

NHSF - Digital Society 'deep dive' Meeting  
2023, 3rd May 2023

Joseph Padfield (National Gallery, London, E-RIHS)

## E-RIHS DIGILAB

# E-RIHS ERIC (2025)

*European Research Infrastructure for Heritage Science (E-RIHS) ERIC will be a permanent distributed research infrastructure bringing together scientific and cultural heritage institutions across Europe to conduct interdisciplinary research on cultural heritage.*

Represent a growing global community of Heritage and Heritage Science researcher

Will support discussion, interpretation, preservation, documentation and understanding of Heritage Science

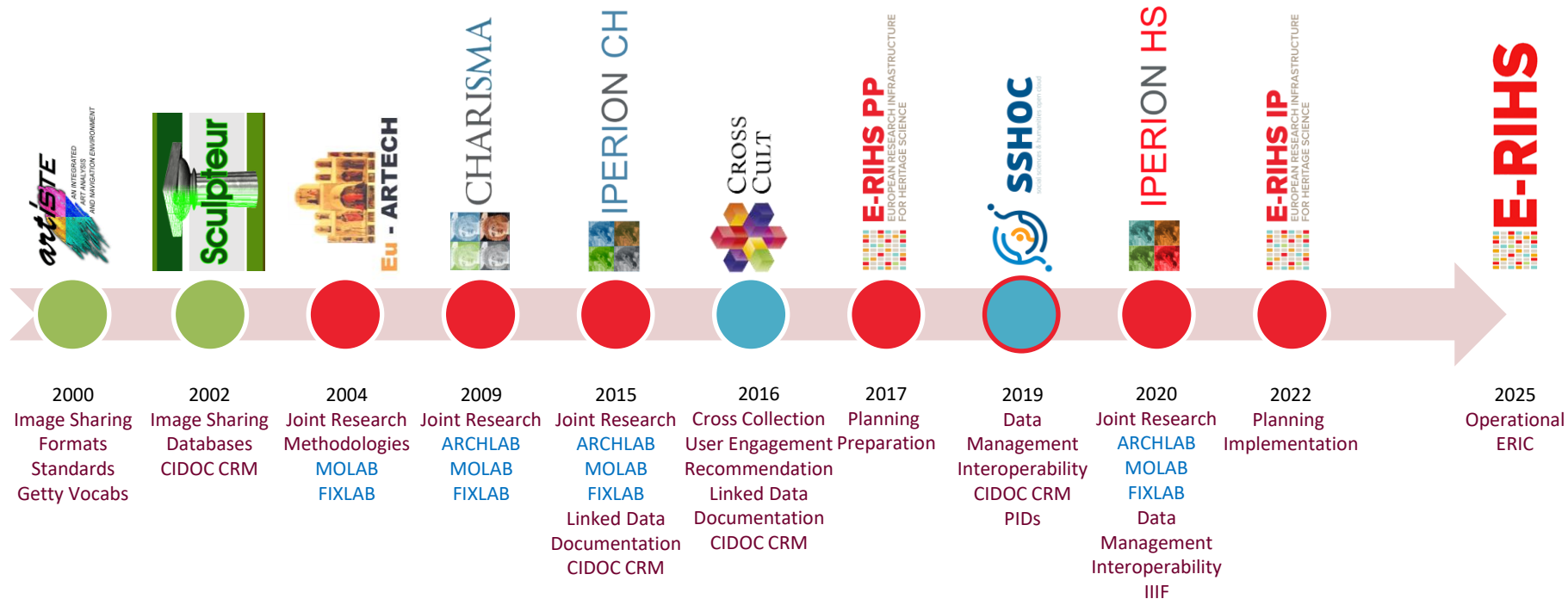
**E-RIHS**

Will deliver an integrated single access point to expertise and technologies.

**20+ years in the making**

integrating world-leading European facilities

# Development of E-RIHS + Related Projects



TOWARDS  
A NATIONAL  
COLLECTION

# E-RIHS access provision platforms



**ARCHLAB**

access heritage archives and  
collections



**DIGILAB**

data and tools for heritage  
research



**FIXLAB**

access LSF and advanced  
laboratories



**MOLAB**

mobile instruments for in-situ  
diagnostics

*ARCHLAB, FIXLAB & MOLAB – Almost 20 years of development and growth*

***DIGILAB will be the new platform within E-RIHS***

# Access provision platforms via a central E-RIHS hub



## E-RIHS ARCHLAB (archives)

Access to specialised knowledge and organized scientific information – in datasets largely unpublished from archives of prestigious European museums, galleries and research institutions.



## E-RIHS FIXLAB (fixed facilities)

Access to large-scale and medium-scale facilities (particle accelerators and synchrotrons, neutron sources; non-transportable analytical instruments) offering a unique expertise to users in the heritage field, for sophisticated scientific investigations on samples or whole objects.



## E-RIHS MOLAB (mobile facilities)

Access to an impressive array of advanced mobile analytical instrumentation for in situ non-invasive measurements on valuable or immovable objects, archaeological sites and historical monuments.

