DANUBIUS-PP

Preparatory Phase for the pan-European Research Infrastructure DANUBIUS–RI "The International Centre for advanced studies on river-sea systems"

Working model of the DANUBIUS-RI components and their interactions

Deliverable 5.2

European Commission

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Executive summary

The International Centre for Advanced Studies on River-Sea Systems (DANUBIUS-RI) will be a distributed research infrastructure bringing together world leading expertise and providing access to a range of river-sea systems, facilities and expertise, to provide a 'one-stop shop' for knowledge exchange, access to harmonised data, a platform for interdisciplinary research, education and training and hence provide answers to questions regarding sustainable management and environmental protection of the river-sea continuum.

Work Package 5 of DANUBIUS-PP addresses the architecture of the research infrastructure. This Deliverable sets out an initial working model of the DANUBIUS-RI components and their interactions. It is complementary to other completed Deliverables, in particular those from Work Package 5 dealing with the architecture, role and operation of individual components.

The Components comprise: the Hub; four Nodes; eight Supersites; the Data Centre; and the Technology Transfer Office. Additional Supersites, and possibly other components, will be considered during the Preparatory Phase. All components will be of equal status and work together as a unified research infrastructure.

Central management will be provided by the Director General and the Executive Team, which will work from the Headquarters of DANUBIUS-RI be based in the Hub. If the status of an ERIC (European Research Infrastructure Consortium) is achieved, it is expected that some components of DANUBIUS-RI will be within the ERIC and some outside. Depending on the resulting configuration, the management details will vary in particular regarding the interaction between central and local management and the involvement of the host institutions. In addition, there are different models for the extent of the strength of central management.

Continual interaction between all the components will be essential for the effectiveness of the research infrastructure. In particular, bidirectional flow of data will be critical. The details of data flow and storage are the subject of ongoing work in other Work Packages. While the extent to which users and stakeholders will need to interact with DANUBIUS-RI through a central point will need to be decided, the Data Portal at the Data Centre will provide access to data and metadata.

1. Introduction

The International Centre for Advanced Studies on River-Sea Systems (DANUBIUS-RI) will be a distributed research infrastructure (RI) that brings together world leading expertise and provides access to a range of river-sea (RS) systems, facilities and expertise, to provide a 'one-stop shop' for knowledge exchange, access to harmonised data, a platform for interdisciplinary research, education and training and hence provide answers to questions regarding sustainable management and environmental protection of the RS continuum. DANUBIUS-RI plans to seek ERIC (European Research Infrastructure Consortium) status as its legal identity.

