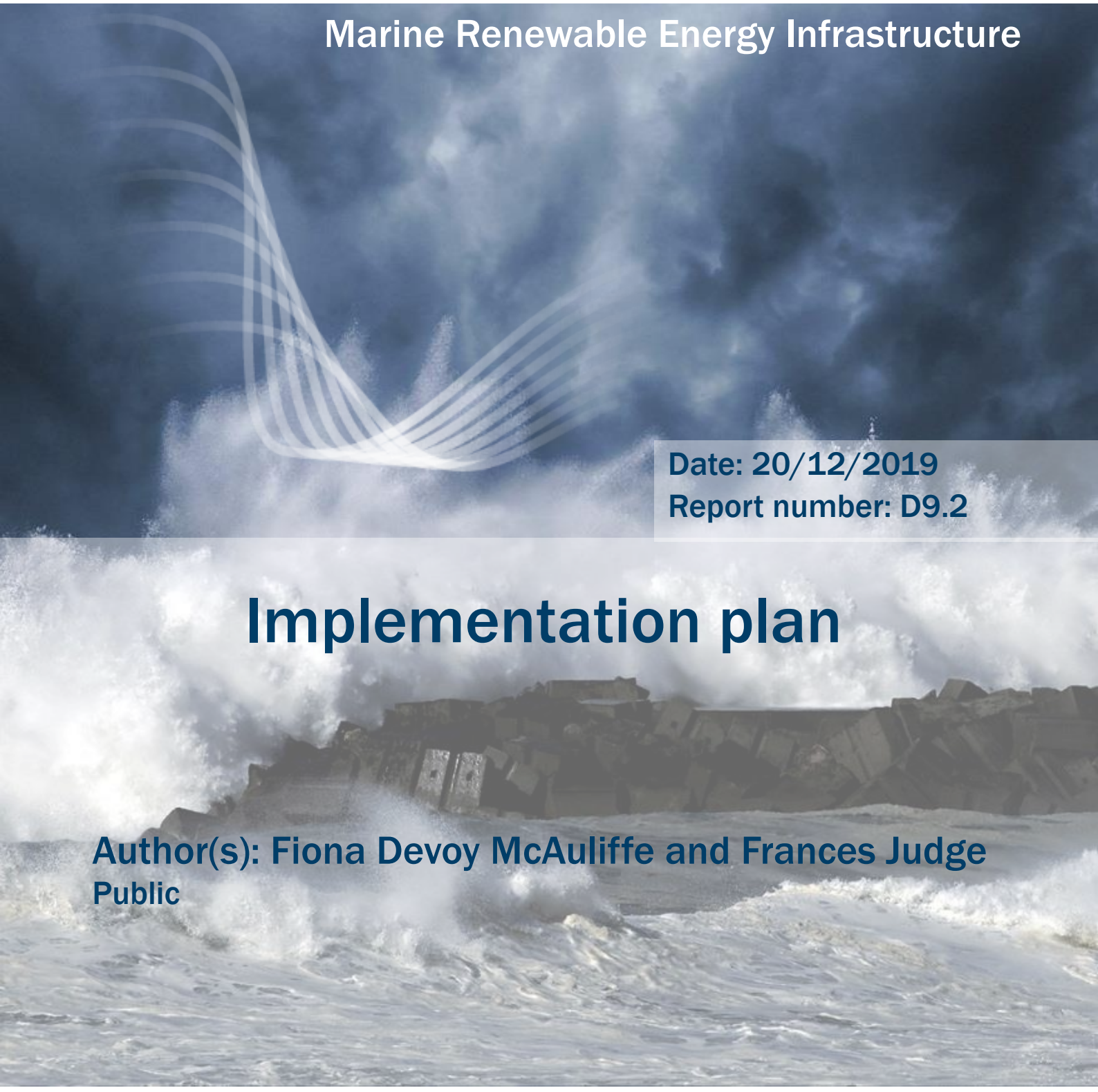
marinerg-i

Marine Renewable Energy Infrastructure



Date: 20/12/2019
Report number: D9.2

Implementation plan

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Public

This project has received funding from the European Union's H2020 Programme for research, technological development and demonstration under grant agreement No. 739550

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Document Information

Version	Date	Description			
		Responsible	Authors	Reviewed by	Approved by
0.1	17/12/2019	UCC	Fiona Devoy McAuliffe and Frances Judge	All partners	Fiona Devoy McAuliffe

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Abbreviations

CMO	Central Management Office
DRI	Distributed Research Infrastructure
EOC	Expression of Commitment
EOI	Expression of Interest
ERIC	European Research Infrastructures Consortium

ESFRI	European Strategy Forum on Research Infrastructures
LOI	Letter of Interest
MOU	Memorandum of Understand
ORE	Offshore Renewable Energy

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1. Introduction

The world is transitioning to more sustainable energy sources and Offshore Renewable Energy (ORE) has the potential to make a significant contribution. The H2020 MARINERG-i project has developed a plan for an integrated European Research Infrastructure of testing facilities; an independent legal entity, designed to facilitate the future growth and development of the ORE sector. This herein will be known as the MARINERG-i Distributed Research Infrastructure (DRI).

Following an application to the 2016 European Strategy Forum on Research Infrastructures (ESFRI) roadmap, the proposed DRI was identified as an emerging Research Infrastructure of European significance. Evidence of the benefits of a coordinated approach were provided by the FP7 funded MaRINET and subsequent H2020 MaRINET2 projects. Consisting of 45 infrastructures operated by 36 research centres across Europe, MaRINET successfully delivered joint research to improve the quality of testing outcomes, a functional network, and a high demand access programme. However, these efforts have a limited impact given their transient nature. It is time now to transition to a fully integrated and long-term approach.

MaRINET was very well received by the research infrastructures, the ORE industry and national funding agencies that are now supporting MARINERG-i. The proposed DRI will extend existing programmes and seek additional mechanisms to support a sustainable collaboration. The H2020 MARINERG-i project was a first step in forming an independent legal entity of distributed testing infrastructures, united to create an integrated centre for delivering ORE.

The MARINERG-i H2020 INFRADEV-02-2016 project comprises 14 partners from 12 countries interested in participating in the proposed DRI. Project Partners have joined together to complete the studies required, developing a comprehensive vision and model for the proposed DRI. Output is being periodically evaluated by a Transnational Advisory Committee composed of 9 international experts. The TAC was selected so as to be as representative as possible of the different categories of stakeholders associated with the testing of ORE devices in the context of ESFRI. Project results will ensure that the DRI model attains the criteria necessary for a successful application to the roadmap in 2021.

The project key aims included:

- Broaden the number of member states involved
- Secure further national support from partners
- Develop a business plan including governance, legal, financial and strategic issues
- Create a design study and scientific plan
- Create and agree an implementation plan.

This deliverable addresses the final point, outlining the plan for implementing the MARINERG-i DRI through the different phases of ESFRI roadmap lifecycle (from concept, design and preparatory work to implementation, operation and decommissioning). The document is broken down into preparatory work and planning. These outline the design work that has been undertaken during the project (including further actions required) and a plan of work that will be undertaken in the subsequent phases respectively. This seeks

to address the majority of the Implementation section of the ESFRI application questionnaire (section C).

2. Preparatory work

2.1. Vision and mission

By consolidating expertise, investment and access to infrastructures, the DRI will foster innovation across a variety of ORE technologies and stages of development. As the only integrated ORE platform of this scale worldwide, it will be the epicentre of this developing industry.

The DRI mission is to:

- Drive the development of innovative, investable ORE technologies by
  - Streamlining research, testing, training & user access
  - Adopting common codes of practice for uniformity in testing performance metrics, validation and certification
  - Implementing an e-infrastructure platform for remote access & secure data storage and analytical services
- Accelerate the development of the ORE industry by leveraging and combining local/regional knowledge and capacity.
- Inform national and EU policy and infrastructure investment strategies to sustain global leadership and reputation in the ORE sector.

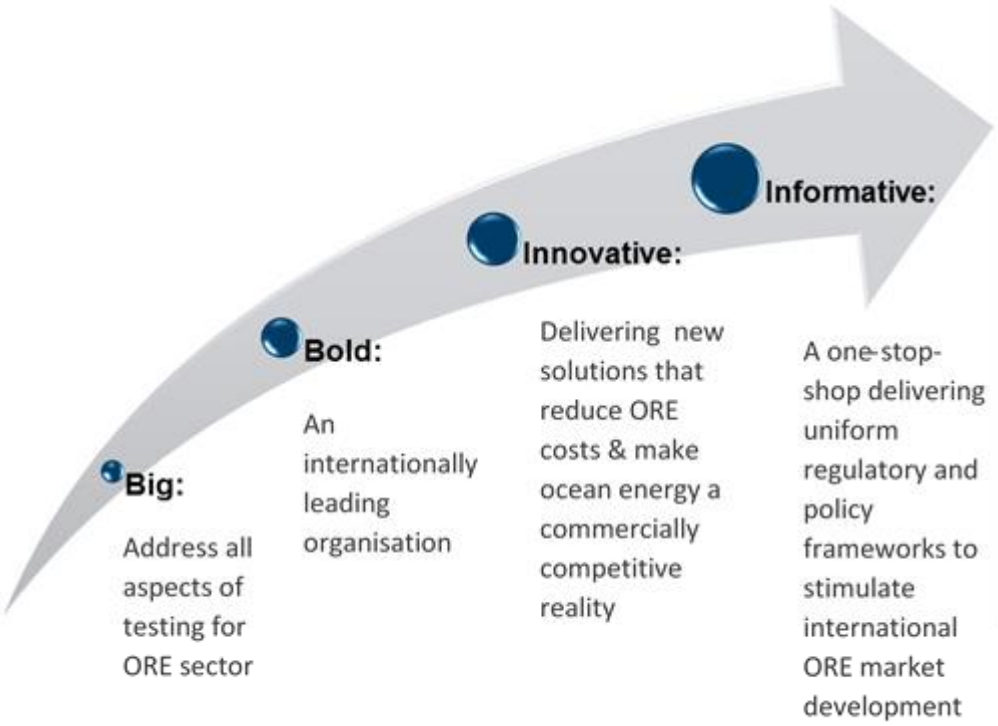


Figure 1 Vision of the MARINERG-i DRI

The core values can be summarised as follows:

