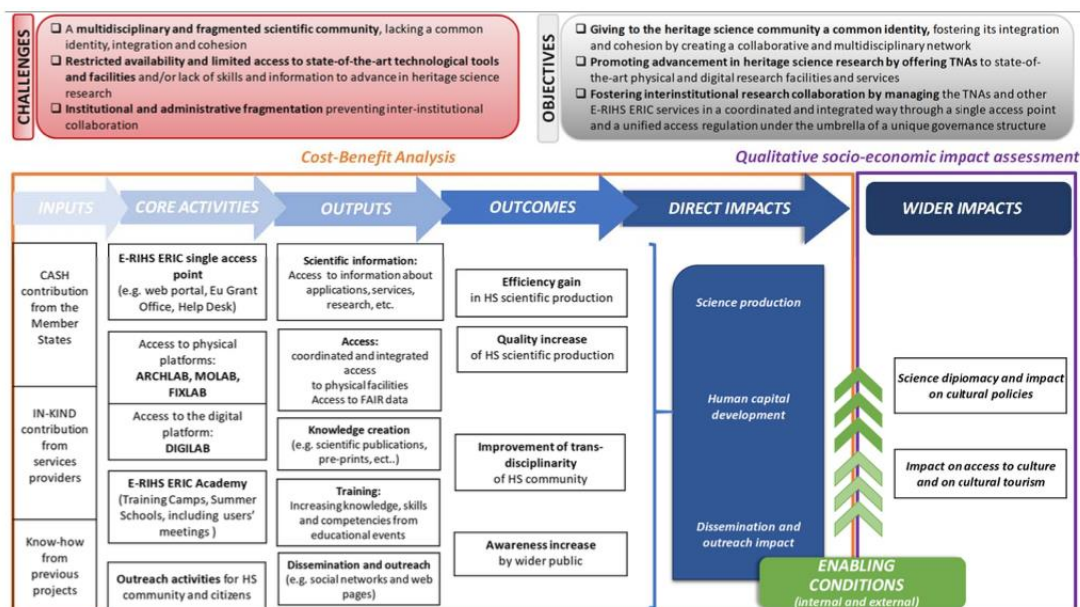

Figure 6: E-RIHS ERIC CBA and socio-economic impact evaluation logic model (D6.1)

The conclusions show that, as expected for any research infrastructure, the main field of impact is related to the science production. 92% of the total quantified impacts, for a total of EUR 65,9 million in present terms (2017 prices) in the baseline scenario, relate to an increased efficiency in the science production in the heritage science community, i.e. for the E-RIHS target users. Being this research community an emerging, multi-disciplinary and currently rather fragmented, a unique point of access facilitating and coordinating Trans National Access (TNA) to technologies, data and skills of excellent quality is expected to improve the efficiency (in terms of time saved) and effectiveness (better quality) of the research production in heritage science and related domains.

Furthermore, the activities of E-RIHS ERIC have the potential to achieve wider socioeconomic impacts. They include, for example: science diplomacy and impact on cultural policies or impact on access to culture and on cultural tourism.

Two conditions are key for success - the number of users at the steady state and the degree of coordination and integration (added value) of services provided. The last point has been discussed during the final project meeting from the point of view of its indicator. It is believed that the added value indicator will naturally emerge from the ratio of the number of the raised demands to the number of satisfied clients.

1.4.7. Work package 7 – E-RIHS Academy

WP leader: UCL – *Matija Strlic*
State of the work
The offer of interdisciplinary training as well as engagement is a crucial component of any research infrastructure and domain in general. Heritage science skills development requires training and delivery channels that can ensure optimum use of available resources for training and strengthen capacity of those responsible for their use and management within the European Research Infrastructure for Heritage Science.

Within WP7, we have cross-referenced our work with other E-RIHS internal strategies and external evidence. The key guiding influence was the E-RIHS Scientific Vision and its priority areas and core values, in particular the emphasis on competencies, responsible and ethical research, and excellence. The training offer of the E-RIHS Academy will reflect these values, supporting cross-disciplinarity, co-creation, ethics, communication, innovation, complementarity, interoperability and quality user experience.

The second shaping factor is the current training needs, identified in the E-RIHS Academy research report, produced as Task 7.1 deliverable. This insight, along with a review of future skill needs in the heritage context, raises important questions about how to develop a future-proof, cross-disciplinary and supportive training ecosystem. Much of this strategy, and the delivery channels in particular, are a response to the E-RIHS needs assessment.

A significant undertaking of WP7 as a whole was the inclusive process that led to the definition of the term 'heritage science', as is now enshrined in E-RIHS documents: "Heritage science is the interdisciplinary domain of scientific study of heritage. Heritage science draws on diverse humanities, sciences and engineering disciplines. It focuses on enhancing the understanding, care and sustainable use of heritage so it can enrich people's lives, both today and in the future. Heritage science is an umbrella term encompassing all forms of scientific enquiry into human works and the combined works of nature and humans, of value to people." This definition is now also part of the Wikipedia Heritage Science page.

Task 7.1 Assessment of education and training needs
Task leader: IPCHS – *Polonca Ropret*
The Task has been successfully completed and the Deliverable D7.1 has already been reported on.

Task 7.2 User-focussed training and Task 7.3 Training of E-RIHS personnel
Task leader*: ITAM – Michal Vopalnesky²,* Task leader*: UCL / NTU – Haida Liang*
To showcase the best practices in cross-disciplinary training of users as well as of providers of E-RIHS access, a pilot workshop was organised at Nottingham Trent University on 28th/29th March 2019. The aim of this workshop was to bring together those engaged in the study of heritage from different backgrounds (e.g. historians, curators, archaeologists, conservators and heritage scientist)

to illustrate how science can address a wide range of research questions related to a variety of heritage objects and to foster interdisciplinary collaboration between the participants.

The objectives of the workshop were:

- To present a 'dialogue' between the Art & Humanities' research questions and the response using scientific analysis;
- To present how a range of analytical methods can assist the investigation of materials composition to inform art history/history, provenance, conservation strategy and storage needs of archaeological, archival and museum objects;
- To offer the opportunity to see in practice how the scientific analysis of various types of artworks is performed;
- To provide a deeper understanding of both the principles of operation and the benefits of the use of a series of analytical techniques that a mobile lab, like the ISAAC Mobile Lab, can offer through the examination of various types of cultural heritage objects;
- To provide an opportunity to experience interdisciplinary collaborative research;
- To inform the future training strategy for users and providers of E-RIHS facilities.