<https://www.iperionhs.eu/iperion-hsaccess/>

<https://www.e-rihs.eu/access/> - April 2023

# Offered via IPERION-HS



## IPERION HS

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Platform

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

MOLAB • CATEGORY: 2D/3D ANALYSIS

TECHNIQUE: 3D STRUCTURE-LIGHT SCANNER AND 3D LASER SCANNERS

TOOL: 3D STRUCTURE-LIGHT SCANNER AND 3D LASER SCANNERS SYSTEM

3D structure-light scanner: works with white light and does not acquire colour information. It is equipped with a CMOS 5 Megapixel camera and three different sets of lenses. The S60, with a field of view of 49x40mm and a maximum resolution of 0.02mm. The S125, with a field of view of 116x98mm and a maximum...

Provider  
Science and Technology in Archaeology and  
Culture Research Center

Country  
Cyprus

FIXLAB • CATEGORY: AGEING TECHNIQUES

TECHNIQUE: ACCELERATED ARTIFICIAL AGEING FOLLOWED BY MECHANICAL TESTING AND SPECTROPHOTOMETRY

TOOL: ACCELERATED AGEING TOOL

Exposure of samples to artificial conditions for ageing studies using: - KBF climatic chamber from WBT Binder with controlled temperature and humidity; - Exposure to light for accelerate degradation using simulated sunlight (Hoenle solar simulator SOL lamp) or museum/gallery type lighting (LED or fluorescent).

Provider Country

IPERION HS > FIXLAB > CATEGORY: Ion Beam Analysis techniques

### Rutherford Backscattering Spectroscopy (RBS)

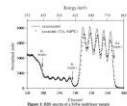


Figure 3. RBS spectra of a sample

Rutherford Backscattering Spectrometry (RBS) is a non destructive analytical surface technique for the determination of the structure and composition of materials. RBS is based on the measurement of the backscattering of an energetic ion beam (typically protons or alpha particles) of the MeV range) impinging on a sample. The energy of the backscattered particles depends on two parameters: i) the nature of the target atom (the heavier, the higher energy) and ii) its location from the surface (the incident particle loses energy in the material then is backscattered and loses energy again to get out of the material). The technique gives access to depth profile concentration of elements. It is particularly efficient for heavy elements on light substrates (glazings, fused ceramics...)

#### Fields of application

**Cultural heritage**  
architecture, art, decorative arts, demo-anthropologic object, firm manuscript, mosaics, musical instrument, other, painting, papyrus, photo, sculpture, textile, archaeological object

**Natural heritage**  
animal product, botanic collection, fossil, mineral, object in formalin, other, shell, skeleton, taxidermy collection

#### Materials

**inorganic**  
glass, stone, metal and metallurgical By-Products, ceramic, clay, mud brick, terra cotta, earthenware, stoneware, porcelain, pigment

**organic**  
wood, paper, textiles, parchment.

#### TOOLS



Provider  
Ion Beams Laboratory

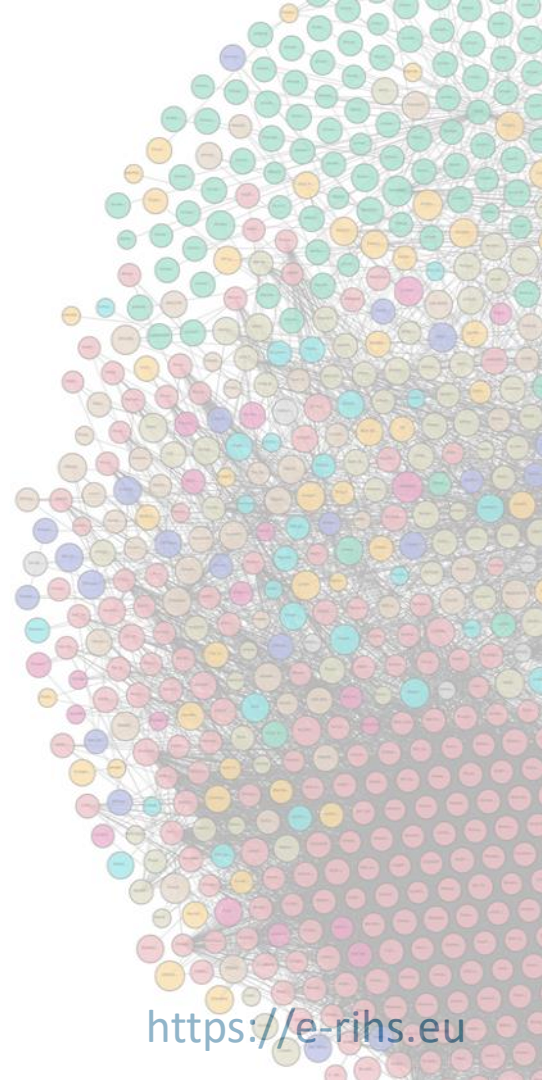
## Catalogue of Services

- Central list of facilities – with detailed descriptions
- Online access application forms
- Online proposal management system