- Excellence and commitment

- Openness and accessibility
- Open science and sustainability
- Cross-border, cross-marine energy research
- Collaboration, cooperation and quality assurance
- Standardisation and interoperability
- Knowledge dissemination

2.2. Stakeholder community

2.2.1. RI members and continued engagement strategy

At the close of the H2020 MARINERG-i project, Table 2-1 provides an overview of the current prospective participants of the proposed DRI as well as their status in terms of signed Memorandum of Understanding (MoU); Expression of political support (EOS) letter; and Expression of financial commitment (EOC) letter. There are currently eight research institutes (proposed lead nodes and core participants) who have signed or are expected to sign an MoU; six countries who are expected to provide an EOS; and the lead node (Ireland) who are expected to provide an EOC. It should also be noted that a number of additional research institutes have been identified as prospective participants and are expected to either sign the MoU or a Letter of Interest (LOI).

Table 2-1 Overview of current MARINERG-i DRI prospective participants and status

Country	National Node's location	National Node's name; other institution(s)	MoU / LOI	EOS	EOC
Ireland	Cork	University College Cork (ERI, MaREI, LIR NOTF)	Yes	*Expected*	*Expected*
UK	Strathclyde	University of Strathclyde; Plymouth, Exeter, Queens and EMEC	Yes from Strathclyde and LoI signed by other institutions	*Expected UK ESFRI application due by Feb 10. EoS will come out of that process, from EPRSC (academic) and Innovate UK (industrial).*	*Expected*
Belgium	Ghent	University of Ghent	Yes	*Expected – have already completed national ESFRI application*	*TBC*
France	*To Be Confirmed (TBC)*	THeoREM	*Expected*	*Expected – submitted national ESFRI application. Decision in Feb 2020.*	*TBC*
Portugal	Lisbon	WaVEC	Yes	*Expected*	*TBC*
Spain	Canary Islands	PLOCAN	*Expected*	*Expected – need to complete national ESFRI application*	*TBC*
Norway	Trondheim	SINTEF Energi AS	Yes	*Not possible prior to application due to*	*Not possible prior to application due to*

		(SINTEF Energy Research)		*national roadmap application process*	*national roadmap application process*
Italy	Rome	CNR	*Expected*	*Possible – completing the National ESFRI application 15th December 2019*	*TBC*
Netherlands	*TBC*	*TBC*	*TBC*	*TBC*	*TBC*
Germany	*TBC*	*TBC*	*TBC*	*Unlikely at this time as national application requires all EOS and EOC from other participants in advance*	*Unlikely at this time as national application requires all EOS and EOC from other participants in advance*
Sweden	*Probable no at this stage*				
Denmark	*Will not be involved in application*				

The support already secured during the MARINERG-i project exceeds the eligibility requirements stated in the ESFRI application (EOS and EOC from the lead node; EOS from at least 2 other prospective member countries; MoU from core participants (min. of 3) i.e. research institutes). It also exceeds the level of support for the previous application to the 2016 ESFRI roadmap.

There is still some work to do between the end of the H2020 project and submission of the application to finalise the letters and signatures that are listed as expected. The following steps have been taken to ensure this is achieved:

- National champions have been identified by the project to pursue these from their respective institutions and governments via their respective national ESFRI process;
- A package of documents including an overview of the proposed DRI; a presentation to support the overview; templates for the EOS; EOC and LOI;
- A template of the application with inputs to provide guidance for partners for their respective national ESFRI applications where relevant (this isn't required in every country).
- A deadline of 1st April 2020 has been given for National champions to supply the required documentation as the ESFRI application is to be submitted on 5th May 2020.

It should be noted that where there is a National ESFRI roadmap application process, it is anticipated that the proposed DRI will subsequently be listed in the respective national roadmap. Where there is no official process, National Champions will seek to include it in the next draft of national strategic documents e.g. the Irish Offshore Renewable Energy Development Plan etc.

Where "TBC" is listed the project is currently unsure of the status and are still in discussions with the respective National Champions to clarify and/or propose a plan for future engagement as the MARINERG-i DRI develops.

2.2.2. Other stakeholders

In addition to the core group described in section 2.2.1, other European RIs were identified via a profiling study (WP2 and 3) as having the capacity to contribute to fulfilling MARINERG-i objectives. Strategies for their future integration into the DRI were discussed during the stakeholders' meetings held in each of the participating countries.

Other groups of stakeholders having different levels of interaction with the MARINERG-i DRI were identified:

1. Other entities having the capacity for performing tests of ORE technologies, but are not part of MARINERG-i in the early stages of development. Whether providing a complementary or competing capacity, synergies and collaborations are to be sought with those so as to avoid duplication of efforts and to maximize the use of the added value generated by the DRI.

2. End-Users who are the direct recipients of the services offered. This also includes any stakeholders with a specific interest in the outcomes of the research and testing programs, and with the capacity, knowledge and interest to establish a dialogue and contribute to the evolution of the services.

3. Stakeholders having an interest in the added value generated by the DRI but who do not necessarily directly benefit from the its services (academia, wider ORE industry, private investors etc.). They will benefit from the technological developments and the improvement of the global scientific knowledge generated by the DRI. They will be a key target for dissemination and networking activities conducted to accelerate knowledge transfer and its conversion into economic and social value.

4. Public funders who provide the economic support contributing to the development and operation of the DRI. A dialogue will be established to identify their priorities and define the strategies to obtain the best added-value.

5. All those indirectly influenced by the social, environmental, political or financial consequences that MARINERG-i may engender:
   - EU/National/Regional policy makers, who regulate aspects related to strategic infrastructures, ORE development, blue economy and innovation, etc.
   - Competing users of the sea (i.e. fishermen´s guilds, local authority representatives, etc.) and communities directly affected by MARINERG-i that have shown concern about the future use of the technologies developed and their potential impact on the environment and on their activity.
   - Civil society, citizens, regional innovation clusters, NGOs, media concerned by the social, environmental, political or financial impacts that MARINERG-i outcomes may cause.

   Outreach initiatives will be implemented to communicate with this group (data and information dissemination actions, education programs etc.) in order to capitalise on the knowledge generated by the DRI, while reducing barriers between the scientific community and the civil society.

The project has produced a detailed stakeholder engagement plan in D7.4 and D7.10.

2.3. Site selection

As a DRI, MARINERG-i will consist of a Central Hub and interlinked National Nodes. The day-to-day management will be undertaken by the Central Management Office (CMO), which is proposed to be located in Ireland. This is due to existing experience and strong Irish Government support/commitment to hosting the CMO.

Because of the nature of the MARINERG-i DRI activities and the expected size, the network is structured into National nodes acting as hubs at the national level to facilitate coordination and an integrated service. National nodes are composed of centres of expertise providing experimental and in-situ testing facilities, as well as technical and virtual services and data storage capacity.

The location of the National nodes (i.e. lead research infrastructures in each country) and plans to expand the membership were established building upon 1) the existing MaRINET network of facilities; 2) according to the outcomes of the RI profiling activity (WP2 and 3); 3) as well as the identified priorities at the national level in each country. This strategy will ensure:

1. retaining the expertise, experience and connections already established in MaRINET (central to the value proposition);
2. that the profile of participating facilities can meet the testing and research requirements to advance the industry;
3. that site development builds on/integrates with pre-existing national initiatives (e.g. the collaboration of IFREMER and ECN within the TheoREM RI) and avoids unnecessary duplication;
4. the nodes are in-line with national research priorities in terms of technology and funding initiatives.

2.4. Legal structure

The MARINERG-i DRI will have a recognised legal status and will operate under a clearly determined governance structure that defines the responsibilities and competences necessary to guaranty an efficient coordination. Investigations and evaluations conducted as part of design phase clearly showed that a European Research Infrastructures Consortium (ERIC) would be the most appropriate legal structure.

Draft Statutes of the ERIC; contracts covering the non-financial contributions by members; and documents relating to the management of intellectual property rights and access rights have been developed during the design phase. These set out the principles for, and facilitate, the coordination of the DRI. They will be negotiated and finalised during the preparatory phase and will form the basis of the application to be recognised as an ERIC along with the technical and scientific description of the RI.

Governance arrangements in the preparatory and implementation phases (Figure 7 and Figure 8) will follow ERIC guidelines as closely as is practical and will be grounded in legal statutes and associated contracts. This will facilitate an easy transition to the final governance structure (Figure 9) once the MARINERG-i DRI is fully operational.

2.5. Design and feasibility study

The EC MaRINET and MaRINET2 programmes have demonstrated the feasibility of a research infrastructure to support ORE development, identifying the specific facility types and a range of services that are essential to satisfy existing market demands. Design of the MARINERG-i DRI started in 2015 when a bid was prepared to access the 2016 ESFRI roadmap. This proposal included a preliminary design and feasibility study. ESFRI recommendations provided after assessment have been used to elaborate the bid during the MARINERG-i project (2017-2019) and complete the design study.