The workshop discussions and outcomes informed the development of the E-RIHS Training Strategy.
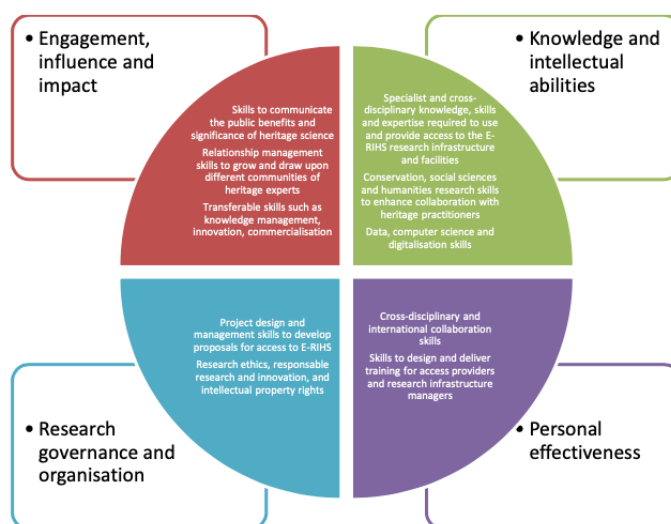

Figure 7: E-RIHS Training Needs (D7.2 - Mar. 2020)

Task 7.4 Education and Training outreach: E-RIHS Academy
Task leader: UCL – *Matija Strlic*
To develop the key outcome of this Task, an E-RIHS Academy Workshop was organised on 14 January 2019 In Windsor, UK, to discuss the core heritage science skills and future needs. The agenda of the workshop consisted of two moderated sessions: Horizon scanning for future skills development, and Developing an E-RIHS Academy alumni network and create engagement of the alumni in the way that add value. The workshop was attended by 23 participants and the outcomes were written up as a report that fed into the development of the E-RIHS Training Strategy.

The Deliverable 7.2, the E-RIHS Training Strategy, consists of the following elements:

- The context in which the strategy has been shaped
- The key strategic objectives for E-RIHS educational and training activities

- A framework strategic approach to guide E-RIHS decision-making about establishing or reinforcing appropriate training activities and programmes at international, and national levels of the E-RIHS community
- A training offer, designed in accord with the strategic approach, and in response to the particular education and training needs identified by the assessment presented in the E-RIHS Education and Training Needs report (Deliverable 7.1)
- Resource and material requirements for realisation of the overall objectives of the E-RIHS Education and Training Strategy
- Indicators against which progress in realising will be measured.

The Strategy has defined measures of success around the following objectives:
1. Identify and promote a set of core skills necessary to deliver E-RIHS excellence
2. Embed continuous learning across E-RIHS and drive the development of future-proof skills in a complex, rapidly changing research field
3. Build around E-RIHS a competency-based Heritage Science Network
4. Ensure that the E-RIHS community has access to state-of-the-art training opportunities through diverse delivery methods
5. Create a culture of cross-disciplinary heritage science research and leadership.

Based on the experience gained, and the developed strategy, WP7 also produced two training videos. A pilot training video was produced jointly with the project Parthenos, on the technical topic of "Digital Humanities and Heritage Science Research Infrastructures: New Approaches to the Study of Pre-Modern Manuscripts". The video specifically guides trainees to recognise the complexity involved in the study of pre-modern manuscripts and the specific challenges connected with their analysis and develops an understanding of how Digital Humanities and Heritage Science Research Infrastructures can contribute to the examination of pre-modern manuscripts
The training is available at https://training.parthenos-project.eu/sample-page/digital-humanities-research-questions-and-methods/dh-and-heritage-science-research-infrastructures/ and the training video is available at the following link: https://youtu.be/ISlHohIQlXc. In the frame of WP7, this activity was coordinated by Haida Liang, NTU.
E-RIHS PP also developed its first own training module on the topic of "Creating an Effective Collaborative Research Environment".
The purpose of this module is to learn about collaborative research in heritage science - research carried out in collaboration between research-intensive organisations, such as academia or research institutes, and practice-led organisations, such as heritage organisations and other public bodies, policy making organisations or the general public. The module looks at the hindrances to collaborative research and how to overcome them, how to design a collaborative proposal that has the optimal options to succeed and how to take personal motivations and institutional strategies into account. A few foremost experts in the field of heritage science research and the E-RIHS training team guide the trainee through the process.
This training video is suitable for anyone embarking on the development of a collaborative research project, or those wishing to improve the management of complex interdisciplinary collaborative consortia. It may also be useful for funders as they design or monitor collaborative research projects.
The video was produced with the collaboration of Nancy Bell (NARA, USA), Cecilia Bembibre (UCL), Loic Bertrand (Universite Paris Saclay), Costanza Miliani (CNR), Polonca Ropret (IPCHS) and Matija Strlic (UCL). It is available at the link: https://www.youtube.com/watch?v=T2V8rWi-7F4.

1.4.8. Work package 8 – E-RIHS services for Heritage Science scholars

WP leader: CENIEH – *Mohamed Sahnouni*
State of the work
WP8 deals with services to be provided to Heritage Science Scholars within the future European Infrastructures for Heritage Science, E-RIHS. The main objectives of WP8 include: a) widening the scope of E-RIHS service provision to new communities, b) involving relevant and complementary service providers, c) designing new services to fill the prioritized gaps, and d) running feasibility studies on new cross-community services ensuring highest efficiency for beneficiaries. Three main tasks are assigned to achieve these WP8 objectives.

Task 8.1 Services for new communities of users
Task leader: CENIEH - Mohamed Sahnouni
The purpose of this task has been to expand the service portfolio of the future E-RIHS ERIC with the objective of widening coverage of services for all Heritage Science communities. For this end, an inventory of the services, that each E-RIHS PP member country could offer to the future E-RIHS ERIC, has been prepared. It has been taken in consideration that its content may be suject to change based on the future E-RIHS quality standard and the final participating countries. These new services are integrated into FIXLAB, MOLAB and ARCHLAB platforms and concern the disciplines of Paleoanthropology, Paleontology, Prehistoric Archaeology and the related Social Sciences and Humanities, which were hardly present in the previous infrastructures.

To obtain the list of potential services data has been collected from several sources of information including: i) an in-depth study of the paleoanthropology community and its potential services, ii) exploration of IPERION CH and IPERION HS catalogues of services, and E-RIHS PP national nodes websites, iii) survey of services possibly provided by E-RIHS partners, and iv) an analysis of FIXLAB platform users demand.

The achievements made can be seen in the evolution of the Heritage Science provision of services to different categories of users' communities as a function of past (IPERION CH), present (IPERION HS) projects and the possible projection of services towards E-RIHS ERIC. From the survey emerged that: i) the future E-RIHS ERIC ARCHLAB could enable access to repositories at least in 10 European countries through the 21 providers compared to the 14 providers currently offering its collections on IPERION HS or the 10 providers that offered its archives on IPERION CH; ii) the future E-RIHS ERIC FIXLAB could enable access to fixed laboratories in at least 15 countries through the 56 providers, compared to the 23 providers of IPERION HS and the 4 providers of IPERION CH; and iii) the future E-RIHS ERIC MOLAB could enable access to mobile laboratories in at least 12 countries through the 39 providers compared to the 18 providers of IPERION HS and the 9 providers of IPERION CH.

The main difficulty encountered while working on this task has been the high number of techniques and services to be managed, especially on the FIXLAB platform. However, this problem has been solved thanks to the organization of these techniques by the type of service and the collaboration of all the partners, especially the E-RIHS coordination office.

Task 8.2 Feasibility studies
Task leader: PIN – Franco Niccolucci
Feasibility studies has addressed how to develop new services. Such feasibility studies concern potential new services selected to answer the common needs and integration of HS communities. In this task small feasibility studies have addressed the viability of such services. These studies have

addressed interoperability and cross-discipline applicability, mostly based on current best practices without involving any additional research.

8.2.1 – Multilevel analysis: Identification, Digitisation and Reconstruction. Leader: FORTH – Participants: ATOMKI (EK); FORTH (OF_ADC); CENIEH; CNRS (IPANEMA); IPCHS; UCL (NTU). This multidisciplinary Paleoanthropological and Bioarchaeological feasibility study concerned the design of an integrated pipeline involving different analytical techniques (e.g. Isotope, aDNA, Proteomics, Tomography, etc.) and their combination with advanced IT methods (e.g. 3D modelling) and the management of a combined repository.