<https://www.iperionhs.eu/iperion-hsaccess/>

<https://e-rihs.eu>

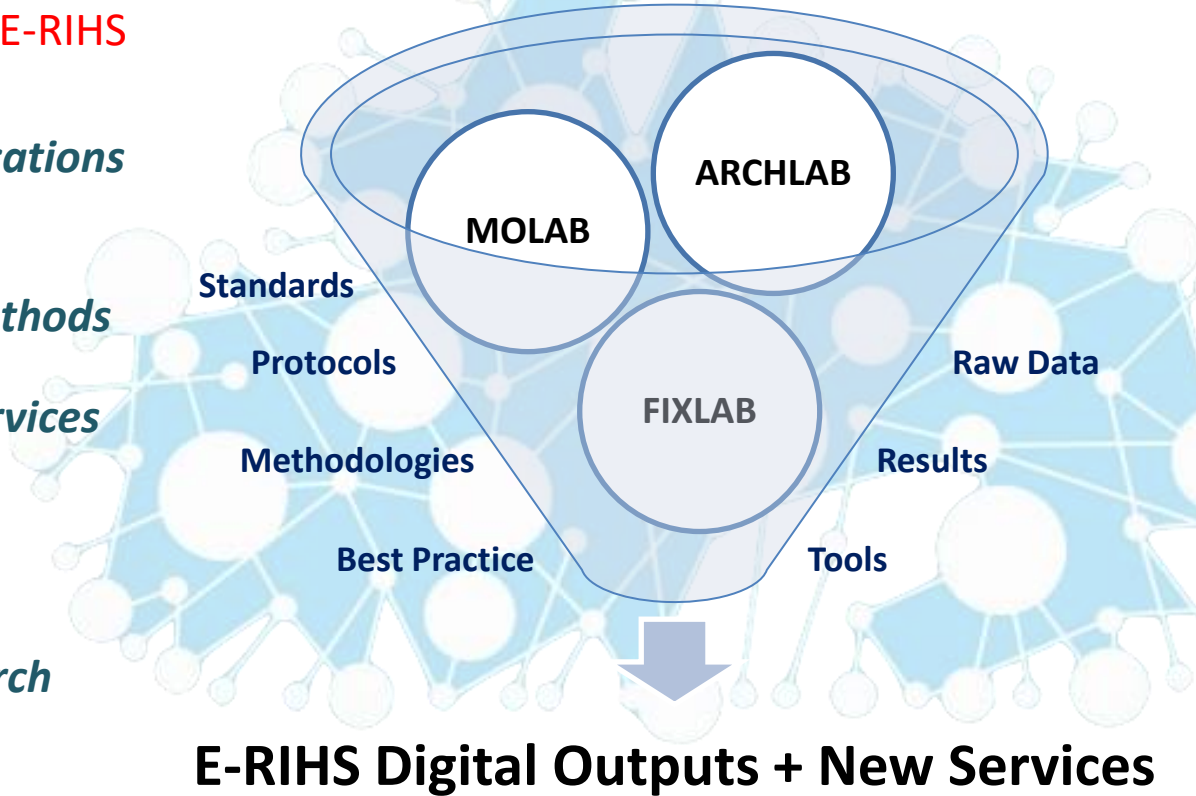
# The development of DIGILAB and an improved digital infrastructure



# E-RIHS DIGILAB

A digital platform for the whole E-RIHS community to provide:

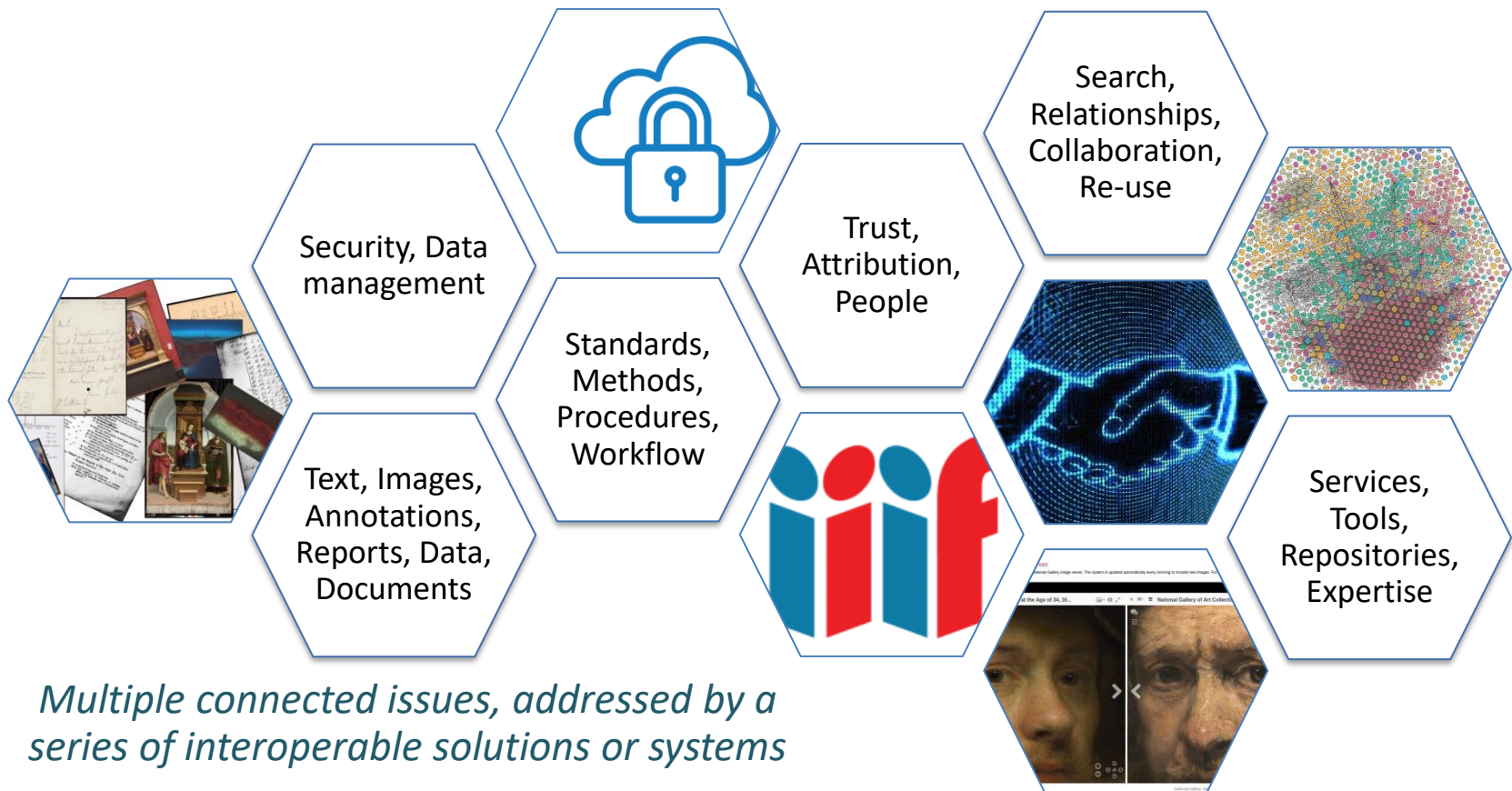
- *Improved Digital Communications and Collaboration*
- *Access to FAIR Data and Methods*
- *Access to Digital Tools & Services*
- *Access to Expertise*
- *Improved opportunities for Collaborative Virtual Research*