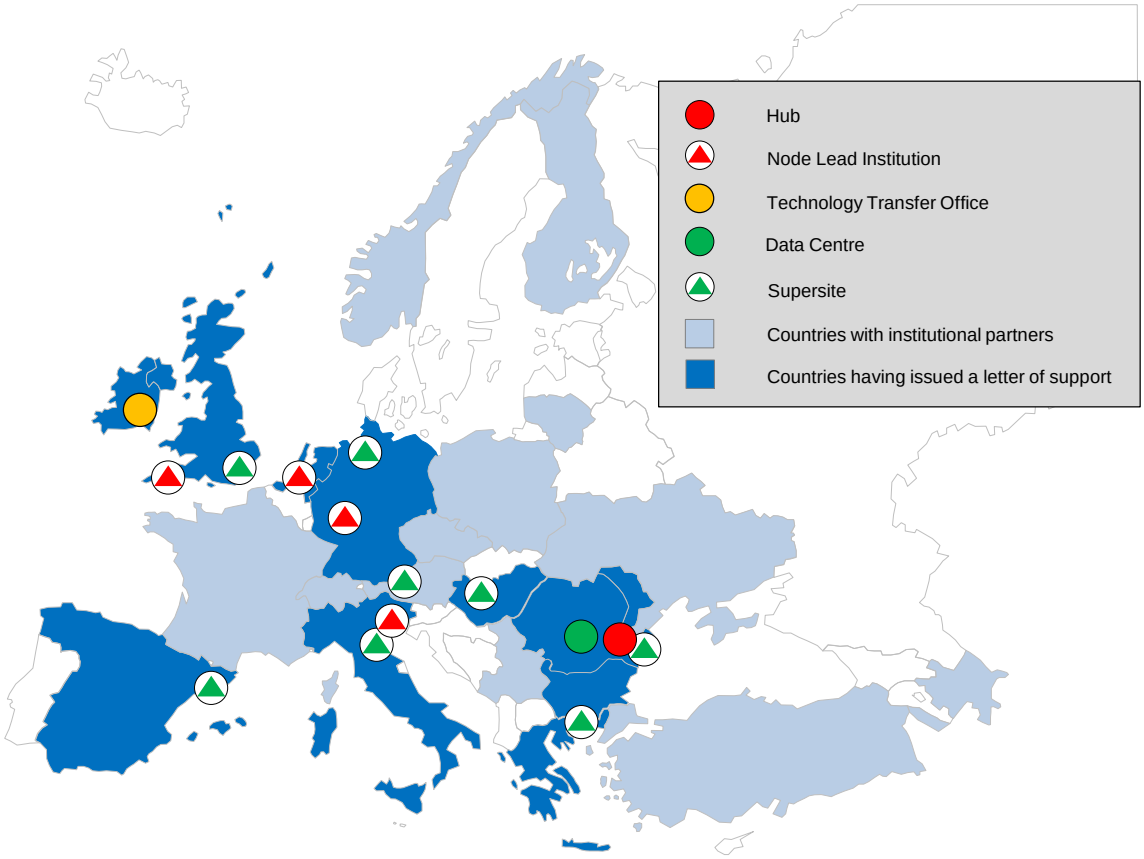

Figure 1. Map showing components of DANUBIUS-RI

DANUBIUS-PP is a three-year project to raise DANUBIUS-RI to the legal, financial and technical maturity required for successful implementation and development. It will bring together key stakeholders at different levels, and strengthen the consortium through a process of wide engagement. Individual work packages will refine the scientific and innovation agenda, the legal framework, governance and management, and policies for access and data management. It will develop the structures and processes to ensure that the RI strengthens

scientific performance by providing a sustainable basis for future operation, delivering key services to the different user communities.

Work Package 5 of DANUBIUS-PP addresses the architecture of the RI, with a set of Deliverables covering the various components and how they will work together. **Figure 1** maps the components of DANUBIUS-RI.

This Deliverable sets out an initial working model of the DANUBIUS-RI components and their interactions. It first describes each component of the RI, and its functional relationship with the others, then considers the interactions between them. It draws on other Deliverables that provide drafts in greater detail of the roles and operation of the individual components. There are areas of uncertainties where different options are discussed. Details may change during the course of DANUBIUS-PP. It should be stressed that none of the material here, going beyond what is already included in the successful bids to the ESFRI Roadmap and for H2020 funding, has yet been the subject of decisions.

At this stage, it is unclear the extent to which the component parts of the RI will be within the ERIC (DANUBIUS-ERIC). The experience of other distributed RIs that have achieved, or are currently seeking, ERIC status suggests that some components of DANUBIUS-RI are likely to be outside DANUBIUS-ERIC.

The legal seat will be in Romania, where the *Hub* and *Data Centre* will be located. The other physical components of DANUBIUS-RI will be the *Nodes*, *Supersites* and *Technology Transfer Office* and will be distributed across Europe.

The key interactions between components are operational, data and management.

2. The Hub

The Hub will be based at Murighiol at the edge of the Danube Delta in Romania. It will perform the headquarters functions of DANUBIUS-RI and provide a range of research, training and educational facilities. **Figure 2** shows the various components of the Hub. Deliverable D5.3 will report on the role and operation of the Hub.

The Hub will provide management to coordinate the activities of the Nodes, Supersites and other components of DANUBIUS-RI.

2.1 Headquarters functions

The Hub will supervise, manage and administer the operations of the RI and of the ERIC. The legal seat of DANUBIUS-ERIC will be at the Hub. It will be the base for the Director General together with some or all of the other members of the Executive Team (Operations Director, Administration Director, Science Director, Data Director and Business Development Director), together with support and administrative staff.