8.2.2 – Universal chronology service. Leader: CENIEH – Participants: ATOMKI; CNR (+INFN); CNRS; UCL (+SUERC). The feasibility study addressed the creation of a universal chronology service, comprising all relevant techniques used to date heritage (e.g. C14, luminescence, paleomagnetism). A 'one-stop shop' service helping to choose the most appropriate technique, laboratory and sampling. Users include museums, government and heritage-related organizations, art historians, archaeologists. A joint research program will be designed on the technique applicability, protocol homogenisation, training, etc.

8.2.3 – Workflow in Digital Archaeology and Analytical Methods. Leader: CYI – Participants: ATOMKI (HNM); CENIEH; DAI; DP; IAA; KIK-IRPA; UCL (NTU). The feasibility study concerned the analysis and the design of the pipeline from field data documentation to site/artefact analysis, and how this process is recorded, performed and shared in a common knowledge repository while integrating analytical and digital methods.

8.2.4 – Reference collections. Leader: RCE – Participants: ATOMKI (EK; HNM); CNR; FORTH; IPCHS; LNEC (+HERC); PIN; UCL. The feasibility study investigated how such collections may be mass-produced (RCE) and/or virtualised (PIN), to offer different scientific communities an easier availability of such important research tools and of guidelines for their use, contacting various scientific communities to analyse their needs.

8.2.5 – Integration of scientific data with general heritage documentation. Leader: PIN – Participants: ATOMKI (HNM); CNRS; FORTH; IPCHS; KIK-IRPA; RCE; UCL (+NG; SUERC). The study analysed current best practices and designed an integrated system where researchers can discover and use all the information concerning the subject of their study, regardless of its scientific or humanities origin.

8.2.6 – Advanced materials for restoration. Leader: CNR (CSGI) – Participants: CNR; CNRS (+C2RMF); DAI (RRL); FORTH; IPCHS; KIK- IRPA; LNEC (+HERC); UCL (NG). The feasibility study analysed new solutions for the conservation, and the design of an integrated pipeline involving different analytical tools and innovative materials for the definition of the best conservation procedures to ensure the best practice and maximum efficiency for the beneficiary community.

Task 8.3 Catalogue of E-RIHS resources and services
Task leader: CNR – Carlo Meghini
The Task T8.3 "concerns the design, creation and maintenance of an online catalogue of resources and services provided by E- RIHS". Research Infrastructures (RI) provide broader access to services supporting communities of researchers in scientific discovery and collaboration across disciplinary and geographical boundaries. A catalogue provides a logical organization of services used to answer the research community's needs. A RI catalogue is used to navigate and access the content of the RI (taking into account the access policies of the items and organizations) and to search (keyword and faceted) and browse (by tag, organization, group, type) facilities.

Given the preparatory nature of the E-RIHS PP project, the activity of the Task has mainly been centered around an investigation on the relevant issues. In particular, the E-RIHS catalogue is based

on a conceptual model that gives an account of the resources that are of interest to a digital Infrastructure such as the one that the E-RIHS PP project is setting up. Such resources include datasets and services, but also people, organizations, instruments, and other entities. Developing such conceptual model has been therefore a prerequisite to the creation of the Catalogue. Therefore, this conceptual model was implemented as a Relational Database Management System (RDBMS).

1. Creation of the E-RIHS Conceptual Model. In order to create the E-RIHS PP conceptual model, CNR surveyed the most important initiatives in the fields of the Heritage Science and the Humanities that have addressed, and solved, the problem of providing a Catalogue of their domain. These initiatives are: (i) The Integrated Platform for the European Research Infrastructure On Cultural Heritage (IPERION CH) project; (ii) The Advanced Research Infrastructure for Archaeological Dataset Networking in Europe (ARIADNE) project; (iii) the National Heritage Science Forum Kit-Catalogue produced by the National Heritage Science Forum; (iv) The Pooling Activities, Resources and Tools for Heritage E-research Networking, Optimization and Synergies (PARTHENOS) project; (v) the study "A CIDOC CRM-based Model for the Documentation of Heritage Sciences" that introduces an approach to the documentation of scientific data produced in heritage sciences interdisciplinary research. The objective of this investigation is twofold: (1) to collect the requirements in an implicit way, that is by looking at the solutions developed to meet these requirements, and (2) to study the solutions devised in order to reuse them as much as possible to create the E-RIHS PP catalogue. After examining the above initiatives, we have concluded that the work of PARTHENOS, and in particular the PEM, is the one that best fits the present E-RIHS PP catalogue purposes. Note that the services provided by the E-RIHS infrastructure are a larger set than the ones taken into account by PARTHENOS. Consequently, the PEM was significantly extended to fit the E-RIHS representational requirements.

2. Creation of the E-RIHS Catalogue Database. The E-RIHS conceptual model, has been analyzed and mapped in a relational schema. The mapping has been made following the classical mapping approach: entities have been implemented as tables with attributes and keys, relationships have been mapped according their cardinalities as tables or using foreign keys. The obtained schema has been implemented as a SQL script (composed of SQL Data Definition Language statements), the script has been run in the MySQL runtime environment and the database has been generated on a MySQL DBMS. The main achievements of this activity are the script to generate the Database and the Database itself.

   2.1. Ingestion of data in the E-RIHS Catalogue Database. To create the E-RIHS PP catalogue, CNR chose a bottom-up approach, starting from an analysis of the available descriptions of resources. Due to the difficulty to retrieve a significant number of descriptions from the institutions participating in the Task 8.1, CNR (ISTI-CNR) in collaboration with National Institute of Optics (INO-CNR) decided to take into account the list of resources collected within the IPERION HS project. The input data used in this activity were previously collected using the following approach: the main entities individuated in the data model were represented by a spreadsheet template and for every item the corresponding templates were used to create google spreadsheets' containing information related to entities. The resulting dataset consists of a large number of spreadsheets, each one containing (unrelated) information. We designed and built a software tool that execute the following actions: i) harvests google spreadsheets from the google server and store them locally; ii) reads the spreadsheet structure and gets the data from every file and stores these data in the corresponding relational table or tables; iii) according to a number of pre-defined rules infers

relationships and populate relationships tables; and iv) performs tests to check consistency of ingested data.

The main issues in this activity are related to the structure and the content of the dataset used for the ingestion, in particular: i) the relationships existing in the data model were not explicitly represented in the spreadsheets; ii) key values where missed in a significant number of spreadsheets; and iii) values format were not homogeneous. To fix the above issues we performed a significant amount of manual work. Additionally, the ingestion software built is strongly tied to the specific data set structure, this means that in order to re-use it, a refactoring process will be needed.

Our opinion is that a review of the data collection procedure would be needed in order to save time and enable the creation of more efficient tools. The complete Database has been exported as a SQL file (containing data and SQL statements) and migrated in the production environment. The main achievement of this activity is the complete Database.