**E-RIHS Digital Outputs + New Services**



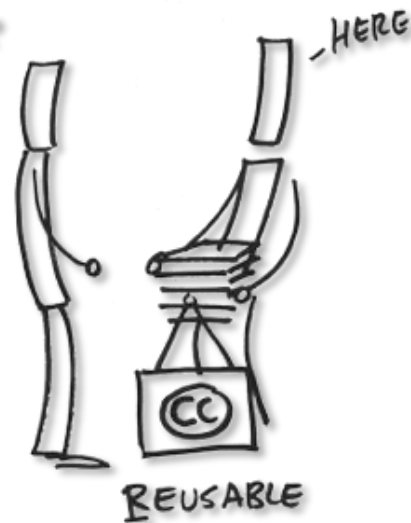
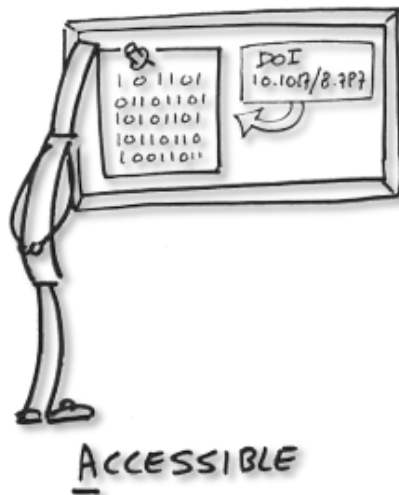
# DIGILAB: Based on a core digital infrastructure



*Multiple connected issues, addressed by a series of interoperable solutions or systems*

# Combined to support Access to FAIR Data and Services

## FAIR DATA PRINCIPLES



[https://www.openaire.eu/images/Guides/FAIRdatapinciples\\_foster.png](https://www.openaire.eu/images/Guides/FAIRdatapinciples_foster.png)

# Ensuring E-RIHS Data, Tools and Services are **Findable**

**Findable** relates to ensuring that data and services are described with appropriate metadata, are uniquely identified with open resolvable Persistent Identifiers (PIDs) that can be used to discover resources.



# Ensuring E-RIHS Data, Tools and Services are **Findable**

## PIDs

### Standard PID Registries

- Agreed, documented list of standard PIDs used to define data, tools, services, equipment, people, etc.

## Keywords

### Open Vocabulary Servers

- Use of agreed standard keywords and categories to define standardised core metadata fields and tag data, tools and services.

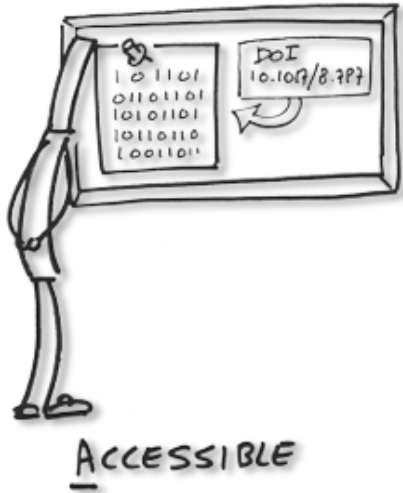
## Catalogues

### Central Hubs to find tools and services

- The core E-RIHS Catalogue of Services will list a wide range of EU level Heritage Science physical and digital services.
- Along with other lists of recognised repositories, digital resources and open tools.
- Linked to or aggregated in broader Catalogues and Marketplaces, such as the SSHOC and EOSC Marketplaces.