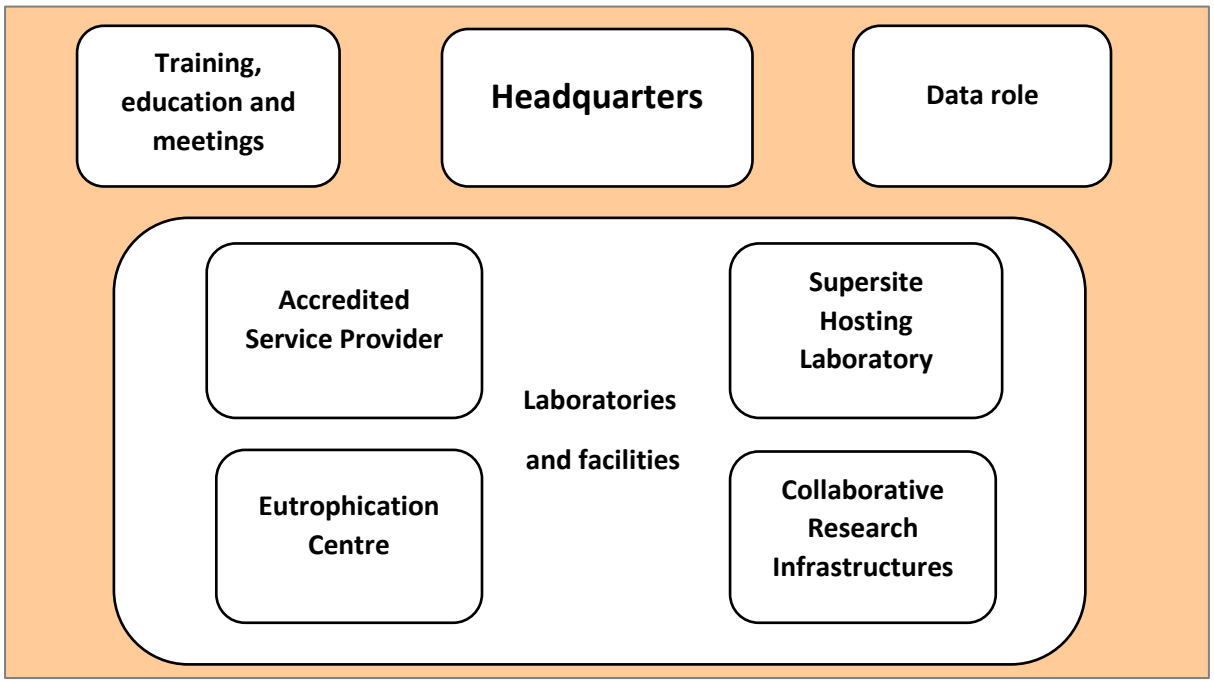

Figure 2 Components of the Hub

The Executive Team will provide leadership, governance and coordination, and operate management, audit and evaluation committees.

The Director General will be responsible for the overall direction and management, reporting to the General Assembly of DANUBIUS-ERIC.

The Operations Director, who may be based at the Hub, will have responsibility for communications (within DANUBIUS-RI, with stakeholders including governments, funding bodies and other RIs) and for relations with users of the RI's facilities and services. S/he will also have responsibility for the Nodes (Section 3) and Supersites (Section 4) through local managers at the host institutions, and for the laboratories and research facilities at the Hub (Section 2.6).

The Administration Director, who may be based at the Hub, will ensure the proper and efficient use of funds across the RI. S/he will be responsible for human resources, legal matters, finance, procurement, and internal audit.

The Science Director, who may be based at the Hub, will be responsible for developing and implementing the science strategy for DANUBIUS-RI, the DANUBIUS Commons and the Eutrophication Centre. S/he will also have responsibility for the independent, international Advisory Board which will assist in the identification of needs and opportunities.

The Business Development Director, who might be based at the Technology Transfer Office (TTO) or the Hub, will have responsibility for the TTO (Section 6) and for IPR across DANUBIUS-RI.

The Data Director, who might be based at the Data Centre or the Hub, will be responsible for data policy and management, and for operation of the Data Centre (Section 5) including the Data Portal.

2.2 Links with other research infrastructures

Developing and maintaining links with other RIs in Europe, in particular ESFRI RIs, and globally will be coordinated by the executive team at the Hub, led by the Director General. These links will be mainly through personal contact with senior staff at other RIs, through membership of integrating bodies such as ENVRIplus, a Horizon 2020 project bringing together RIs, projects and networks with technical specialist partners to create an interoperable cluster of environmental RIs across Europe. The Hub will also be at the centre of collaboration and shared infrastructures with other RIs (Section 2.5).

The Director General will lead the exploitation of opportunities for developing a global role in RS system research for DANUBIUS-RI through sharing infrastructure, expertise and ideas with RIs and other organisations outside Europe, for example in the Mekong RS system.

2.3 Training, education and meeting facilities

The Hub will be a central point for DANUBIUS-RI training and education activities. Providing state-of-the-art facilities for residential workshops and meetings, and for virtual events. For a distributed RI, videoconferencing between the Hub and other components will be an essential management and communication tool.

Training and education activities will include: international exchange of doctoral students; training programmes at all levels for scientists, technicians and administrators; and citizen science.

2.4 Host Laboratory for Danube Delta Supersite

The Hub will be the Host Laboratory for the Danube Delta Supersite (Section 4.1) and facilitate access to the Danube Delta, Lower Danube and the Black Sea. Laboratories at the Hub (Section 2.6) will undertake the primary processing of samples collected in the field and, when necessary, their immediate analysis. It will store, and provide training for the use of, field equipment. Primary digital data collected or produced by laboratory analysis will be transferred to the Data Centre. Information on non-digital data stored from the Danube Delta Supersite will be electronically maintained at the Hub.

2.5 Host Laboratory for collaborative research infrastructures

The Hub will use the laboratories and research facilities (Section 2.6) to interconnect with existing ESFRI projects and potentially other RIs. Agreement in principle has already been reached for a number of collaborations in the region of the Danube Delta and coastal western Black Sea. Greenhouse gas measurement towers will be managed jointly with *ICOS ERIC* (Integrated Carbon Observation System). Reedbeds and other aquatic and wetland plants could become experimental areas for *AnaEE* (Infrastructure for Analysis and Experimentation on Ecosystems). Deployment facilities could be provided for *Euro-Argo ERIC* (European

contribution to the international Argo Programme) to test equipment dedicated to shallow waters at RS interaction zones. A dedicated platform in the RS interaction will contribute to *EMSO ERIC* (European Multidisciplinary Seafloor and water-column Observatory). Facilities for biota collection and storage are a possible contribution to *EMBRC* (European Marine Biological Resource Centre). A network of sensors for the measurement of geodynamics (from profound to superficial subsidence) may become a contribution to *EPOS* (European Plate Observing System).