2.2. Update and tuning of the relational schema. To test performances and data consistency of the Database a number of SQL queries have been created. Using the result sets of these queries we have made some minimal changes to the relational schema of the Database in order to improve efficiency of the system.
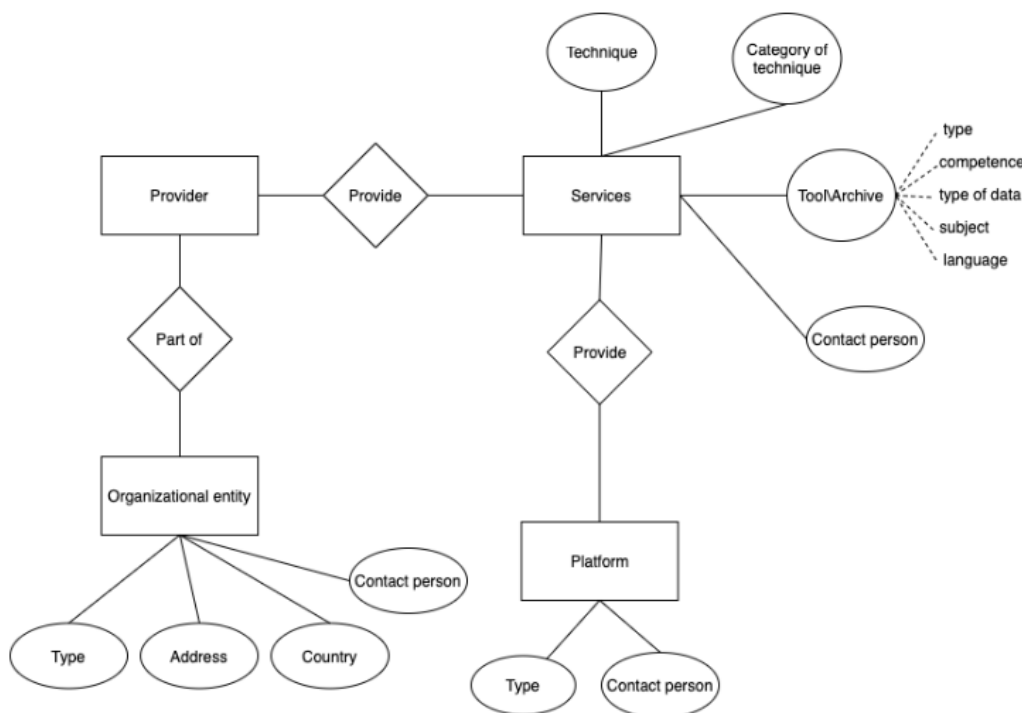

Figure 8: ER scheme of the catalogue of services (D8.1 - Jul. 2020)

1.4.9. <u>Work package 9 – Excellence and Innovation</u>

WP leader: FORTH – *Demetrios Anglos*
Scope
The success and long-term sustainability of E-RIHS will rely on its capacity and means to foster scientific excellence and, in interconnection, to identify, unfold, promote and exploit its innovation potential.

Combining state-of-the-art infrastructures and high-level services will ensure E-RIHS becomes the place where most advanced scientific investigations of heritage will materialize and where

collaboration between RI providers and users will enable the community to formulate and address unanswered interdisciplinary research questions through innovative approaches generating new knowledge for understanding the past and safeguarding the future of Heritage.

In the context of WP9, E-RIHS PP participants have collaborated with the aim of describing their scientific ambitions that extend the current state of the art and lead to innovative developments for E-RIHS in the years to come, defining appropriate tools, methodological approaches and monitoring mechanisms.

As an outcome, two main documents have been finalized that will pave the way forward: a) the E-RIHS Scientific Strategy and b) the Innovation Agenda. These are aimed at serving as roadmaps for the development of next generation instruments, new research techniques, novel methodologies and knowledge management tools capable of advancing the state of the art across E-RIHS, introducing novel and efficient access services and offering unprecedented research opportunities to a broad spectrum of user communities including industry.

Main objectives
- Map the national and international RI landscape relevant to Heritage Science
- Define strategies for exploring novel opportunities and research challenges
- Elaborate the E-RIHS Scientific Vision and Scientific Strategy with access providers and users
- Identify the innovation potential in E-RIHS
- Assess opportunities for developing new technologies, tools and products
- Define strategy to engage industry as RI users or as partners in research and development

State of the Work Carried Out
Task 9.1 Excellence: priorities and strategy
Task leader: CNRS – *Loïc Bertrand*
Concept: The general aim in Task 9.1 is to monitor the landscape of the setting up of E-RIHS, to describe the main scientific ambitions of E-RIHS in the coming years and to outline what pathways will be followed to achieve them. Two main documents are scheduled in the framework of T9.1. The E-RIHS Scientific Vision is the introduction of the E-RIHS Scientific and Technical description, one of the core documents that will be produced to apply for the ERIC status. The E-RIHS Scientific Strategy is a high-level book that details the topics announced in the E-RIHS Scientific Vision and in the E-RIHS Scientific and Technical Description

Scientific strategy
In the framework of Task 9.1, the E-RIHS Scientific Strategy was discussed, elaborated and articulated in a comprehensive document, "D9.3 - The E-RIHS Scientific Strategy, v.1.0", delivered in September 2020 (M44). The coordination of the preparation of the Scientific Strategy document was carried out by Loïc Bertrand, Bénédicte Charbonnel, Fanny Dubray and Sophie David (CNRS - IPANEMA), Marta Castillejo (IQFR-CSIC), Hilde De Clercq (KIK-IRPA) and Marika Spring (NG).

The main aims and methodology concerning the drafting of the E-RIHS Scientific Strategy involved:

1. Identifying drivers and priorities in terms of science
2. Defining a strategy and key procedures to reach our goals and optimise our impacts
3. Providing a flexible scheme that will allow continuous upgrades of E-RIHS
4. Assessing impacts in research and beyond and optimisation strategies
5. Engaging partners and user communities in the building of the research infrastructure

The coordinating group has interacted on a regular basis and met regularly virtually and physically over the period. The work carried out within T9.3 was presented at E-RIHS PP interim and annual meetings.

A list of relevant consultation meetings/events follows:

Jan. 2019, Windsor, UK	Presentation of the Scientific Strategy at the E-RIHS Academy workshop
Feb. 2019, Paris, F	World Meeting on Heritage, Sciences and Technologies, Paris + Dedicated WP9 side-event
Apr. 2019, Aachen, D	E-RIHS Interim Meeting and IPERION CH Annual Meeting, Aachen + Scientific Strategy Meeting
Jun. 2019, Brussels, B	Dedicated Scientific Strategy Meeting
Aug. 2019, Madrid, E	Dedicated Scientific Strategy Meeting
Sep–Oct. 2019	First draft version of the Scientific Strategy v1.0 disseminated to a large group of contributors
Oct. 2019	Presentation of the draft to the IPERION CH Scientific Advisory Board
Jan 2020, Evora, PT	Discussions in the framework of the E-RIHS Interim Meeting
T1, T2 2020	Integration of comments after the Evora Interim Meeting, E-RIHS Glossary
Summer 2020	Contribution to the revision of the Scientific and Technical Description (S&TD) in collaboration with the relevant Working Group of the Interim General Assembly

Table 4 – List of relevant meetings and events

In brief, the Scientific Strategy concentrates on the following:
1. The Science Drivers
   Enhancing Knowledge of Heritage, Preserving Heritage, Developing New Capabilities for Cultural Heritage
2. The 10 Pillars of E-RIHS (see Fig. 9)
3. Infrastructure to Enable New Science
   Physical Archives, Digital Lab, Fixed Laboratory Facilities, Mobile Instrumentation
4. Implementation
   Access Policy, Data Policy, Policy and Procedures for Selecting Access Providers

An E-RIHS Glossary was generated collaboratively in order for the consortium to gradually come with a common definition of the main concepts at the origin of the infrastructure processes.