# Ensuring E-RIHS Data, Tools and Services are **Accessible**



**Accessible** relates to ensuring that the metadata defining and describing data and services is retrievable online via standard, documented procedures.

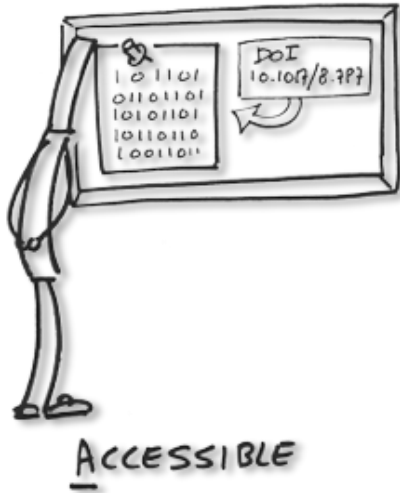
# Ensuring E-RIHS Data, Tools and Services are **Accessible**

## Repositories Central Core E-RIHS Data Repository

- Connected to appropriate standardised Institutional, National, EU repositories: Zenodo, DIGITAL.CSIC, HAL open science, etc.
- Providing a Hub of aggregated metadata with links to actual data sources – Linked to existing services like OpenAire.

## DMP Agreed data management plans

- “As Open as Possible, As Closed as Necessary”
- Ensure the existence of resources can be found even if direct access may be embargoed.



# Ensuring E-RIHS Data, Tools and Services are **Interoperable**



**Interoperable** relates to ensuring the appropriate use of common formats and standards, and describing or categorising data and services with agreed terms which are documented within open controlled vocabularies.

# Ensuring E-RIHS Data, Tools and Services are **Interoperable**

## DMP

### Exploitation of agreed standard formats

- Led by heritage science experts - Identify and recommend appropriate data formats.
- Document relevant open formats to support the required use of proprietary formats



## Standards

### Agreed, open documentation

- Use of standardised models and schema to document and describe Heritage Science work and data.
- Ensure the workflows, methods and processes used can be as FAIR as the data.

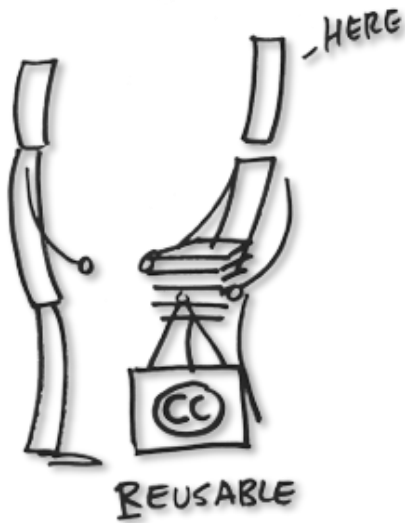
## Communications

### Good open, shared documentation

- Develop community driven approaches to data management to ensure that researchers continue to capture and publish the required documentation, metadata and data.



# Ensuring E-RIHS Data, Tools and Services are **Reusable**



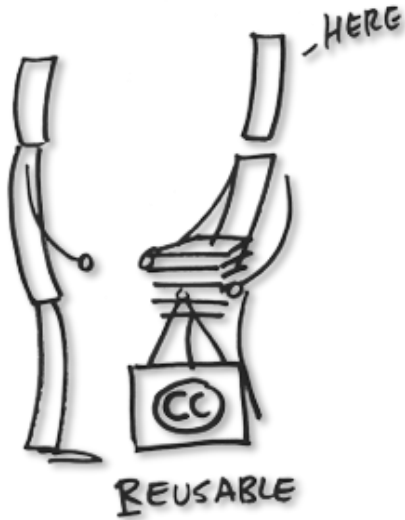
**Reusable** relates to ensuring that data are well organized, documented and clearly licenced.

# Ensuring E-RIHS Data, Tools and Services are **Reusable**

## Licences

Agreed approach to licencing.

- Where possible all resources should be published with clearly defined, standardised open licences, such the CC system.
- Embargoed or restricted access resources should still be appropriately licenced – including the dates and reason related to any restrictions.



## Sustainable

Persistent, citable digital resources.

- Future users need to trust digital resources in order to use them as the basis of future work.
- The long term sustainability plan for all digital resources should be clearer documented and presented.