The Hub will be open to providing further facilities for collaboration with other ESFRI RIs.

2.6 Laboratories and research facilities

The Hub will establish laboratory capability that will support the Analysis Node and Observation Nodes in particular, and thereby support the activities of the Modelling and Impact Nodes. A wide range of biological and earth scientific equipment and research facilities will be housed in laboratories at the Hub. These will cover: scientific equipment construction, testing and maintenance; sampling, samples handling and sample storage; genomics and genetics; microbiology and phycology; bioanalysis, environmental toxicology; bioresources and biodiversity; microscopy and imaging; geochemistry and biogeochemistry; sedimentology; mineralogy; tectonics and structural geology; geophysics; magnetometry, gravimetry, radiometry and seismo-acoustics; remote sensing and Earth observation; hydrochemistry; hydrology and oceanology; Geographical Information Systems (GIS).

The Head of the Hub laboratories and research facilities, with the possible exception of the Eutrophication Centre (Section 2.8), will report to the Operations Director.

2.7 Accredited Service Provider

For many of its research capabilities, the Hub will attain the status of an Accredited Service Provider (ASP) (Section 3.5) for some or all of the four Nodes (Section 3). This role is particularly important in helping to overcome the lack of RI competence and capacity in South-Eastern Europe. The Hub will work with the Nodes to encourage ASP accreditation of further research laboratories in the region.

2.8 Eutrophication Centre

The Hub will provide a research centre to develop an integrated interdisciplinary approach to research on eutrophication of freshwater, marine and transitional ecosystems. While making use of Hub laboratories and research facilities described in Section 2.6, it will have the status of a self-standing centre within the RI and will be a demonstrator project for the approach adopted by DANUBIUS-RI. It will lead and coordinate collaborative activities with the Nodes and Supersites.

The Head of the Eutrophication Centre will report to the Science Director or Operations Director.

2.9 Data role

Local storage will be provided for data collected at the Hub, including the Danube Delta Supersite, with synchronisation to the main data storage at Nodes and the Data Centre (Section 5). The Hub might also be used as backup for storage and services of the Data Centre.

To enable the data role of the Hub, Murighiol will be connected to the optical fibre network to connect with the Data Centre.

3. Nodes

The Nodes will be key components of the RI as centres of recognised thematic expertise entrusted with the task of developing, implementing and maintaining the quality of the DANUBIUS Commons in their areas of expertise. In the current configuration, Nodes are planned to cover Observation, Analysis, Modelling and Impact. Other Nodes may be added in the light of developments and need.

Nodes will be hosted by Leading Laboratories, chosen for their recognised scientific excellence in the area of expertise. They can appoint Accredited Service Providers (Section 3.5). Nodes will provide facilities and services, data storage and provision, experimental and *in situ* measurements facilities, state-of-the-art analytical capabilities and implementation of standardised procedures to users. They will provide interfaces with regional and local stakeholders, enhancing knowledge exchange and innovation. The four initial Nodes will have Leading Laboratories in the UK (Observation Node), Germany (Analysis Node), Italy (Modelling Node) and The Netherlands (Impact Node).

Under the coordination of the Leading Laboratories, extra needs – both for facilities and geographical coverage – will be identified. These needs will be satisfied by ASPs (Section 3.5) - facilities to be developed or built under the coordination of the Leading Laboratories and respecting the DANUBIUS Commons: the set of harmonized methods, protocols, instruments, data acquisition and management implemented across DANUBIUS-RI, to guarantee the consistency and quality of scientific output.

The Nodes, working with the Operations Director and Science Director (Section 2.1) will be responsible for ensuring full implementation of the DANUBIUS Commons across the Supersites.

Nodes will also have a role in developing links with local and regional stakeholders in government in the public and private sectors.

The Operations Director will have responsibility for the Nodes, working through Node Managers and local managers at the host institutions of the Leading Laboratories and ASPs.

Deliverable D5.4 will report on the role and operation of the Nodes, including rules for selection and development of Leading Laboratories and ASPs.

3.1 Observation Node

The Leading Laboratories for the Observation Node will be in the UK: Plymouth Marine Laboratory (PML) and the University of Stirling (USTIR). PML will lead on operational data processing and USTIR on calibration, validation and training. The two laboratories will work together on research issues.

The Node will ensure that data are acquired and integrated from *in situ* sensor networks and satellites, processed and distributed. It will develop, and provide access to, state of the art analytical research facilities for bio-optics and remote sensing research. It will be responsible for standardisation of procedures, including of instrumented buoys and sampling across Supersites (Section,4) for EO validation, calibration of instruments, sensor network development, training and capacity building.

It will assess laboratories for ASP status (Section 3.5).

3.2 Analysis Node

The Leading Laboratory for the Analysis Node will be the Federal Institute of Hydrology (BfG) in Germany.

The role of this Node is to ensure consistency and reliability in analytical techniques to enable a common evaluation and effective comparison between research groups operating within and between Supersites, and other observation and experimental sites. It will provide access to state-of- the-art scientific expertise, laboratories, instrumentation and methodologies to identify anthropogenic impacts and their processes and interactions. This includes analytical capability across disciplines in geology, hydrology hydromorphology, chemistry, biology, ecotoxicology and hygiene.