Figure 9: Cover page of the Scientific Strategy and the 10 Core Values/Pillars of E-RIHS

As foreseen in the DoW, a World Meeting entitled "Heritage, Science and Technologies – Frontiers in Heritage Science" was organized at the *Académie des sciences, Institut de France, Paris*, from 13th to 16th February 2019 to nurture the reflection on the E-RIHS Scientific Strategy. CNRS IPANEMA and the French Académie des sciences undertook the organisation of the symposium, in partnership with Academies of Sciences from many countries (Algeria, Austria, Czech Republic, Italy, The Netherlands, UK, and Sweden). The symposium started with a dedicated E-RIHS meeting with invited attendance and the character of a workshop focusing on the Scientific Strategy (13/02/2019) and was followed by the main scientific symposium (14, 15/02/2019) open to the research community and a general public event (16/02/2019). The scientific symposium gathered internationally renowned scientists, from a large range of countries representing different disciplines related to heritage materials. Thus, it provided a constructive synthesis of current works and future perspectives in the field of heritage science contributing ideas to the final reflection on the Scientific Strategy.

A major outcome of the Symposium was the signing by the delegates of a Declaration "*Heritage, Sciences and Technologies: An opportunity for our societies and the global economy*" by means of which participants expressed their strong support on initiating a call for action through the mobilization of knowledge to improve the understanding, preservation and enhancement of cultural and natural heritage in order to promote sustainable development.

The E-RIHS dedicated event gathered over 25 individual researchers from within and outside ERIHS-PP provided insights and addressed gaps in the scientific strategy. The aims of E-RIHS to achieve a distributed heritage science infrastructure that will enable new research were discussed along with the expected impact on the European and global research area.
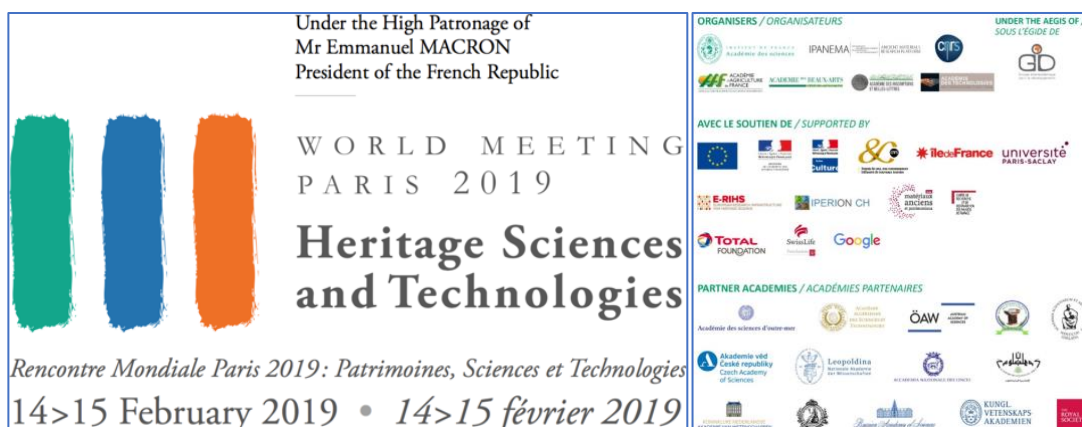
Figure 10: The International Symposium flyer and the organizers along with the partner academies

Task 9.2 Exploitation of E-RIHS capacities: innovation, transfer of knowledge and marketing
Task leader: FORTH– *Demetrios Anglos*
Concept: In Task 9.2, focus is placed on Innovation as the second pillar of E-RIHS success in balance with Scientific Excellence. The aim of this Task is to explore and map the present innovation landscape of E-RIHS and identify and suggest pathways for continuing and enhancing the innovation potential and output of E-RIHS, preparing the Innovation Agenda.

Innovation Agenda
In the framework of Task 9.4, the E-RIHS Innovation Strategy was discussed, elaborated and articulated in a comprehensive document, "*D9.4 – Innovation Agenda*", which was delivered in September 2020 (M44). The document builds upon the content of D9.2, 'Analysis of the Innovation Background. Main contributors to the Innovation Agenda (D9.4) have been Sophia Sotiropoulou and Maria Makridaki (FORTH), Mary Teehan and Anthony Corns (DP), and Michal Vopálenský (ITAM) with additional contributions also by Marta Castillejo (IQFR-CSIC), Adam Gibson (UCL) and Polonca Ropret (IPCHS). The effort was coordinated by Demetrios Anglos (FORTH). The group met regularly virtually (bi-monthly) and physically (during project meetings).
The main focus of the work has been on:
1. The E-RIHS Excellence and Innovation
   with emphasis on E-RIHS as an innovation ecosystem and the concept of innovation in Heritage Science and the motivation for innovation.
2. The E-RIHS – Strategic Research and Innovation Agenda (SRIA)
   which has been analysed with respect to several aspects including: Strategic objectives, Agenda essentials, Challenges, Access and Innovation, Monitoring and Managing of innovation as well as Technology Transfer, IPR Management and Exploitation.
3. Education and Innovation
   with emphasis on Building and structuring HS innovation through the training of future Heritage researchers and by sharing the knowledge produced within E-RIHS and adopting open innovation practices.
4. Collaborations and interoperability
5. Collaboration with Industry.

The progress of the work was in T9.2 was presented at E-RIHS PP interim and annual meetings as follows:
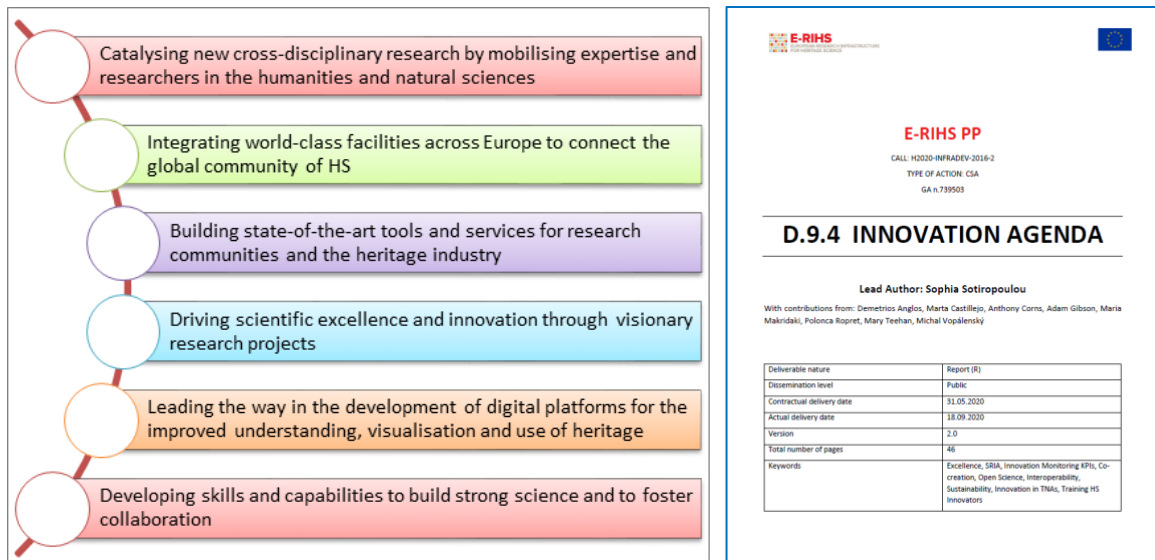
Figure 11: Major drivers in the Innovation Agenda and cover of deliverable D9.4

In all, Innovation constitutes the goal and at the same time the medium for achieving the strategic objectives of E-RIHS and therefore the Innovation Agenda addresses all research actions and services, training and communication as well as collaborations with other RIs and Industry, in the Heritage domain. A systematic approach in monitoring innovation, defining metrics and indicators (KPI's), will provide a reliable assessment of the innovation impact to Excellence, Synergies and Co-creation, Users and public engagement and the Sustainability of E-RIHS as the leader in the global HS landscape.