The MARINERG-i project was funded under the H2020 INFRADEV-02-2016 — "Preparatory Phase and support to early phase of ESFRI projects" call. The consortium consisted of 14 partners from 12 countries and have has secured the political and financial support and developed the documentation required for a successful application to the 2021 ESFRI roadmap including a design study and science plan (D4.4 and 4.3); business model and financial assessment (D8.2 and 6.4); and a legal framework including draft documentation (user access agreements and statutes) (D5.7, 5.9). Key deliverables have been evaluated by the project Transnational Advisory Committee (TAC) composed of 9 international experts. The following summarises the design study (D4.4):

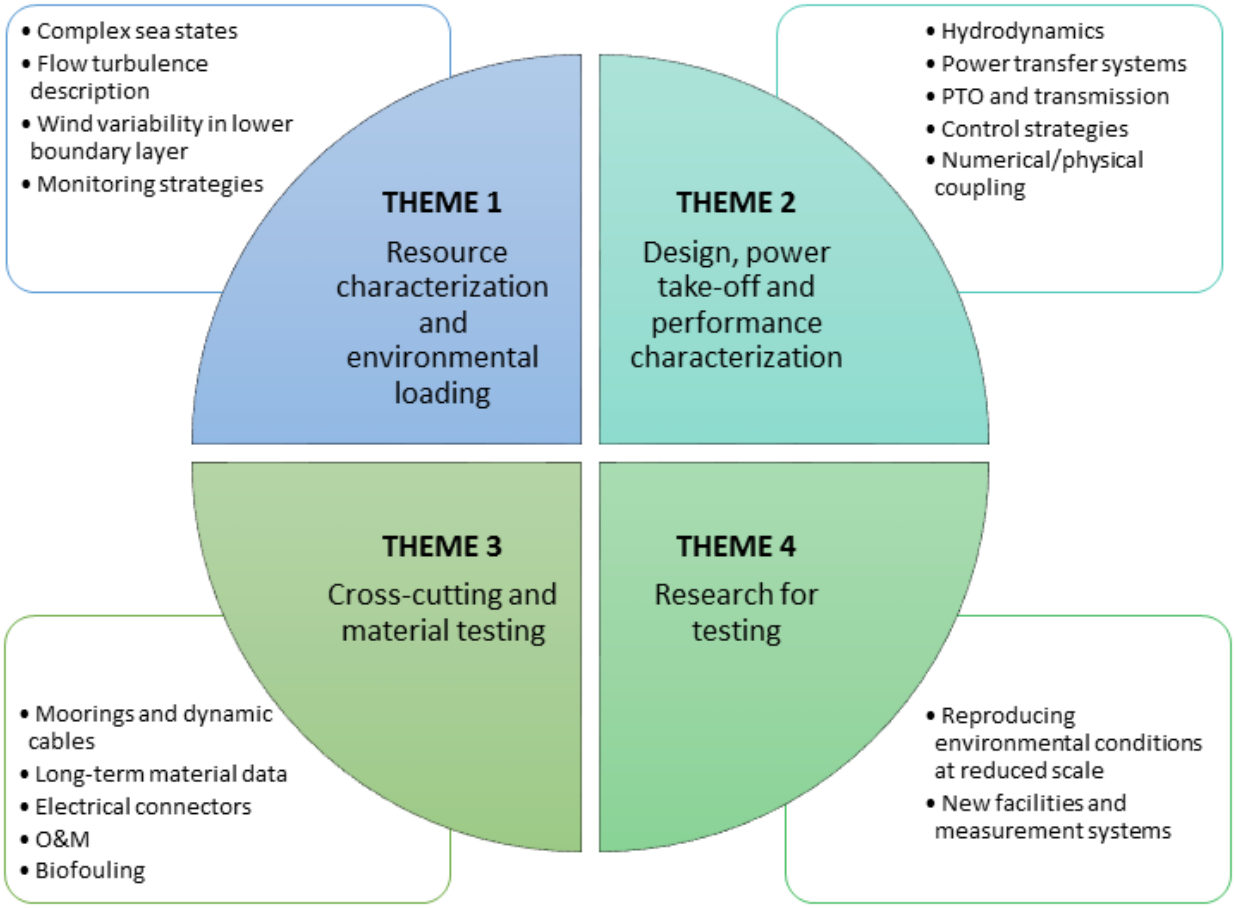
The proposed MARINERG-i DRI is composed of a network of pan-European testing facilities with an acknowledged capacity for conducting research on design and development of ORE systems. Activity conducted during the MaRINET (FP7) and MaRINET2 (H2020) projects demonstrated the importance of facilitating access to test facilities for ORE developers, along with providing support from a community of acknowledged specialists in the various fields of relevance. The organization and implementation of these two projects provided a good reference point to determine existing and future demands for testing facilities as well as the capacity required to meet demands in terms of focus group (waves, tidal, offshore wind, cross-cutting and electrical), facility size and regional distribution.

The identification and selection of the MARINERG-i facilities was conducted through RI profiling using an iterative and collaborative approach (including workshops and meetings) to

- ensure that key stakeholders in all participating countries have contributed to defining end-user requirements;
- identify the specific infrastructures to be included in a MARINERG-i DRI in order to provide the services required and initial sustainability of the business.

Infrastructures were selected according to a given set of technical and strategic criteria allowing for identification of the most relevant facilities including: having an established background in research for ORE; an adapted technical capacity; and a confirmed level of support at the national level. After completion of the iterative profiling process and validation by the relevant authorities at the national level, a set of facilities was selected that could potentially contribute to the DRI at various stages of its development. The distribution of the facilities within this set considering both size classes and focus group appears to be relatively in line with findings under the MaRINET and MaRINET2 Transnational Access programs.

In addition to RI profiling, a survey was conducted and a questionnaire was addressed to the end-users and stakeholders. This assessed their requirements and priorities in terms of the capacity and services offered by ORE RIs to actually contribute to their research and towards the industrialization of ORE systems. Identified end-user requirements show that this demand might evolve in the long-term, depending on the development of the technologies and the priorities of the market. Therefore, a capacity to adapt and include new facilities in the DRI is necessary. This long-term adaptation is part of the MARINERG-i research agenda and is dealt with in the "Research for testing" part of the Science Plan.



2.6. Science plan

Bringing together a large number of engineers and scientists, the DRI will create a cohesive scientific community with core strategic objectives focused on improving services, identifying ways to minimize the Levelised Cost of Energy (LCoE), and ultimately enabling the development of the ORE sector. A common science plan will address a wide panel of fundamental questions, which need to be answered to support the ORE industry through all the stages of development along the path to deployment and production. The scope has been separated into four main themes as illustrated in Figure 2.

The Science Plan has been developed in parallel with the Design Study (D4.4) and Business Plan (D8.2) as key interrelated elements of the MARINERG-i INFRADEV project.

Figure 2 Science agenda - key themes

End-user analysis allowed the elaboration of a clearly established scientific agenda. The activity necessary to implement this agenda will be conducted following two distinct but interlaced paths:

- The research activity conducted with the end-users within access programs. It will drive policy and user selection, through to the testing and proofing of new ideas and concepts at all stages of development. It will constitute a constant support to the development of innovative approaches and theories or even changes of paradigms that will drive the evolution of the strategic plan.
- Research for innovation programs will address the fundamental science and engineering questions, through a cross-sectorial approach and considering the key research disciplines. It will also tackle the issues related to the improvement of the testing methodologies. MARINERG-i research programmes will take advantage of the critical mass of resources that the DRI will bring together.

2.7. Services

The following summarises the core services that will be provided by the MARINERG-i DRI and the value-added by an integrated approach:

ACCESS: A common virtual platform will serve as a one-stop-shop, facilitating efficient access to ORE research and test facilities within the MARINERG-i consortium. The research institutions involved currently focus on providing services where a proven demand already exists e.g. via the MaRINET projects. Access through MARINERG-i will include both paid access to facilities as well as campaigns for free access, designed to further the common scientific agenda.

STANDARDS & QUALITY: A key advantage of an integrated approach will be that MARINERG-i RIs will be able to establish best practices and common standards, ensuring the quality of member facilities as well as the consistency and comparability of results between centres.

E-INFRASTRUCTURE: The virtual platform is required for efficient coordination of access campaigns to multiple infrastructures across Europe. However, it will also facilitate effective coordination of e-infrastructure sources by mediating access to curated data archives, knowledge resources and analytical tools.

COLLABORATION & NETWORKING: MARINERG-i will coordinate and ensure the operational and scientific integration of centres, augmenting existing knowledge and expertise (e.g. staff exchanges and training programmes) and producing new synergies.