It will assess laboratories for ASP status (Section 3.5).

3.3 Modelling Node

The Leading Laboratory for the Modelling Node will be the CNR Institute for Marine Science (ISMAR) in Italy.

Numerical modelling tools are pre-requisites for delivering well-informed management information in RS systems. Modelling is one of the major services provided by DANUBIUS-RI, drawing on the inputs in particular from the Nodes and Supersites. This Node will integrate data collected from Supersites, and other observation and experimental sites, in models that simulate specific processes, interpolate between available measurements and carry out forecasts and 'what if?' predictions. It will provide a technological advanced platform for modelling services, in terms of software and shared data.

It will assess laboratories for ASP status (Section 3.5).

3.4 Impact Node

The Leading Laboratory for the Impact Node will be Deltares in the Netherlands.

It will integrate technical knowledge on RS systems (including water, subsurface and infrastructure) with governance and policy-making for problem-solving. It will develop and test concepts, methods and instruments. Methods and instruments may be focused, for example, on accelerating design and decision making (e.g. by using a decision theatre), improving quality and decreasing the costs of spatial planning in RS systems. Methods and instruments may also focus on how to better cope with uncertainties in decision making processes, how to involve stakeholders (e.g. in knowledge co-creation), and on spanning the boundaries between the different science disciplines involved in DANUBIUS-RI (e.g. by the development of a common language).

Methods and instruments developed will help to transfer and apply knowledge in practice to deal with issues in highly complex dynamic RS systems. It will transfer scientific outputs from

DANUBIUS-RI to managers of RS systems and, through innovation, transfer knowledge, products, services and spinoffs to the business sector. It will work closely with the Technology Transfer Office (Section 6).

It will assess laboratories for ASP status (Section 3.5).

3.5 Accredited Service Providers

In addition to the Leading Laboratories, Nodes will include ASPs - laboratories or facilities accredited to provide specific scientific expertise, capability or technical capacity to a Node.

To be accepted for accreditation the laboratory or facility will be assessed to ensure that it satisfies all requirements. These concern the obligation to apply the relevant aspects of the DANUBIUS Commons, location in an ERIC Member State, and a clear need in terms of Node capability or capacity. Responsibility for assessing and accrediting ASPs will fall to the individual Node Managers and the Operations Director, with the details of respective roles to be decided.

Deliverable D5.5 will provide a list of ASPs required.

3.6 Data role

The Nodes will provide primary storage and analysis facilities for data derived not only from the Nodes themselves, but also from Supersites and elsewhere. Data will generally be stored, managed and analyses by the data and computing facilities of the Leading Laboratories though, where necessary or advantageous, other arrangements will be considered. For example, data storage at individual Supersites might be an option.

Connectivity between the Nodes and other components is discussed in Sections 7-9.

4. Supersites

Supersites are study sites that provide the focus for observation, analysis, research and modelling at locations of high scientific importance and opportunity across RS systems, from source to coastal sea. There is an initial suite of eight Supersites but proposals for additions will be considered during the Preparatory Phase.

Each Supersite will have a single Host Laboratory or a hosting group of institutions responsible, at local level, for the implementation, maintenance and user support in accessing the Supersite. The Host Laboratory will be responsible for managing a coordinated observation programme, providing field facilities, facilitating field access, and capturing data.

If a hosting group provides services or facilities for the Supersite, one laboratory should be in the lead as the single Host Laboratory with a Supersite Manager who may have a support team from others in the hosting group.

The full suite of Supersites will include transition zones such as between freshwater and marine (deltas, estuaries) or groundwater and surface water. Wherever possible, there will be a symbiotic relationship between DANUBIUS-RI and other pan- European RIs in the use of Supersites. The Hub will be the Host Laboratory for the Danube Delta Supersite. It will also provide site facilities for several other RIs (Section 2.5).

Supersites will be the main generators of DANUBIUS-RI data and the flow of data between them, the other components parts of the RI and the Data Centre will be the lifeblood of DANUBIUS-RI.

Deliverable D5.6 will report on the role and operation of the Supersites, including rules for selection and development of Host Laboratories.

4.1 Selection of Supersites

Selection of Supersites will be based on the following criteria: scientific relevance and importance, added value to DANUBIUS-RI, existing or potential strong Host Laboratory, existing or potentially strong local and/or regional community of stakeholders, and existence of financial and political support.

The initial suite of eight Supersites, together with their Host Laboratories, is as follows:

- Danube Delta, Romania - DANUBIUS-RI Hub
- Ebro-Llobregat Deltaic System - Universitat Politècnica de Catalunya (UPC)
- Elbe Estuary, Germany - Helmholtz Zentrum Geesthacht Centre for Materials and Coastal Research (HZG)
- Lake Lunz, Austria - WasserCluster Lunz (WCL)
- Nestos – Hellenic Centre for Marine Research (HCMR) and partners
- Po Delta and North Adriatic Lagoons - Consortium for Coordination of Research Activities concerning the Venice Lagoon System (CORILA)
- Szigetkoz, Hungary - Széchenyi István University (SZIU)
- Thames Estuary, UK - Centre for Ecology and Hydrology (CEH)

Three further candidate Supersites (Guadalquivir Estuary, Spain; Rhine/Meuse Catchment, Germany/Netherlands/Belgium; Tay Catchment, UK) will be assessed during the course of the Preparatory Phase.