# E-RIHS DIGILAB – Services and Infrastructure

## DIGILAB E-Services

Data processing and searching tools, virtual research environments, etc

## DIGILAB Expertise

Training, systems setup and development, etc

## DIGILAB Tools

Curated repository for open-source tools developed in relation to E-RIHS

## Digital Services

## DIGILAB Registry

Resource with International PID system and License Management

## DIGILAB Repository

Core data repository – including data access and information publication

## DIGILAB Data Search

Metadata search of aggregated internal and linked external data repositories

## Data Management

## E-RIHS

### Knowledge Base

Guides, HowTos, Best Practice, Educational/Training Resources/Links, Bibliographies

### Membership Hub

Single point Authentication, Members services, communications, networking, research/collaboration/E-RIHS Proposals (MOLAB, FIXLAB, ARCHLAB, DIGILAB)

### DIGILAB Resources

Curated databases or presentation tools dedicated to specific research topics

## E-RIHS Hub

## Central Authentication Service

**ORCID**  
Connecting Research and Researchers

## DIGILAB

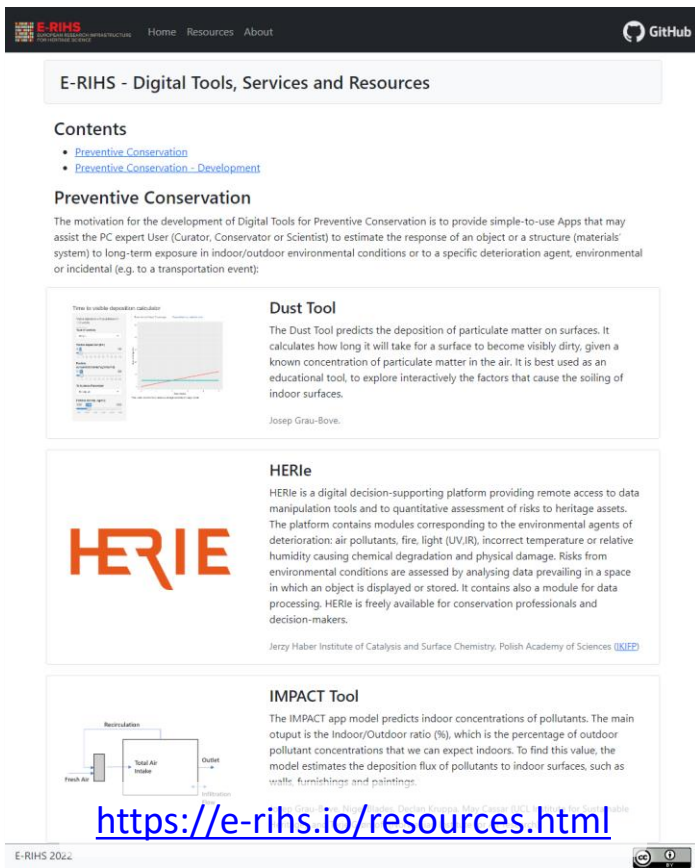
### User Rights Management

Organizing and managing service level access and permissions for E-RIHS services

## E-RIHS DIGILAB Infrastructure

**E-RIHS.digilab**  
EUROPEAN RESEARCH INFRASTRUCTURE  
FOR HERITAGE SCIENCE

# Work is already underway within IPERION-HS and E-RIHS IP



The screenshot shows the E-RIHS website with the following content:

- Navigation: Home, Resources, About, GitHub
- Page Title: E-RIHS - Digital Tools, Services and Resources
- Section: Contents
  - [Preventive Conservation](#)
  - [Preventive Conservation - Development](#)
- Section: Preventive Conservation
  - Motivation: "The motivation for the development of Digital Tools for Preventive Conservation is to provide simple-to-use Apps that may assist the PC expert User (Curator, Conservator or Scientist) to estimate the response of an object or a structure (materials' system) to long-term exposure in indoor/outdoor environmental conditions or to a specific deterioration agent, environmental or incidental (e.g. to a transportation event):"
  - Dust Tool**
    - Description: "The Dust Tool predicts the deposition of particulate matter on surfaces. It calculates how long it will take for a surface to become visibly dirty, given a known concentration of particulate matter in the air. It is best used as an educational tool, to explore interactively the factors that cause the soiling of indoor surfaces."
    - Author: Josep Grau-Bové.
  - HERIE**
    - Description: "HERIE is a digital decision-supporting platform providing remote access to data manipulation tools and to quantitative assessment of risks to heritage assets. The platform contains modules corresponding to the environmental agents of deterioration: air pollutants, fire, light (UV/IR), incorrect temperature or relative humidity causing chemical degradation and physical damage. Risks from environmental conditions are assessed by analysing data prevailing in a space in which an object is displayed or stored. It contains also a module for data processing. HERIE is freely available for conservation professionals and decision-makers."
    - Author: Jerzy Haber Institute of Catalysis and Surface Chemistry, Polish Academy of Sciences (IKIP)
  - IMPACT Tool**
    - Description: "The IMPACT app model predicts indoor concentrations of pollutants. The main output is the indoor/outdoor ratio (%), which is the percentage of outdoor pollutant concentrations that we can expect indoors. To find this value, the model estimates the deposition flux of pollutants to indoor surfaces, such as walls, furnishings and paintings."
    - Author: Josep Grau-Bové, Noé Rodríguez, Declan Knappa, May-Cecilia Rodríguez

<https://e-rihs.io/resources.html>

- Establishing a model to define new digital tools and digital based services.
- Consistent, manageable ways of presenting and promoting opportunities.
- Gathering together existing expertise and resources.

# ... but more work is required to list and highlight existing digital services

**ISAAC DIGILAB**

Building on the success of the AHRC-funded *AI for DIGILAB* project, the ISAAC Research Centre is excited to announce the launch of a new facility: the ISAAC DigiLab. This is a standalone facility, offered free of charge to non-profit organisations engaged in heritage science research.