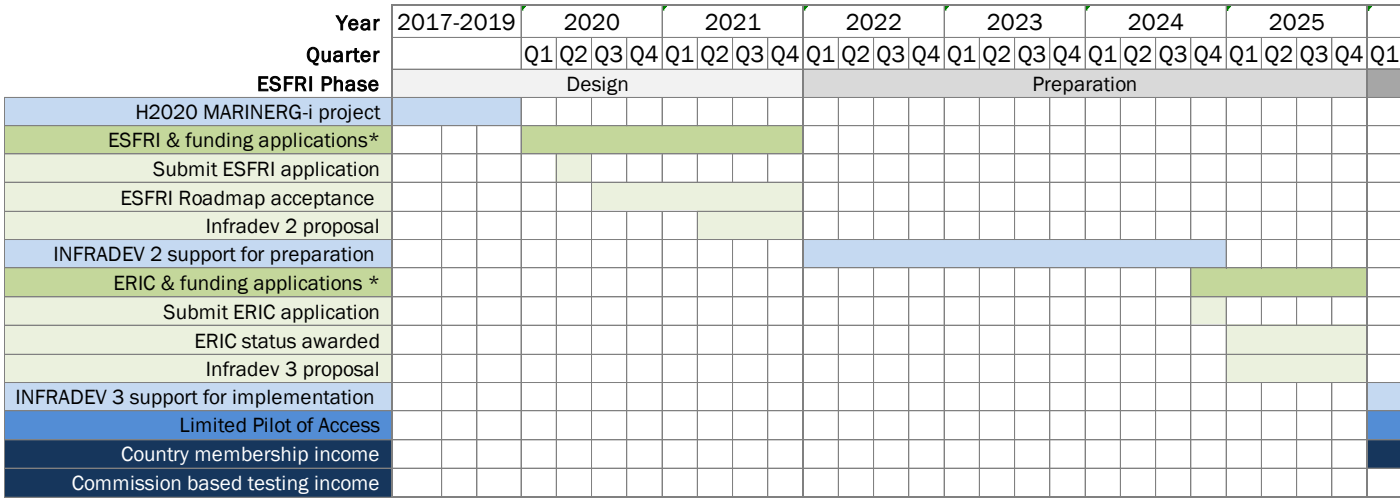
PLANNING & EFFICIENCY: The DRI will promote operational and strategic planning and efficiency to make best use of infrastructures and target research that will accelerate the development of the ORE industry.

2.8. Business model and finances

2.8.1. Business model

The successful development of the DRI will be realised through the delivery of infrastructure access, research and integrated services to the ORE sector and ultimately to a global marine engineering market. This section summarises the MARINERG–i DRI business plan (D8.2) including the structure, management and operational strategy.

MARINERG-i DRI timeline



* using country support e.g. in-kind contributions from RI staff; national grants or EU funding where available e.g. WeCANET or othe

Figure 3 provides a timeline overview of the business model.

The DRI will have an ERIC legal status, with Central Hub and National Nodes. The DRI will undertake phased business development from entry on to the roadmap in 2021 to the establishment of the ERIC in 2026 to achieving sustainability in 2029.

During the **preparation phase (2022-2025)**, the Hub will be operational by the first year to coordinate activities. Contracting RIs and upgrades to facilities (to ensure the required quality) will run until 2024 when the ERIC application is submitted. The pathway to financial sustainability is achieved through the adoption of a lean-burn CMO operational model, where overheads are minimised. Business development will initially focus on providing access to ORE infrastructures where a demand for service already exists (e.g. proven through MaRINET). This is the quickest route and lowest business risk to initiate and expand revenue generation. Incomes will be generated from research grants until the DRI is established as an ERIC.

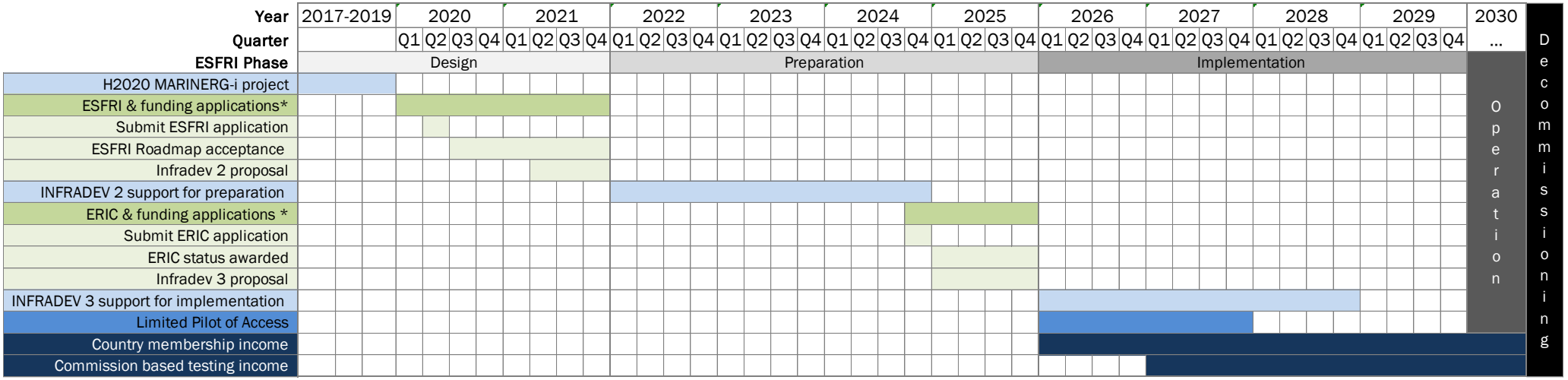
During the subsequent **implementation phase (effectively from 2026-2029)**, the DRI will implement the scientific strategic agenda through research and a pilot access programme. The number of RIs included in the DRI portfolio will be continuously expanded based on additional market analysis. This will diversify the range of services offered, expanding towards the wider offshore engineering industry sector. The DRI may eventually include non-EU facilities, considering the increased ORE development in North America and East Asia. The introduction of membership fees; commission-based infrastructure access; and service provisions will reduce dependency on financial supports e.g. grants.

It is expected to achieve financial sustainability and become fully **operational by 2030**. Having achieved sustainability and entered the operational phase, continuous ORE and offshore energy market scoping and assessment will be maintained. These will inform

future DRI evolution and it is highly likely this will include a widening of participating RIs and services to include subsea supporting engineering and services.

The business case has not yet been externally assessed. However, a financial model was built (WP 6 D6.4) so as to estimate the viability of the MARINERG-i DRI. The model follows a standard methodology for balance assessment of estimated costs and revenues. Different cost assumptions can be tested, allowing assessment of their impact on the feasibility of the DRI. The model also allows for sensitivity analysis of the main inputs and sources of risk for the long-term sustainability of the DRI. The financial assessment of this business model is outlined in section 2.8.2.

MARINERG-i DRI timeline



* using country support e.g. in-kind contributions from RI staff; national grants or EU funding where available e.g. WeCANET or other related projects such as MaRINET2

Figure 3 MARINERG-i DRI timeline towards sustainability

2.8.2. Finances

Preparation phase (2022-2025)

From the establishment of the MARINERG-i DRI in 2022 and its formation as a functional body up until the end of 2024, it is estimated that **approximately €3 million** will be required. The costs incurred are associated with:

- the setting-up the DRI and staffing the CMO;
- formalising participation of the preferred infrastructures who will deliver the MARINERG-i DRI service provisions;
- undertaking the preparatory work required to begin the implementation phase and apply for recognition as an ERIC (see Section 3.2 for a breakdown of the work plan);
- upgrading infrastructures to bring them up to a uniform high level of operation.

This phase will primarily be funded from research grants i.e. INFRADEV but additional supports will be sought via local funding secured at in-Country level and local infrastructure investment to support gearing up to become an ESFRI entity.

Implementation phase (2026-2029)

On the basis of the ERIC legal status being awarded to the MARINERG-i DRI at the start of 2026, the initial cash burn within the first 3 months (Quarter) of the launch of the MARINERG-i DRI **operating under an ERIC legal framework** is estimated approximately **€49,000 per month.** Operational costs are expected to **increase annually in line with inflation,** although the 'lean-burn' operational model is adopted to minimise these. In addition, a **limited pilot of access will be run from 2026-2027**.

Expenditure will be accounted for against income received through in-country participation payments (country membership fees commencing 2026) and transitional grant support from the EC i.e. INFRADEV available to support initial DRI operations under an ERIC legal framework as it evolves towards financial sustainability. In addition, it is anticipated that commission-based access will commence from 2027.

From an annual cash balance, a cash surplus generated at the end of Year 1 (2026) will aid the transition to financial sustainability at the end of Year 4 (2029). Excess cash will be reinvested to upgrade infrastructures; to fund research programmes or additional free sessions of access that support the common scientific agenda; and for training and staff exchange programmes that will enhance quality and the services provided.

D8.2 provides a more detailed breakdown and analysis of the above. Further work is needed to develop the preliminary business plan and cost estimates created during the design phase (as listed in section 3.2.1). This will include the development of a cost book and an external review of the final business case.

2.8.3. Investment plan

It is foreseen that during the implementation phase and the early stages of the operational phase, the MARINERG-i DRI will be composed of already existing facilities. The limited investments necessary to upgrade or refurbish some of these up and running facilities would be limited and supported by funding programs at the national level. However, as accounted for in the business plan, during the initial preparation phase, some of the funds from income received minus operating costs of the DRI will be reinvested in infrastructures to bring them up to a uniform high level of operation prior to the initial implementation. A

review of facilities, upgrade requirements and an investment plan will be a key task early on in the preparation phase as described in Section 3.2.1.

The main necessary investment in the early stage of development of the DRI is associated with the implementation of the e-Infrastructure. It is foreseen that this e-infrastructure will partially benefit from the existing IT structures already implemented in each facility so that the global investment should be limited.

Given the above, investment in the early stages of development should not require sources of funding such as a loan from the European Investment Bank. In the longer term an expansion or an evolution of the DRI may be required to adapt to the evolving demand. Such evolution would be conducted according to the requirements from the end-users and the recommendations of the advisory committees so as to guarantee at all time the optimized spectrum of capabilities to provide the requested services.