Proposals for additional Supersites will be assessed by the Operations Director and Science Director in collaboration with the Nodes.

4.2 Operation of Supersites

Supersites will operate in two main ways: continuous or continual production of data made available online through the Data Centre, and provision of access for DANUBIUS-RI researchers to undertake sampling and measurements.

Each Supersite will have a set of observations and analyses determined by the Nodes and undertaken, or coordinated, through the Host Laboratory. Some of these will be from a list of common parameters and some will be specific to an individual Supersite. Standards for the collection of data will be defined by the Nodes.

5. Data Centre

The Data Centre, in Romania, will be the main site for managing and analysing DANUBIUS-RI data. It will house the DANUBIUS-RI Data Portal, providing access to metadata and data by users and stakeholders. The Data Centre is the DANUBIUS-RI portal to the community of users and the connection with other major e-Infrastructure initiatives in Europe and elsewhere. In this respect it will be the 'front door' of the RI. Deliverable D5.7 will report on the role and architecture of the Data Centre and Data Portal.

The Data Centre will provide a set of high-availability services to the research and academic community, in particular:

- collecting all data from Nodes, Supersites and other sites involved or associated with DANUBIUS-RI
- storing the primary data
- aggregating the data by different criteria
- providing the necessary computing power and storage space for modelling the data or digital simulations
- storing and classifying the results of modelling with the associated metadata
- providing search functionalities.

It will provide a backup for data stored at Nodes and at Supersite Host Laboratories. Online storage will need to have fast accessibility, with 24/7 availability, by designated servers. Offline storage will be secured at a separate location.

6. Technology Transfer Office

The Technology Transfer Office (TTO) will be based in Ireland and its Head will be responsible to the Business Development Director. This Office will aim to ensure that the contracts between DANUBIUS-RI and external partners fully represent the best interests of the RI. As such, its primary objective will be to engage with relevant industries and increase the number of developments and innovations and ensure these are effectively exploited for the advantage of both individual innovators and DANUBIUS-RI as a whole.

Whilst this will build upon existing technology transfer expertise in University College Cork and other Consortium Partners, it must be recognised that there are significant challenges in having a single TTO based in one country that represents a number of entities and infrastructure located in different jurisdictions. Despite most partners in DANUBIUS-PP currently being part of the EU, different implementation agreements and legal considerations exist at national level and therefore there is need to agree a common approach for DANUBIUS-RI that satisfies all involved.

Deliverable D5.8 will report on the role and operation of the TTO, while Deliverable D5.9 will define technology transfer and IP considerations. The draft report for Deliverable D5.8

suggests approaches to agreeing a common vision for DANUBIUS-RI, but this will need to evolve and be discussed thoroughly before a final decision on the role and operation of the TTO is made and included in the final Deliverable D5.8 report to be produced at the end of Year 2 of DANUBIUS-PP.

7. Operational interactions

All the components are of equal status and importance for the operation of DANUBIUS-RI. For success, they need to work together in a dynamic and interactive partnership rather than as a network of self-standing parts. Of particular importance for the smooth running of DANUBIUS-RI will be the interactions between Nodes and Supersites.

An important moderator of all interactions will be the DANUBIUS Commons – the set of standardised procedures and quality control across all aspects of the operation of DANUBIUS-RI, including observation, analysis, data and management. It will impact particularly on Supersites, but also on all the components of the RI and the interactions between them. The Nodes will lead on the establishment of procedures and quality standards under the direction of the DANUBIUS-RI Science Director.

Other areas of interactions (in addition to data interactions in Section 8 and management interactions in Section 9) may be less easy to codify but it will be important to have systems to ensure continual communication and interactions between all components.

There is a need for continuous and bidirectional communication between the TTO and both the Nodes and the Supersites. Information on requests by stakeholders, requirements and observations from the various categories of end-users, together with existing or emerging business opportunities, must be communicated to both the TTO and the Headquarters. The TTO will, with the support of the Executive Team, provide the required advice, and specify the strategies for their implementation.

8. Data interactions

For a distributed RI such as DANUBIUS-RI, with major requirements for data management, storage, transfer and analysis, effective data connectivity between the components of the RI is critical. There will be two-way flow of digital data between all the individual components of the RI. Of particular importance will be bidirectional data flow between Supersites and Nodes. The Observation Node will be responsible for the acquisition of EO data (satellite, airborne, drone, in-situ) and deliver processed data (including near real time) to the RI through web interface and data will be archived at the Node and the Data Centre.