The ISAAC DigiLab will provide spectral imaging data processing such as clustering for large data sets, using an automated methodology which was developed during our large scale survey of wall paintings at the *Mogoa-Caves UNESCO* site and other *Cultural Heritage projects*. Our user-friendly *GUI/visualisation tool* will be provided for viewing the results.

The ISAAC DigiLab can be used in conjunction with the ISAAC mobile lab facilities for data capture, or for analysis of data which are captured "in-house" by institutions which have their own analysis equipment.

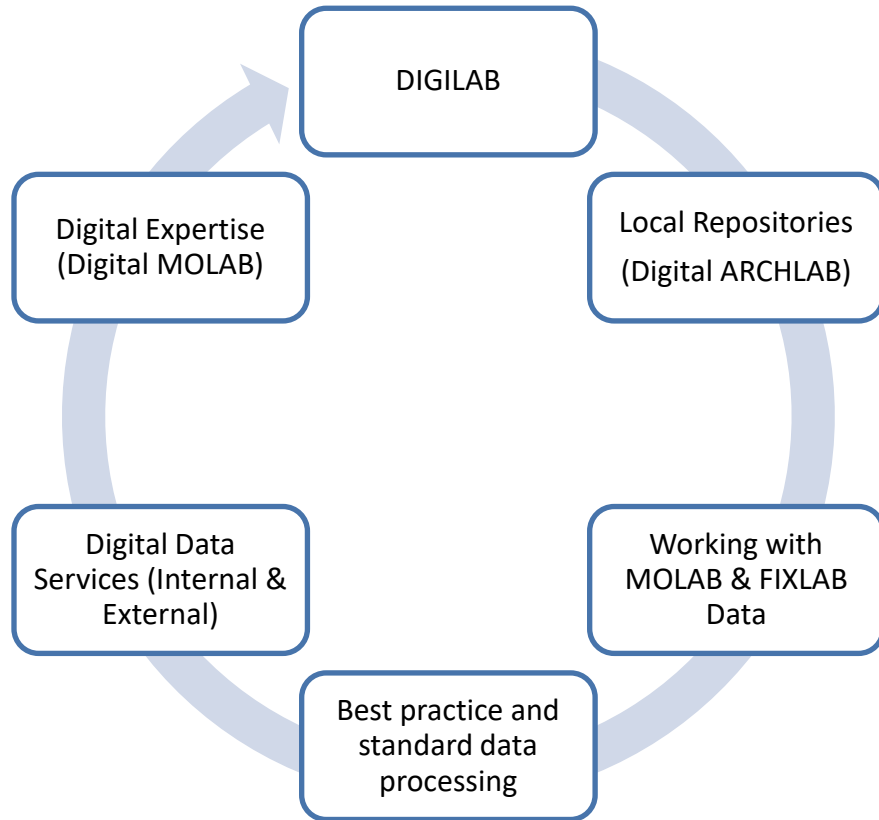
**DIGILAB WORK FLOW**

```
graph LR; Start((Start)) --> RQ[Research question identified]; RQ --> CWD{Can we collect data?}; CWD --> DC[Data collection done in-house]; DC --> PORD[Partner org uses and disseminates results]; PORD --> End((End));
```

- “Building on the success of the AHRC-funded [AI for DIGILAB](#) project, the ISAAC Research Centre is excited to announce the launch of a new facility: the ISAAC DigiLab. This is a standalone facility, offered free of charge to non-profit organisations engaged in heritage science research.”

<https://www.isaac-lab.com/isaac-digilab>

# E-RIHS DIGILAB – Enhancing existing EU services



- Working with digital resources is not new.
- Existing LABs already work digitally.
- DIGILAB will support the enhancement of existing service and work practices
- Aim to identify existing best practice digital workflows.
- Work to improve efficiency of data gathering and documentation.
- Identify and recommend key standards.

# ARCHLAB: Potential Digital Access to Archives?



- Publish digital inventories of Heritage Science archives – improving discoverability and access.
- Provide direct access to appropriate digital resources.
- Continue developing/adopting models to organize Heritage Science data, connected to Historical & Conservation resources.
  - Defining generic standards to be re-used across multiple institutions and systems.
  - Interoperability, Formats, Ontologies, Vocabularies, Software, etc.

# FIXLAB: Potential Digital Developments

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- Standardising core Data Management Plans, including the definition of key metadata terms.
- Document existing repositories currently used by FIXLAB access providers.
- Develop procedures to automatically aggregate the metadata from these repositories to populate the E-RIHS DIGILAB data index.
- Support the dissemination of best practise digital documentation between FIXLAB access providers.