The cost of a state-of-the-art ORE test facility offering the necessary technical and engineering capacity to respond the end-users' requirements (typically a large tank combining reproduction of waves and current for testing at reduced scale) is estimated ~15 M€. The installation and implementation of such infrastructure would require specific funding schemes most probably combining support at the national and European level. Funding programs available at the national and European levels (e.g. EIB, European Fund for Strategic Investment, the Project Bond Initiative, etc.) have been identified that could be used for such future investments in the longer term.

3. Planning

3.1. Objectives and main tasks

The overall objective of the MARINERG-i DRI is to foster innovation across a variety of ORE technologies and stages of development by consolidating expertise, investment and access to infrastructures.

The MARINERG-i DRI will provide streamlined access to world-class test infrastructures for ORE developers, and conduct state of the art research on ORE technology.

The DRI aims is to become a self-sustaining independent legal entity by 2030. Table 3-1 provides a breakdown of the key activities required to achieve this per ESFRI phase from design to decommissioning.

Table 3-1 Timeline per ESFRI phase

Phase	From year	To year	Activities per phase
Design	2017	2021	Following the MARINERG-i H2020 project (2017-2019) and the submission of the ESFRI 2021 roadmap in May 2020; **succession to the roadmap** is anticipated by the end of Q4 in 2021.
Preparation	2022	2025	Once accepted on the ESFRI roadmap, the consortium of the proposed MARINERG-i DRI will

			prepare **an application to become an independent legal entity** including the following tasks: - establish the CMO - further develop and review the required legal framework and business structure; - secure the remaining required political and funding commitments; - formalise the participation of the remaining initial infrastructures required to supply DRI services. It is anticipated that the application to be recognised as an ERIC will be made at the end of Q4 2024, with granting of formal recognition anticipated at the beginning of Q1 **2026**. During the interim, a lean-burn approach will be undertaken to maintain the structures in place.
Implementation (construction)	2026	2029	Once established as an ERIC, the MARINERG-i DRI will have the legal framework to **begin trading as a not-for-profit entity.** The main objective is to prove the DRI is sustainable by 2029. This phase will involve the following: - Initiating a pilot programme for free access; - Providing an increasing range of integrated services to users; - Country funding and commission-based access will commence; - Expanding the MARINERG-i DRI and services available based on market assessments.
Operation	2030	->	With the ERIC implemented and sustainability validated in 2029, the DRI will become **fully operational** from 2030.
Termination	-	-	

Section 3.2 further describes the activities envisioned from preparation to decommissioning.

3.2. Work structure

Figure 4 provides an overview of the lifecycle of an RI. In the case of the MARINERG-i DRI, the MARINERG-i H2020 project constitutes the majority of the Design phase, which concludes with the publication of the 2021 Roadmap. In the following sections, the proposed work structure is outlined for the Preparation, Implementation, Operation and Termination phases of the MARINERG-i DRI.

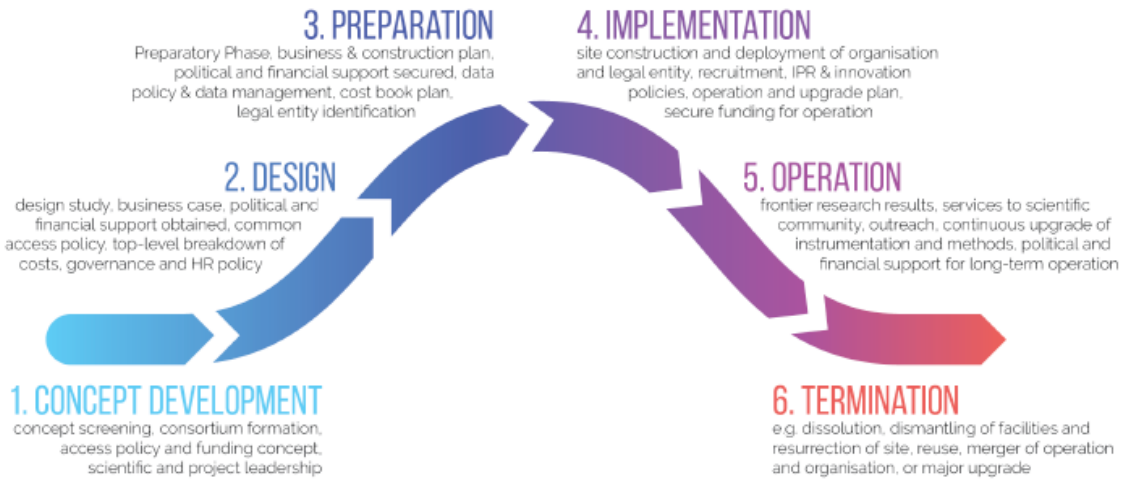


Figure 4 Research infrastructure lifecycle

3.2.1. Preparation phase

The preparation phase aims to address the tasks necessary to establish a new pan-European DRI. Much of the groundwork for this phase has already been done in the MARINERG-i H2020 project that constituted the Design Phase. It is anticipated that the preparatory work will be undertaken from 2022-2024, and that it will be supported by INFRADEV 2 funding. The Work Breakdown Structure (WBS) of the Preparation Phase is illustrated in Figure 5 below, and described in the following paragraphs. The governance structure is shown in Figure 7.

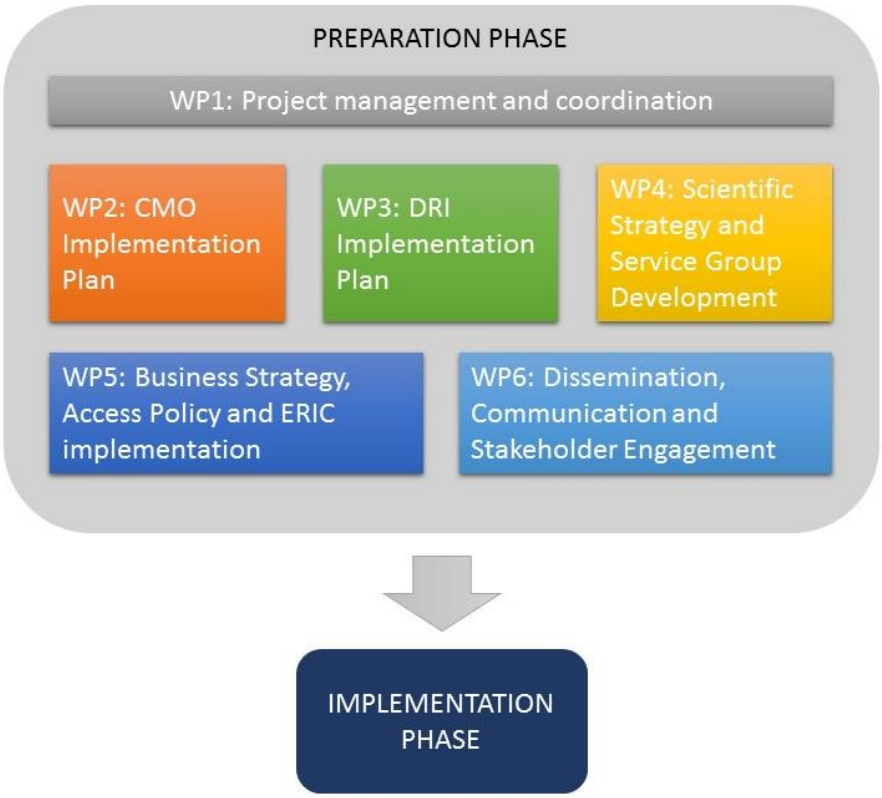


Figure 5 Preparation Phase WBS

WP1: Project management and coordination

WP1 will ensure the effective delivery of the preparation phase. The Project Coordinator (UCC_MaREI) will be responsible for monitoring and managing the progress and performance of all work packages.

WP2: Central Management Office Implementation Plan

The objective of this WP is to establish the Central Management Office (CMO) early in the preparation phase and being the process of coordinating its underlying services. Therefore, when the MARINERG-i DRI has achieved ERIC status (c. 2026), the necessary systems will be in place to commence trading.

Whereas the operation of each individual facility in the DRI will be decentralised, the CMO will represent the access point and coordinate the activities of users seeking to test in MARINERG-i facilities. A key output from this work package will be the development of a web platform or portal through which users can gain access to the services provided by the DRI.

A plan will be developed for carrying out a pilot access programme in the implementation phase. Steps will also be taken to set-up of the Scientific, Technical, Quality and Ethical Advisory Committee (STQEAC), which will be in place before or shortly after the MARINERG-i DRI is awarded ERIC status and commences trading.

Key Deliverables:

- Access platform for MARINERG-i services
- Pilot Access Plan

WP3: DRI Implementation Plan

The aim of this work package is to form a world class DRI that provides the services required by the ORE sector. Part of the work required involves formalising the participation of the infrastructures identified during the design phase. This will be done by putting in place Access Agreements will each participating infrastructure.

In the first quarter of this phase, a detailed plan will be drafted describing a prioritised list of RI upgrades as well as new facilities necessary to meet the needs of the ORE sector. The plan will include a comprehensive characterisation of existing infrastructures already committed to MARINERG-i, and planned developments. This exercise will be used to perform a gap analysis and the development of both short- and long-term infrastructure development plans. The infrastructure development plan will be structured so that appropriate facilities are in place in the most suitable locations in order provide the services demanded by industry and will align with the objectives of the scientific strategy produced by WP4. The outputs of this WP will also guide the targeting of particular facilities when it comes to expanding the MARINERG-i DRI.