By using the services of GEANT (the pan-European research and education network that interconnects Europe's National Research and Education Networks (NRENs)) the collecting sites (eg Supersites), processing sites (eg Nodes) and storage sites (eg Data Centre) of useful

data within DANUBIUS-RI will be interconnected. Research and education organisations within a country can access GEANT services using facilities of NRENs that offer connectivity.

Access to data by researchers and stakeholders will be through the Data Portal (Section 5).

Deliverable D8.3 will be a study of the options, using GÉANT, for linking the Data Centre and other components of the distributed RI. Interconnectivity design will be addressed by Deliverable D7.5, covering the Data Centre, sites, storage capacities, transfer requirements and protocols, options and technologies, and by Deliverable D5.10 on the role and operation of the ICT infrastructure.

9. Governance and management interactions

The interactions between the components of DANUBIUS-RI will be driven by the governance and management arrangements, both for DANUBIUS-ERIC and the wider DANUBIUS-RI, that are decided. These are in terms of both the legal identity of the RI and the management model that is adopted.

9.1 Legal identity

Deliverable D 3.1, with the endorsement of the DANUBIUS-PP General Assembly at its second meeting in May 2017, has concluded that the most appropriate legal identity is the European

Research Infrastructure Consortium (ERIC) and agreed that this should be sought for DANUBIUS-RI. An ERIC will require all DANUBIUS-RI partners, including the home organisations of the components, to be from countries that are members of DANUBIUS-ERIC. This does not, however, mean that all components have to be within the ERIC: the RI may be wider than the ERIC. Existing ERICs have some components within, and some outside, the ERIC. Decisions on whether each component is within the ERIC is likely to be taken at a national level.

Figure 3 shows, diagrammatically, three scenarios for the relationship between DANUBIUS-RI and DANUBIUS-ERIC. Scenario A depicts all components of the RI within the ERIC. Scenario B depicts only the Hub within the ERIC, with all other components outside. Scenario C depicts the Hub and some other components within the ERIC, and some components outside. From the experience of other ERICs, and of environmental RIs seeking ERIC status, Option A appears to be unlikely.