Problems
The work carried out in WP9 covers a considerably broad landscape of issues and this has been demanding in the context of interactions among the teams and required several iterations as the concepts put forward are novel and dynamically evolving at an international level (for example, the role of RIs as tools for economic development, open innovation, social innovation etc).
As a result, delays have been incurred, concerning completion of both D9.3 and D9.4.

Achievements
Deliverables 9.3 and 9.4 constitute two distinct achievements of WP9.
In parallel, through major events such the World Meeting in Paris and further discussions and contacts with experts and colleagues (at conferences, public events etc) E-RIHS and its future role is being increasingly communicated in Europe and internationally generating valuable feedback that helps to formulate and clarify aspects related to grand scientific challenges in the field of Heritage Science.
Considering that E-RIHS participants are also members of the National E-RIHS nodes or structures equivalent to a national E-RIHS node at different countries, developments in E-RIHS PP concerning scientific excellence and innovation are diffusing towards the national nodes and good practices established at national level are being used to enrich the E-RIHS scientific strategy and innovation agenda.
Concerning the Scientific Strategy Document a number of significant achievements are worth to be mentioned.

1. It clarified the Mission and Vision Statement and put forward new concepts, in particular "Co-creation" and "Competencies First". It also contributed significantly to the Harmonization of Vocabulary and Definitions.
2. It proposed new approaches on access services by placing the focus on both Short and Medium-Term Projects.
3. It contributed to two important Declarations of the World Academies of Science and of the EU MS ministers responsible for Cultural and European Affairs signed at Paris in the framework of the World Meeting on Heritage Science and Technologies.
4. It contributed to the establishment of the 10 Pillars and 5 Core Simplifications, connected to practical implementation as Policies and Procedures.
5. It helped E-RIHS to receive Very Positive Evaluation by ESFRI and HLEG in 2020.

Likewise, the Innovation Agenda Deliverable has helped to identify key issues underlying the formulation of an effective innovation strategy as shown in Fig. 12.

1
- Serving the real needs of the broader cultural heritage community;

2
- Maintaining research excellence and global recognition as the EU-hub for HS Research;

3
- Managing knowledge integration, creating and applying knowledge;

4
- Identifying gaps in the already provided catalogue of services;

5
- Stimulating innovation to address global and internal challenges;

6
- Activating an *Innovation Radar* mechanism capturing emerging trends internationally and identifying opportunities in view of new markets or getting involved in global value chains or networks;

7
- Improving and harmonizing the governance of national or regional policies for innovation;

8
- Stepping from breakthrough inventions to innovation: creating conditions for impact;

9
- Educating young HS researchers with skillsets empowering them to innovate.

Figure 12: Basic components and steps for the E-RIHS SRIA

1.4.10. Work package 10 – Advocacy, Communication and Dissemination

WP leader: CYI – *Sorin Hermon*

State of the work carried out
During the project, different communication and dissemination activities were carried out choosing the proper messages, media and tools time by time. All the visual products have been created following the E-RIHS visual identity guidelines, that make E-RIHS communication consistent and recognisable at a glance. The guidelines are the reference document also for the communication activities in the national nodes. The E-RIHS logo has been registered as a trademark to guarantee its unicity.

A digital toolkit for events has been created to help partners organise meetings, conferences, workshops under the E-RIHS label. In the project lifecycle, 16 project meetings, 9 international events and 6 E-RIHS presentations around the world were organised.

Since the beginning of the project, the E-RIHS website (www.e-rihs.eu) has been active. The homepage has been continuously populated with news and events to maximise the impact and publicity of the E-RIHS activities. The home page represents the main entry point to the E-RIHS world: users can visit specific webpages (vision, objectives, partners) to better understand what is E-RIHS, what E-RIHS can do and offer, the people involved in E-RIHS and so on.

E-RIHS has activated two main social media accounts, Twitter and Facebook. The social media analysis has measured a relevant increase (900%) of followers during the three years of the project. Thousands of users were reached, and some hundreds engaged. Visual posts and videos have received more attention than informative posts. The map of the users shows that E-RIHS is monitored by users spread worldwide.

Based on the experience in the IPERION CH project (GA. 654028), typical users interested in this kind of research infrastructure are young researchers, 25-35 years old, looking for job and training opportunities and transnational access calls. E-RIHS PP did not offer these services. Despite this, the followers have the same identikit. This consideration pushed the Communication Office to design a special tool: The Heritage Science Hub (HSH), a semantic web tool acting as an access point for information, services, opportunities in the field of Heritage Science.

This cloud service, developed in collaboration with a private company, provides a selection of contents automatically taken from the web and partially filtered both through a controlled Wikipedia-based dictionary and the Communication Office. In the HSH, users have a personalised Content Dashboard where they can save searches continuously updated and set up personal and private classification mechanism.

Another tool for the community is the E-RIHS catalogue of services.

The catalogue was a specific task in WP8, but the Communication Office has crucially and actively contributed to design a user-friendly interface. Since the E-RIHS project did not provide any call for Transnational Access, being only a preparatory phase, to test the catalogue for the future E-RIHS-ERIC the Communication Office decided to include the services offered in the IPERION HS project (H2020-INFRAIA-2019-1, GA n. 871034). In February 2019, the Communication Office created a multi-disciplinary working group and started collecting and structuring data. User experience testing has been carried out with expert and non-expert users to design a dynamic online catalogue better. At the moment, the catalogue is available on the IPERION HS website. It is possible to set up filters to find suitable analyses for type, category, country, facility, or to search freely by word. The online catalogue gives information about 150 techniques and scientific archives provided by 57 facilities in the three platform (ARCHLAB, FIXLAB, MOLAB).

E-RIHS has a wide range of stakeholders who have varying priorities and interests. By developing an understanding of the needs and interests of each group, the project aimed to design the right message for the various target audiences (Governments and policy-makers in Member States and potential new Member States, Scientific community, General public, E-RIHS community). Awareness of the needs of community helps identify the best channels for contacting stakeholder groups (such as email lists, conferences, other means) and in the design and planning of dissemination materials and activities, thus helping to raise the visibility of the project and promote use of its outputs.