The identified priority infrastructure upgrades will take place in the second half or the preparation phase. Financing of the upgrades will be achieved by leveraging a portion of the INFRADEV2 grant to obtain match funding from national bodies.

Key Deliverables:

- Infrastructure development plan
- Access agreements
- Upgrade implementation

WP4: Scientific Strategy and Service Group Development

Updating the Science Plan originally developed during the H2020 MARINERG-i project (Design Phase) will be a key task in this work package. The state of the art in each of the key research areas will be reviewed, and the proposed research strategy fine-tuned to take account of evolving industry requirements. A plan will be elaborated for the implementation of a research programme; this will include assigning responsibility for priority research areas to National Nodes or regional research groups. The plan will also align with the infrastructure development plan produced by WP3.

Service Groups will be defined to drive development of key MARINERG-i objectives, i.e. the development of standards and quality management systems, e-infrastructure and data management, technological advancement in the offshore wind, wave and tidal sectors, etc. Responsibility for each of the identified service groups will be assigned and a strategy developed to ensure each group is up and running by the end of the preparation phase. The Service Group Strategy will be aligned with the infrastructure upgrades and the Science Plan implementation.

Key Deliverables:

- Implementation of the Science Plan
- Service Group Strategy Document

WP5: Business Strategy, Access Policy and ERIC implementation

This work package will further develop the preliminary Business Plan created during the design phase. This will include the development of a cost book and an external review of the final business case. IP rules will be defined and the access policy and governance finalised.
This work package will also put in place the documentation necessary to make an application to the EC to become an ERIC. This will include finalised statutes originally prepared in the Design phase.

Key Deliverables:

- Final Business Plan for ERIC Implementation
- Final Statutes
- DRI Access Policy

WP6: Dissemination, communication and stakeholder engagement

The main objective of this work package is to expand the network of countries and facilities already engaged with MARINERG-i (e.g. Norway). Workshops and events will be held to attract the interest of relevant stakeholders and outline the benefits of joining the MARINERG-i joint research and activity programme. A key activity will be the confirmation of financial contributions/expressions of commitment from the current membership. Continued market assessment will be carried out, and communication and outreach events will be coordinated to increase public awareness and understanding of offshore renewable energy research and innovation.

Key Deliverables:

- Final membership database
- Finalised Expressions of Commitment and Support
- Initiation of Stakeholder Engagement Plan

3.2.2. Implementation phase

The implementation phase will commence upon the MARINERG-i DRI being awarded ERIC status, which is estimated to take place in 2026 and will last approximately 3-4 years. The goal of the implementation phase is to become a self-sustaining DRI within the 2021 ESFRI Roadmap 10-year timeframe. It is anticipated that the implementation phase will be supported by INFRADEV3 funding.

The preliminary WBS for this phase is described below, and illustrated in Figure 6. The governance structure is shown in Figure 8.

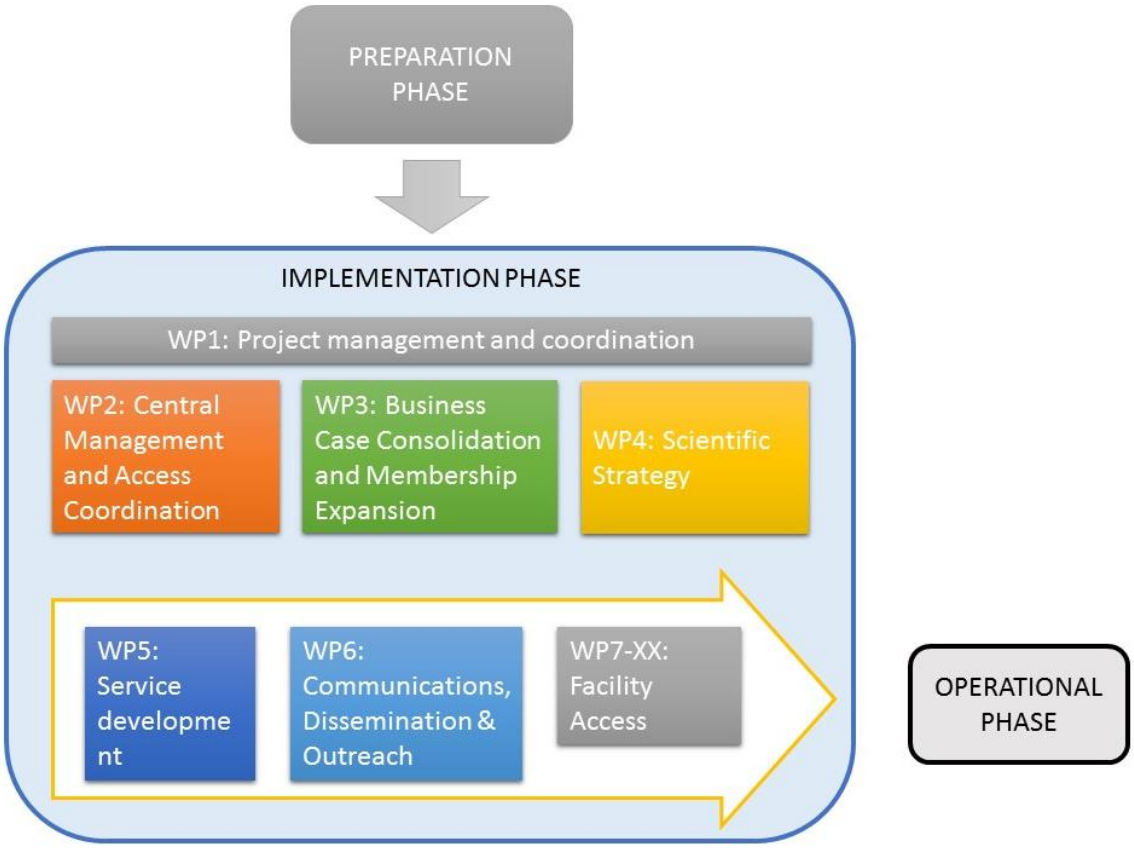


Figure 6 Implementation Phase WBS

WP1: Project Coordination

This work package will ensure the fulfilment of project administration and EC reporting requirements.

WP2: Central Management and Access Coordination

The WP will focus on the establishment of procedures the effective handling of legal, contractual and operational issues of the MARINERG-i DRI. A quality management system and risk assessment tools will be developed and implemented during this phase.
A Pilot Access Programme will also be coordinated through this work package based on the Pilot Access Plan developed in the preparation phase. A portion of the Infradev 3 funding will be allocated to provide free testing within the MARINERG-i DRI. This will be achieved through periodic 'Calls' where users submit a detailed application, which will then be assessed by a panel of experts. Access will be granted to projects that meet a defined standard, and are aligned with the MARINERG-i scientific agenda.

WP3: Business Case Consolidation and Membership Expansion

This work package will be dedicated to the consolidation and enlargement of the countries and facilities committed to supporting the MARINERG-i DRI. A final funding model will be developed for when ERIC status is granted and the DRI begins operating as a not for profit entity.

WP4: Scientific Strategy

This work package will develop a long-term research strategy that identifies key research challenges and strategic objectives for the MARINERG-i DRI once it is established as an ERIC (i.e. from 2026). The developed strategy will provide a prioritised list of research topics to meet predicted user needs up to 2031, and will encompass a horizon scan to 2036. The Scientific Strategy will be developed in consultation with the STQEAC, and will take into consideration the results of the Pilot Access Programme.

WP5: Service Development

The focus of this work package will be on developing a training strategy and providing training for prospective users. A key element will also be the development of standards and good practice documents that will be implemented across the whole DRI to ensure consistent testing standards.

This work package will also aim to build capacity to meet the objectives of scientific agenda and expand the services provided by MARINERG-i beyond offshore renewable energy to the wider offshore sector to include general engineering research and design.

WP6: Communication, Dissemination and Outreach

This work package aims to strengthen links between the participants in the MARINERG-i DRI, communicate with stakeholders and promote the Access Programme.
Following completion of the Pilot Access Programme (2026-2027), the updated scientific agenda will be pushed to key EU and national policy makers.

WP7-XX: Facility Access

These work packages will offer access for ORE research to users to each of the facilities in the DRI as part of a Pilot Access Programme. An application will be made by MARINERG-i for funding to provide sessions of free access geared towards investigating key areas in the scientific agenda, in addition to paid access. Each facility participating in the Pilot Access Programme has its own work package for project management purposes.

3.2.3. Operational Phase

It is anticipated that the operational phase will commence in 2030, upon the MARINERG-i DRI completing its journey through the ESFRI Roadmap and being awarded Landmark status. At this stage, the DRI will be self-sustaining; with a steady income stream from access fees/service provision levies and membership fees. As the MARINERG-i ERIC will be a not for profit organisation, any surplus generated will be reinvested into the infrastructures comprising the DRI to ensure state of the art test facilities continue to be available to the ORE sector. Resources will also be allocated to building research programmes, and providing training (e.g. staff exchanges). Funding will be sought in order to continue providing free as well as paid access programmes. The expansion of DRI beyond Europe will also be investigated.

The day-to-day management of the DRI will be undertaken by the CMO in Ireland which will be populated by staff directly employed by the CMO and/or staff seconded from a member facility. The governance structure for this phase is shown in Figure 9.

3.2.4. Decommissioning

The main decommissioning activity of relevance to the MARINERG-i DRI is the winding up and termination of the e-Infrastructure platform. A decommissioning plan will be made that effectively deals with all data and other information stored within the e-Infrastructure.