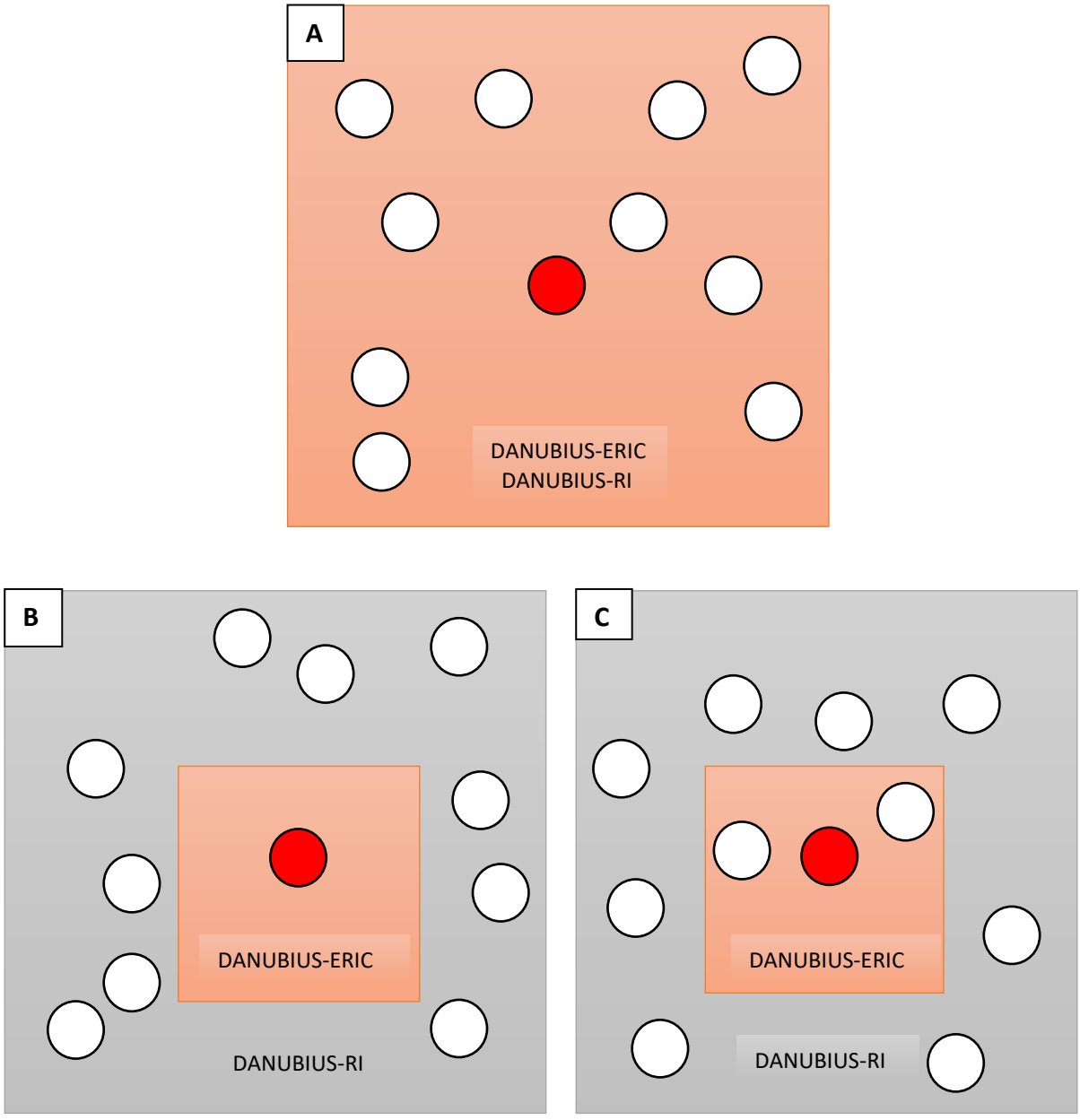

Figure 3. Diagrams to show three scenarios for position of components within or outside the ERIC (Hub – red circle; other components – white circles)

9.2 Management model

The three scenarios from **Figure 3** are shown in **Figure 4**, which also summarises the management arrangement for each.

	All Components within ERIC	Hub within ERIC. Other components outside ERIC	Hub and some components within ERIC. Other components outside ERIC
Summary management arrangements	All staff employed by, or seconded to, ERIC. Single management pyramid.	Only Hub staff employed by ERIC. Other staff employed by, or seconded to, hosting organisations. Management set out in contracts between ERIC and non-Hub components.	Staff at components within ERIC employed by, or seconded to, ERIC. Other staff employed by, or seconded to, hosting organisations. Management set out in contracts between ERIC and components outside ERIC.
Examples of other RIs	?	EMSO-ERIC EPOS (proposed)	ICOS-ERIC LifeWatch-ERIC

Figure 4. Three scenarios for relationship between DANUBIUS-RI and DANUBIUS-ERIC

Managing the relationship is more straightforward with components inside the ERIC: even though contracts will be needed with the host organisations of the components, the ERIC statutes may stipulate that management is the responsibility of the ERIC rather than the host organisation. In contrast, for components outside the ERIC, contracts between the host organisations and the may stipulate joint management arrangements.

If all components are within the ERIC, management is conceptually straightforward with a management pyramid peaking through the Executive Team with the Director General. For components outside the ERIC it is less straightforward with the additional involvement of local management within the host organisations of the components.

A separate, and important, component of the management model is the way in which the Director General, and her/his Executive Team, operate. There is a cline between 'strong' and 'light-touch' management models. At one extreme, under the strong management model, all access to the DANUBIUS-RI services and facilities are made through the Headquarters (ie controlled by the Executive Team) and the Nodes and other components have few

responsibilities to make policy or operational decisions[1] without reference to the Executive Team.

At the other extreme, light-touch management from the Director General and Executive Team allows researchers to seek access directly to Nodes and Supersites, and gives components considerable responsibility for policy and operational decisions. In this way DANUBIUS-RI becomes a network coordinated by the senior management. It is likely that a management model somewhere between these two extremes will be chosen. **Figure 5** shows examples of interactions under different management models.

	Strong management model	**Intermediate management model**	**Light-touch management model**
Application for access to facilities and services	Headquarters manages Application Panel with reference to relevant component(s)	Agreed process involving both Hub and relevant component(s)	Relevant component(s) manages Individual Application Panel without reference to Hub
Request for help on IPR	Initially considered by Headquarters then passed to TTO	Agreed process involving both TTO and Headquarters	Considered by TTO without reference to Headquarters
Proposal for additional ASP for a Node	Headquarters assesses strength of proposal, with reference to Node, and makes recommendation to GA		Node assesses strength of proposal and makes recommendation to GA
Replacement of field equipment installed at Supersite	Decision made by Hub with reference to Supersite and relevant Hub	Decision made by relevant Node with reference to Headquarters	Decision made by Supersite without reference to Headquarters or relevant Node
Assessing national call on service/ facility outside DANUBIUS-RI	Headquarters decision	Headquarters to delegate decision to local Evaluation Panel	Local decision

Figure 5. Examples of how different management models might work[2]

[1] It is important to recognise that such decisions are those within the competence of DANUBIUS-RI managers, rather than the General Assembly which will be the main decision-making body of DANUBIUS-ERIC

[2] In this Figure, 'Node' is shorthand for the Leading Laboratory and 'Supersite' for the Host Laboratory

The operation of an agreed management model will be set out in the details of the ERIC statutes and of the contracts between the ERIC and outside components. It will also be driven by how panels management committees are established and which managers, from which components, are involved.

10. Conclusions

The components of DANUBIUS-RI are generally well defined and described in draft in Deliverables D5.3 – D5.10. They have evolved from, but are not substantially different to, the structure set out in the ESFRI and H2020 proposals. The interactions between them are set out in this Deliverable in general terms. The main areas for further work before the details can be agreed are on the management model, on data storage and on ICT infrastructure.

DANUBIUS-PP

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