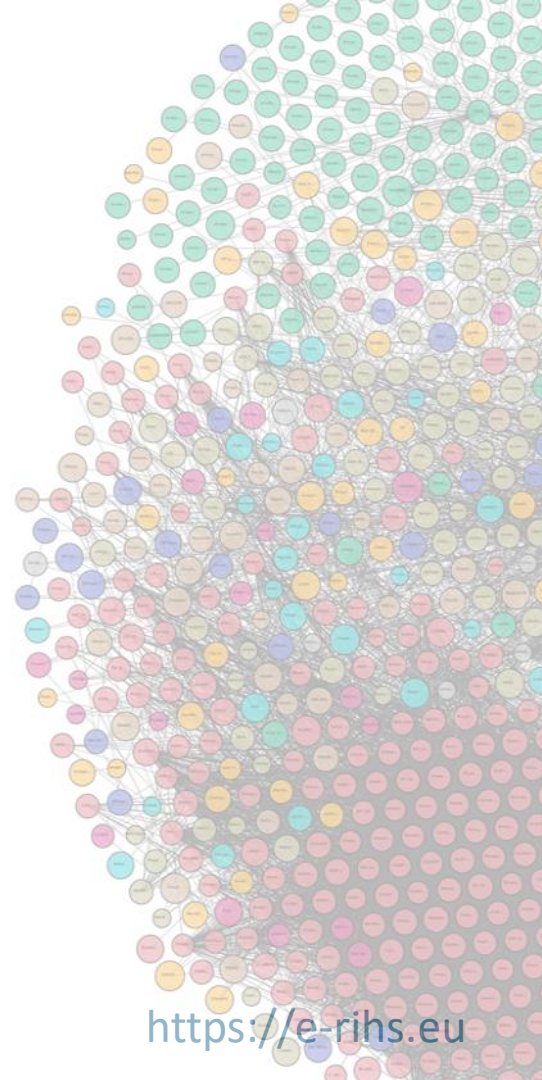
# MOLAB: Potential Digital Developments

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- Standardising core Data Management Plans, including the definition of key metadata terms.
- Document existing repositories currently used by MOLAB access providers.
- Develop procedures to automatically aggregate the metadata from these repositories to populate the E-RIHS DIGILAB data index.
- Support the dissemination of best practise digital documentation between MOLAB access providers.



**E-RIHS will be a permanent  
infrastructure not a short term  
project.**



# Not all the work is being done at the European level!

- National hubs reinforce the commitment of the E-RIHS community to create and enlarge a pan-European research infrastructure.
- **24 national nodes** including partners beyond Europe are participating in the H2020 project **IPERION HS**  
Integrating Platform for the European Research Infrastructure on Heritage Science  
funded by the European Commission under G.A. 871034



# Some example National Digital Initiatives

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- Cyprus is developing a new [digital innovation hub](#).
- The [EquipEx + ESPADON](#) project "In Heritage Sciences, the Dynamic Analysis of Old and Digital Objects" is an ambitious and unifying project, coordinated by the C2RMF in France.
- KIK-IRPA is leading a Belgium initiative to organize and provide access to digital Heritage and Heritage Science data in the [HESCIDA project](#).
- New Heritage Science digital documentation solutions are being developed within the Italian node of DARIAH.
- and the UK is beginning to develop Heritage digital infrastructure opportunities supported by UKRI under [RICHeS](#).

# Some specifically developing National DIGILAB Nodes

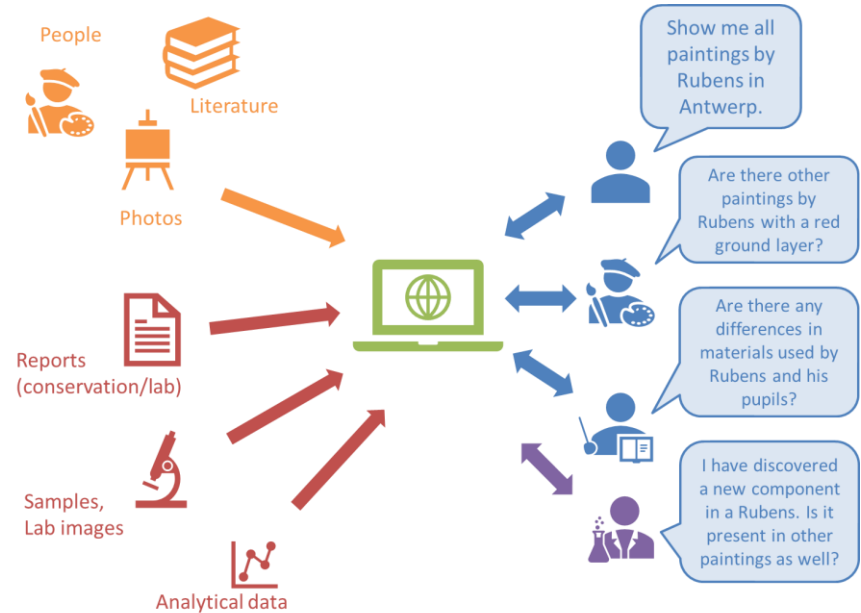


Developing a repository: **Heritage Science Data Archive** (2019-2022)  
Funded by the Belgian Science Policy (Belspo)

▪ Goal: to play a key role in European Research Infrastructures



ART & HISTORY MUSEUM



<http://hescida.kikirpa.be>

<https://e-rihs.eu>

# European and Global Digital Collaborations

- E-RIHS DIGILAB will act as hub of excellence bringing together the very best of European and Global digital Heritage Science developments.
- Supported by current and future wider digital resources, programmes and initiatives.
- Which the UK can exploit and collaborate with.



**EOSC-hub**



<https://e-rihs.eu>

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2023, 3rd May 2023

Joseph Padfield (National Gallery, London, E-RIHS)

# Thank you