Furthermore E-RIHS set-up an efficient mechanism of communication of activities by E-RIHS partners, in order to facilitate gathering of information and its transmission to the dissemination channels and designed and implemented a continuous two-way information flow between E-RIHS and stakeholders at national, regional and international levels.
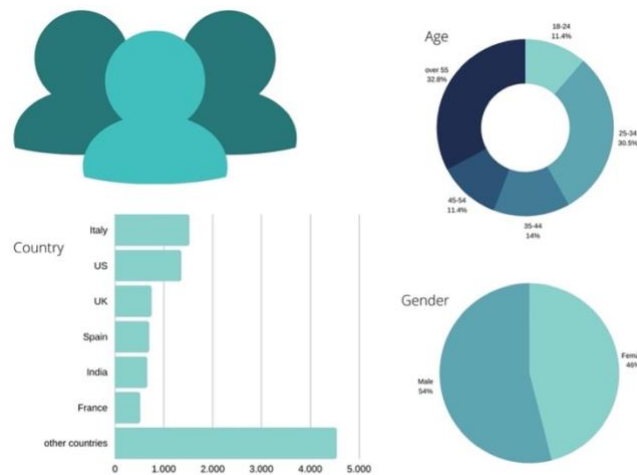
Figure 13: Identikit of the user of the E-RIHS website (Google Analytics, 2020)

Problems

The main problem in communicating and disseminating the project is the nature of E-RIHS PP, a project that can be considered more technical and political rather than scientific. The result is that it is complicated to engage the public at large. The analytics tools highlight that the main entry point in the E-RIHS world is the website that has been visited by people interested in its political aspects (vision, partners, etc.). Instead, the social media audience shows interest, especially in posts related to job opportunities or conferences or transnational access and not in the political achievements of E-RIHS. A better balance between the two aspects will help fill the gap. The general audience appreciated short videos: increasing this type of creations will increase the attention on the project. Another criticality is the broad and diversified audience of E-RIHS. In the last years, the E-RIHS community enlarged the vision including new communities (built heritage, palaeoanthropology, archaeology) and the partnerships: new countries are proposing themselves as observers, and potential members of E-RIHS ERIC and many international collaborations were activated across the world. This trend makes communication and dissemination truly challenging. Flexibility in the use of the tools and continuous monitoring of the impact of the communication activities will allow adapting and delivering proper messages to specific audiences at the right time. It means to apply the smart principles of the communication strategy.

As regards the Heritage Science Hub, at the moment, it is offline. The considerable potential of this web tool and the impact on the web reputation push the Communication Office to work on setting better its filters to offer to the users more precise and relevant results.

In addition, new functionalities will be developed together with other stakeholders in the field of Heritage Science (e.g. ICCROM, JPI-CH). The idea is to make the HSH a global benchmark in the field of Heritage Science.

A further challenge is the communication at the time of emergency. One of the questions is whether and how it is possible to offer services remotely. It is not easy for E-RIHS to change the approach: too many questions related to conservation arise, and deeper reflections are requested, but surely E-RIHS -ERIC should accelerate the creation of DIGILAB, the digital platforms where digital services and access to scientific data will be offered. The Communication Office can help set up this platform, e.g. with the Heritage Science Hub.

Figure 14: Back-end of the Heritage Science Hub

Achievements
- Social media and website continuously implemented
- Toolkit for E-RIHS events created
- E-RIHS logo registered as a trademark
- Heritage Science Hub developed with new functionalities
- Catalogue of services designed with a user-friendly online interface
- International events and meetings organised

1.4.11. Work package 11 - Implementation

WP leader: CNR – *Luca Pezzati*
Work carried out and achievements
The ambitious aim of WP11 was to synthetize all the project findings resulting by the activities of the other WPs to prepare the two base documents for E-RIHS ERIC to be established: the **E-RIHS ERIC Business Plan** (now D11.1) and the **E-RIHS ERIC Implementation Plan** (now D11.2). The two documents together are the backbone of E-RIHS ERIC strategy of implementation.

To achieve this, WP11 closely followed the preparatory work in all the other WPs to minimize and to mitigate potential divergences in aims and strategies, contributing to the discussions on all the

topics of interest for the preparation of these two plans (which means, almost all the topics treated by the other WPs).

The responsibility for the production of the final deliverables, as expected, was shared with the informal Interim Governance group, established at the 2nd year of the project, who acted as Task working group for both T11.1 and T11.2.

Task 11.1 Integration and harmonization of planning documents
Task leader: CNR – *Luca Pezzati*
Task 11.1 progressed timely until M44. The expected deliverable (D11.1) submission was delayed from the initial M27, after the extension amendment, to 2020, May 31st (M39) to include all the advancements generated by the other deliverables (delayed themselves) and by the international discussion at the iGA. It was timely submitted on June 1st. D11.1 is now the E-RIHS ERIC Business Plan (version 1.0), an overarching document describing the E-RIHS ERIC structure, strategies and sustainability.

T11.1 contributed also largely to the drafting of the Scientific and Technical Description of E-RIHS ERIC. A document which is needed to submitting Step 1 application towards the ERIC. This activity was not clearly foreseen at the beginning, but it was nonetheless completed with success. The S&TD can be indeed considered as an extract of the (larger) Business Plan. The S&TD document was submitted to the iGA to find convergence on it between the potential founding members of E-RIHS ERIC.

Task 11.2 E-RIHS implementation strategy
Task leader: CNR – *Luca Pezzati*
Task 11.2 progressed timely until M44 but for the delayed delivery of D11.2 it extended until M45, one month after the project's end. As for T11.1, this Task collected and organized fundamental material to produce the E-RIHS ERIC Implementation Plan, in cooperation with the interim Governance group.

D11.2 was actually delivered with one full month of delay, on 2020, October 30th.
D11.2 is now the **E-RIHS ERIC implementation**, a "recipe book" including suggestions on the way to implement E-RIHS ERIC, starting from the end of the preparatory phase (2020, September 30th) to the second year of the implementation phase (24 months after the 1st meeting of E-RIHS ERIC GA).

Problems
No significant problems to report.

1.5 Impact

The information on section 2.1 of the DoA are still relevant and do not need to be updated.

2. Update of the plan for exploitation and dissemination of result

The plan for exploitation and dissemination of results as described in the DoA do not need to be updated.

3. Update of the data management plan

All the public deliverables of the project were given a DOI and uploaded on the E-RIHS community in Zenodo (https://zenodo.org/communities/e-rihs/?page=1&size=20).

4. Follow-up of recommendations and comments from previous review(s)

The 1st periodic review "*encouraged to determine a clear identity for the RI in view of its multidisciplinarity, and to work out a plan for a controlled growth in scope and size*". According to this recommendation by the reviewer, the E-RIHS community developed an agreed definition of heritage science which was posted on Wikipedia and adopted by ICCROM:
"

Heritage science is the interdisciplinary domain of scientific study of heritage. Heritage science draws on diverse humanities, sciences and engineering disciplines. It focuses on enhancing the understanding, care and sustainable use of heritage so it can enrich people's lives, both today and in the future. Heritage science is an umbrella term encompassing all forms of scientific enquiry into human works and the combined works of nature and humans, of value to people.
"

About the second recommendation, the international outreach initiatives were limited and the community focused on the preparation of the E-RIHS ERIC strategies and policies.

5. Deviations from Annex 1 and Annex 2

5.1. Tasks

The reasons behind the delays of several deliverables were already explained in the introduction. No other significant deviations in the tasks activities are to be noted.