3.3. Governance

3.3.1. Preparation phase

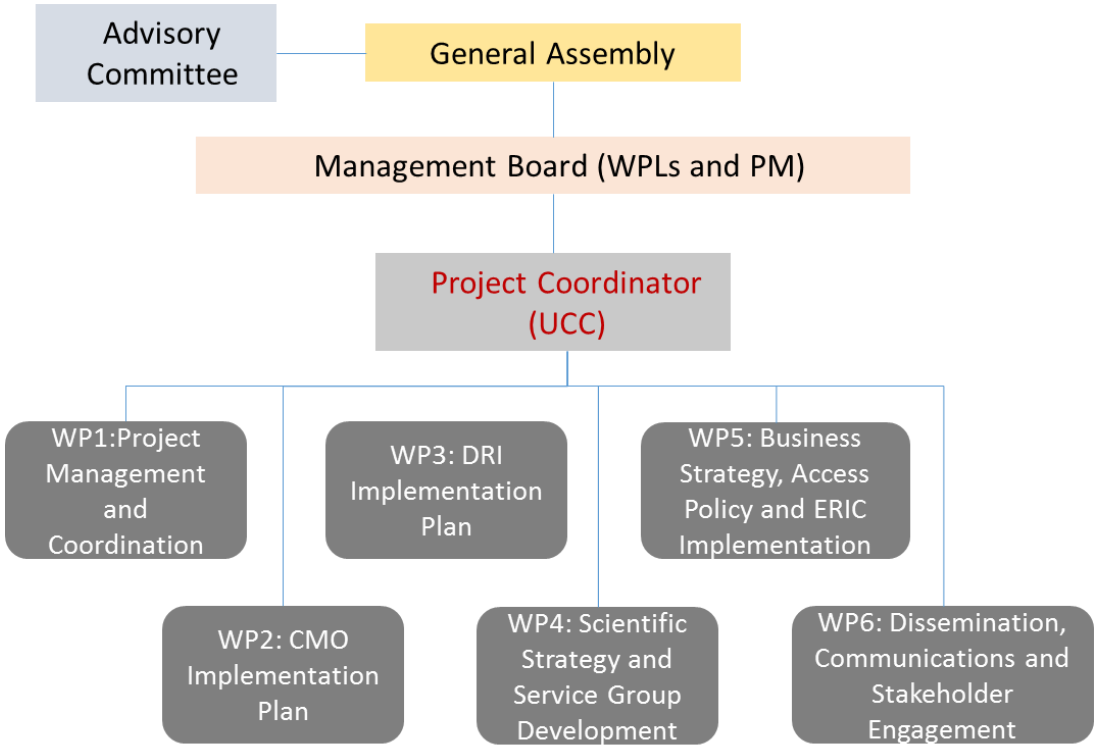


Figure 7 Governance structure: preparation phase

The governance structure in the preparation phase will be defined by the INFRADEV 2 funded project that will be established to manage the DRI before it has ERIC status, and is illustrated in Figure 7. The General Assembly, consisting of the project participants will be guided by an Advisory Committee of selected experts. The Central Management Office (CMO) for the DRI will be established early in the preparation phase (2022-2025) through work package 2. Once the CMO is set up, it will act as the operational and strategic arm in establishing the MARINERG-i DRI as an ERIC.

3.3.2. Implementation phase

The governance structure for the implementation phase is presented in Figure 8. The Assembly of Members (AM) is the ultimate decision making body; it is a non-executive body overseeing and reviewing the implementation of the MARINERG-i DRI. The AM is composed of delegates of member states and receives strategic advice from the Scientific, Technical, Quality and Ethical Advisory Committee (STQEAC). The STQEAC is a panel of internationally recognised experts appointed by the AM and fulfils the role of a regulatory body to ensure the DRI is compliant in its implementation.
The MARINERG-i ERIC will be coordinated out of the CMO, which will have been established in the preparation phase. The leaders of each work package will report to the CMO, and together they will form the Executive Committee (EC), which will have executive powers for the implementation phase. The EC will appoint a CEO who will have responsibility for the CMO.

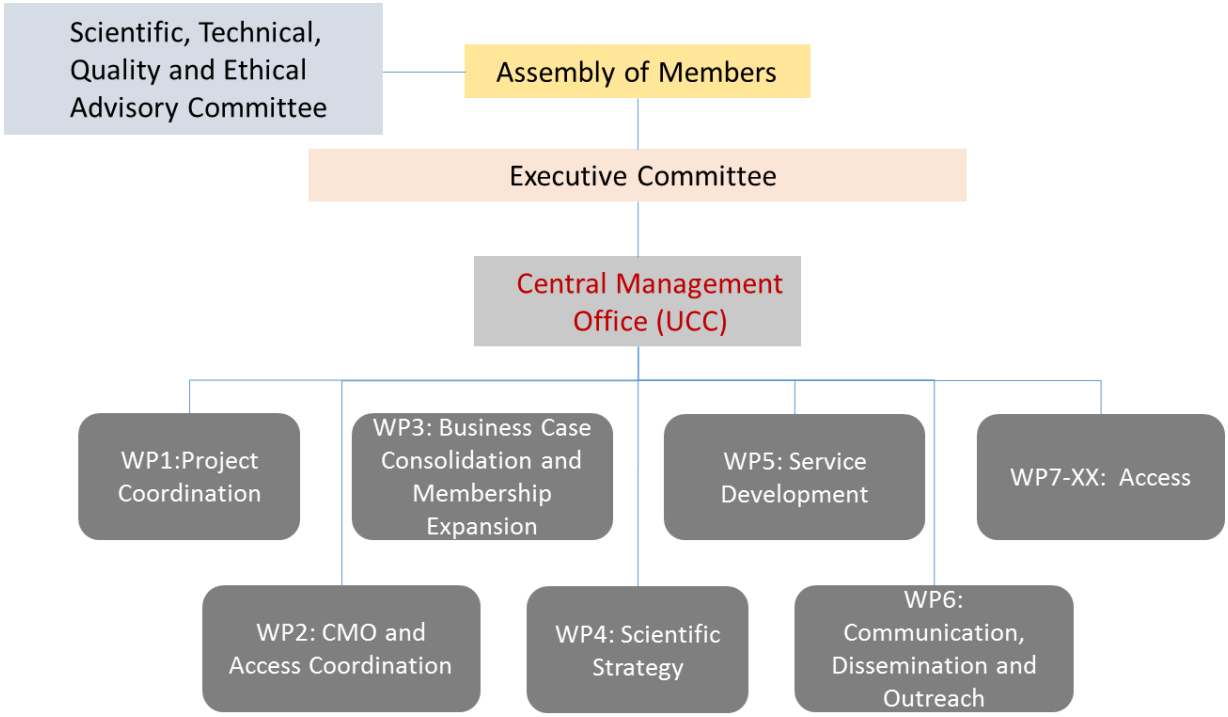


Figure 8 Governance structure: implementation phase

3.3.3. Operational Phase

The governance structure for the operational phase is illustrated in Figure 9. As is the case in the implementation phase, the Assembly of Members (AM) is the ultimate decision making body and oversees the operation of the MARINERG-i DRI. The AM is composed of

delegates of member states and receives strategic advice from the STQEAC. The Executive Committee (EC) is appointed by the AM; it consists of representatives of the research institutes that will serve as the National Node in each participating country. The EC has executive responsibility for the operation of the DRI. The CMO, led by the CEO, will carry out the day-to-day operation of the DRI. The CMO will manage the access to the facilities comprising the DRI, oversee facility upgrades and the research programme, promote the MARINERG-i brand, and secure funding for operation, maintenance and expansion of the DRI. Roles within the CMO include a Finance Officer, Administrative and Access Manager and Links Coordinator responsible for business development, industry liaison and international connectivity.

The governance structure will also include Service Groups that will be established to provide support in different areas to users of the DRI and to the CMO and EC. The supports provided will include development and implementation of the MARINERG-i scientific research agenda, e-infrastructure development, quality and standards, and training. Additional service groups will be added as the need arises.