5.2. Use of resources

Beneficiary #1 CNR is reporting 22 extra PMs relative to the 2nd Reporting Period, in specific 11 PMs in WP 1 and 11 PMs in WP11. CNR provided fundamental central support to establish and operate the interim General Assembly as of December 2019 (WP1) and participated in the iGA Working Groups (WP11). Accordingly, CNR initiated the establishment and provided support to the Digital Working Group (WP1) with the scope to mitigate the special circumstances occurred in the WP5 and to contribute to the DIGILAB Implementation plan (WP11).

Beneficiary #2 KIK-IRPA has claimed an average cost per PM of 5.190,15 €/month compared to the 3.459,46 €/month foreseen in the Grant Agreement, an increase of 50,03%: due to administrative personnel recruitment problems, specific for federal institutions, KIK-IRPA decided to assign the activities to the director and senior staff with greater involvement than expected (detailed timetables are setup).

Beneficiary #5 DAI

In the first submission DAI claimed an average cost per PM of 10.625,71 €/month compared to the 5.435,19 €/ month foreseen in the Grant Agreement, an increase of 95,50% because they made an error in RP2 by omitting the person-months of SPK, 3rd linked Third Party. Then DAI have adjusted the report accordingly.

(To be consistent with the financial amendment where the SPK costs initially claimed in RP1 had moved to RP2, they have then also moved the SPK person-months initially claimed in RP1 to RP2. This change had no impact on the overall number of person-months and the costs per person month.) The increase on the average personnel costs is based on an average wage calculated for researchers in 2016. However, the DAI has employed a senior researcher (Wolfgang Schmidle), and salaries have increased since 2016.

Beneficiary #7 CENIEH has claimed an average cost per PM of 3.943,24 €/month compared to the 2.375,00€/month foreseen in the Grant Agreement, an increase of 66,03%. Also, CENIEH introduced an adjustment of Period 1. Total personnel costs claimed in RP1 amount 26.823,38€ and total PM claimed in RP1 is 3,27 PM which leads to average personnel costs per month of 8.202,87€, an increase of 245,38%.

CENIEH exceeded the personnel posts budget because in the proposal they didn't consider Mohamed's Sahnouni dedication to the E-RIHS PP project. Mohamed Sahnouni is regarded as high-level staff, and he was involved in the project since May 2017. In the proposal, we foresaw the participation in the Steering Committee and the WP8 leadership with a much lower personnel cost. Still, due to its significance, CENIEH decided that Dr Sahnouni should lead the project work. We also had a slight salary increase during the last years. These are the reasons to have higher personnel costs than budgeted. The adjustment to RP1 was submitted to detect some mistakes in the PM and cost calculations. The average cost per PM was higher for the same reasons mentioned before.

Partner #9 DARIAH used 10.42 PMs during the course of the project, slightly more than the 9PMs initially planned. Despite its foreseen participation in Work Packages 8 and 11, these PMs were only associated to Work Package 3. The delivery of a human resources policy (D3.2) for E-RIHS required several interactions and adjustments throughout the project according to the development of the overall strategy of the infrastructure. Therefore, it was agreed with the Consortium to keep DARIAH's main focus on the delivery of task 3.2. Furthermore, DARIAH's other direct costs were 51% higher than initially planned. These costs were mainly used to attend interim meetings and were partially balanced by the overestimation of personnel costs in the proposal. As a result, the total requested contribution is slightly lower than initially planned.

Beneficiary #16 RCE has provided all the work pertinent to the 2nd reporting period in-kind and is not claiming any cost within this RP. No costs have been declared because in the year 2020 the Cultural Heritage Agency did not spend all of its own general budget. Some of RCE general activities could not have been carried out because of the restrictions of the Covid-19 pandemic. RCE decided to use it to co-finance the E-RIHS PP project. As a result, they decided not to declare any costs in the final periodic report, although we carried out our part of the work packages of E-RIHS PP and even made an extra effort for E-RIHS in general on our account. The quality and quantity of our deliverables have not suffered from our refunding - all the work has been accepted according to the assessment of the project.

Beneficiary #17 NCU

In the first submission NCU claimed an average cost per PM of 2.676,18 €/month compared to the 2.000,00 €/month foreseen in the Grant Agreement, an increase of 33,81% because the NCU made an error in the calculation of the number of personal months (PM) of the RP2. Specifically, the amount of work was miscalculated for the following work packages: WP2-WP5 and WP9. As a result, the total number of PMs in the second period was adjusted from 21,43 to 46,61 PM and for the whole project to 56,77 PMs. The revised numbers have been incorporated into the on-line financial report. As a result, the average cost per PM is currently 1.489.18 €/month instead of the 2.676,18 €/month as reported before.

Beneficiary #18 LNEC and HERC have claimed an average cost per PM of 7.221,18 €/month (101.818,58 € / 14,1 PM) compared to the 5.571,43 €/month foreseen in the Grant Agreement (156.000,00 €/28 PM), an increase of 29,61%.

As pertains LNEC (excluding third party Universidade de Évora) the proposal was prepared in 2016, with the last available personnel costs referring to 2015. Following the 2008 financial crisis, public workers' salaries were progressively cut in Portugal, first by 5% and then by up to 12% for salaries above € 2.000,00 / monthly. In 2015 cuts were at their maximum. Other fringe benefits of public workers had been equally cut while the number of daily working hours and yearly working days had been increased. At the end of 2015, 20% of the salaries previously cut were restored, and during the following years, under a socialist government and with positive economic growth, salaries and benefits were reinstated (e.g. the 35-hour week, and the previous holidays' rules were reintroduced). All this increased the personnel hourly costs that was not accounted for at the time of the proposal because the situation then in force was used to calculate costs. In 2015 the hourly cost of João Manuel Mimoso, principal researcher and LNEC coordinator for the Portuguese participation in the project, was € 44,87 (the value used in the first financial report of Project IPERION CH); in 2018, it was € 57,47 (the value used in the first report of project E-RIHS PP), and in 2019 it had increased to € 61,16 (the value used in the final report of E-RIHS PP for 2019 and 2020 personnel costs) representing, in relation to the 2015 costs and weighing the increase with the personnel expenditure on both project reports, an overall increase of over 30% in personnel costs at LNEC. A similar situation happened with the other personnel involved's salaries, although the increases were lower because the cuts until 2015 had been lower for lower salaries. To this must be added that more work than expected fell on João Manuel Mimoso, the highest-paid researcher of the LNEC team in relation to his colleagues. Furthermore, his knowledge and previous experience in management and finance were highly involved because of how the project developed.

As pertains LNEC's third party Universidade de Évora For the same reasons previously explained for the Portuguese salaries and because of internal advancements in careers, the hourly rate of António Candeias in 2015 was € 42,00. In 2017 he was promoted to Associate Professor and in 2018 (until now) to vice-rector with an hourly rate of € 66,91, representing an increase of more than 50%. The same happened with the cost associated with José Mirão, who concluded his aggregation in 2018, increasing the hourly rate from € 39,53 in 2015 to € 48,72 in 2018. In relation to the other costs associated with the organization of the last face-to-face project meeting in Evora in the last week of January 2020, an organization cost was calculated, but it involved only own University means which, we were informed, must be sustained by the partner as part of the indirect costs. Therefore, the amount of € 1.000,00 referring to "Organization Costs" was removed. Receipts from external purveyors back all the other costs (amounting to € 3.205,00).

5.2.1. Unforeseen subcontracting

Not applicable

5.2.2. Unforeseen use of in kind contribution from third party against payment or free of charges

Not applicable