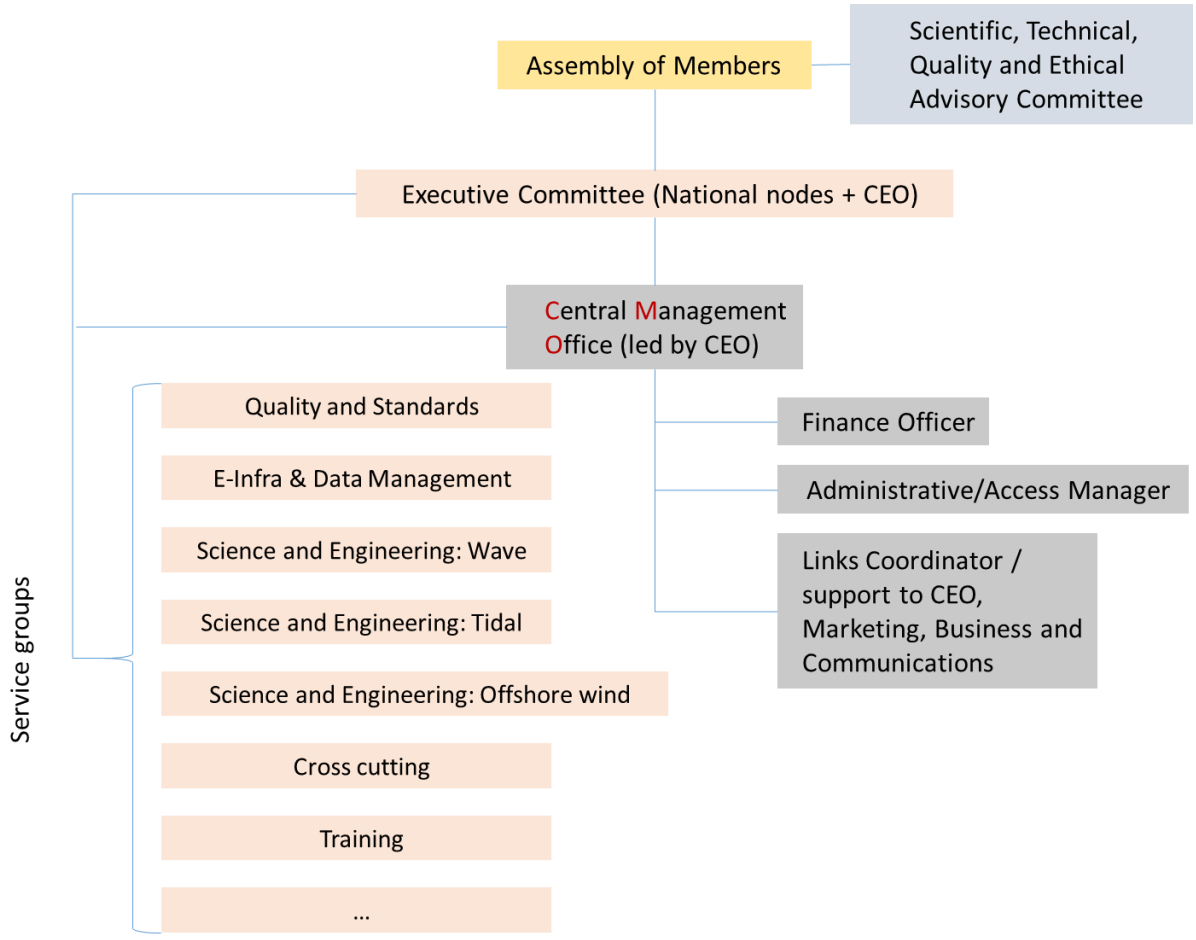


Figure 9 Governance structure: operational phase

3.3.4. Key performance indicators and monitoring

Carefully chosen KPIs facilitate the assessment of the DRI in terms of its success in realising its mission and vision. A series of KPIs have been identified and selected from the OECD Reference framework for assessing the scientific and socio-economic impact of research infrastructures[1], and adapted to the specific activities and objectives of the MARINERG-i DRI. The list of KPIs and associated parameters and definitions are included in the Design Study (Deliverable 4.4). The KPIs relate to the sustainability and excellence of the DRI, and cover the following themes:

- DRI finances
- Operations
- Research activities
- Quality systems
- Access
- e-infrastructure
- Engagement with industry
- Education and training

Monitoring will be undertaken throughout the DRI lifetime, in line with ESFRI requirements/recommendations.

3.4. Human resources – requirements, staffing and policy

Successful operation of the MARINERG-i DRI requires a well-structured organisation and skilled staff. In addition to the staff operating as a secretariat at the central hub, human resources will be necessary within each national node and each facility to facilitate coordination and allow local management. Staff secondment will be considered; especially in the early stages of the implementation. The organisational structure will minimize redundancies between the different nodes. Choices made to define the governance and legal framework of the DRI will be the main drivers for this organisation.

Employment contracts shall be subject to applicable laws and regulations of the country in which the staff are employed or to the laws of the country where the MARINERG-i activities are conducted. Scientific activity conducted by the MARINERG-i DRI, considering both access programmes and specific research programmes, will be conducted by the staff operating the facilities, engineers, technicians and academics.

As an ERIC, MARINERG-i shall be an equal opportunity employer. The procedures for selecting applicants for MARINERG-i staff positions shall be transparent, non-discriminatory and respect equal opportunities, including gender balance and diversity. MARINERG-i ERIC vacancies shall be published internationally.

MARINERG-i will support employee exchange, education and training programs. Staff exchange between MARINERG-i and industry personnel is seen as an efficient way to develop skills and accelerate knowledge transfer, and could be supported by funding schemes such as the RISE program. At the intersection between research and industry, MARINERG-i also has the capacity to contribute to education and training of graduated

[1] https://doi.org/10.1787/3ffee43b-en.

students in contributing to the development of targeted Innovative Training Networks. MARINERG-i will also deliver user training and education programs to optimise expertise and skills.

Transnational collaboration and networking are key elements enabling the capacity of the DRI to operate as an integrated entity. Collaboration between the members of the MARINERG-i DRI is needed to create the critical mass necessary to support the development of the ORE industry and to ensure the operational and scientific integration of the RIs, producing new synergies. This is a key objective of the ocean energy research agenda, as it would reinforce European jobs and leadership in this sector.

The user program including an access program for testing of ORE devices is at the core of the activity conducted by the members of the MARINERG-i DRI to achieve its objective. A substantial part of the available research time of the facilities being part of the MARINERG-i DRI shall be offered to the international research community. The access to the facilities shall be open to researchers, engineers, scientists and students conducting research programs based on experimental testing of ORE devices. Scientific activity conducted by the MARINERG-i DRI, considering both access programmes and specific research programmes, will be conducted by the staff operating the facilities, engineers, technicians and academics. Staff secondment and staff exchange programs will be considered whenever deemed necessary to conduct these programs.

To guarantee its efficiency, such a complex organization requires strong transnational interconnection between partners, reinforced by a recognized legal status and a capacity to operate under a clearly determined governance structure. Under the currently established statutes of the MARINERG-i ERIC, it is stated that “Subject to the requirements of national legislation, each Member shall within its jurisdiction facilitate the movement and residence of nationals of Members involved in the tasks of MARINERG-i ERIC and of the family members of such nationals.”

3.5. Risks

A preliminary risk profiling exercise was carried out as part of the MARINERG-i Implementation Workshop (Deliverable 9.1) and the results are included in Annex I. A range of risks was identified that have the potential to impact different stages of development with varying degrees of severity.

A key strategic risk is that scientific developments or competing projects elsewhere could affect the research outputs from the MARINERG-i DRI. The MARINERG-i objective to accelerate the research, development and deployment of ORE technologies requires a network of test facilities with the capacity to conduct research on the design and development of ORE systems as well as a clearly defined and coordinated scientific agenda in order to foster development across the different TRL stages. No one such infrastructure was identified in the current landscape that could provide the inter-disciplinary capacity necessary to compete with MARINERG-i’s integrated approach. As the MARINERG-i DRI develops, a constant effort will be maintained to expand the membership both within and outside Europe to ensure it stays at the forefront of ORE research.

MARINERG-i's scientific scope focusing on technology development and engineering is clearly delineated and supported by a carefully identified set of infrastructures. However, in order to successfully address the objective of accelerating the development of the ORE industry and to make sure it is provided with the most adapted support, collaboration with complementary infrastructures and initiatives (e.g. smartgrids) is required. Hence, attractive incentives will be identified and implemented to secure collaboration and cooperation.

There is the potential for gaps in technical competencies (facilities/equipment) in the early stages of development of the DRI, or that a key node will cease operating. It is expected that the list of facilities identified in the RI profiling activity conducted during the design phase provides sufficient redundancy in the type, size and regional distribution of the identified facilities potentially contributing to the DRI to mitigate such issues. Throughout all phases of development, work will be ongoing to expand the DRI membership and ensure all necessary competencies and services are included in the MARINERG-i portfolio.

Monitoring of the research activity and getting customer feedback will be essential to ensure that the DRI responds the demands of the market, provides an adapted access policy and maintains sufficient quality of service and standards, and hence has the enduring capacity to attract and retain users over time.

Failure to get adequate political support and financial commitment at the national level would likely affect the DRI capacity to implement the scientific agenda, and would limit the chances of reaching identified sustainability targets. It is important that the DRI is operational as quickly as possible and the MARINERG-i label established, so that the commitment to meeting the requirements of the ORE industry and the national priorities is clear (i.e. significant progress in the tidal and wave sectors, adapted support to the offshore wind industry, reference standards and guidelines, information and technology transfer, etc.). This will give confidence in the ability of the DRI to achieve its objectives.

4. Conclusion

This deliverable summarises

- the preparatory work that was completed during the design phase
- the work planned for the preparation and implementation phase
- an overview of activities during the operational and decommissioning phase
- the governance structure envisioned per phase
- a summary of human resource requirements, staffing and policy
- Identifies the key risks to effective implementation of the DRI.

The report provides input to Part C Implementation Case of the ESFRI application form.

Annex I

REF ID	RISK	PROJECT PHASE	IMPACT 1 – 3	MITIGATION STRATEGY
R1	Threat that another RI might get there first	Preparation/ Implementation	3	Analysis of current landscape did not identify and infrastructures with sufficient interdisciplinary capacity to compete with MARINERG-i. As the MARINERG-i DRI develops, efforts will be made to expand membership both within and outside Europe.
R2	Failure to connect with other projects conducting important and relevant research through lack of a desire to collaborate	Operation	2	Identify and implement incentives to secure collaboration and cooperation
R3	Expertise gap in a key area	All	2	Build redundancies into the DRI. Monitor competencies and take steps to hire/train personnel to ensure key areas are covered
R4	Gaps in technical competencies (relating to facilities/equipment) in early stages of DRI operation	Operation	2	Identify facilities in the preparation phase that fill any gaps and target these in stakeholder engagement/membership expansion activities
R5	Critical node in charge of a service stops operating	Operation	3	Monitor operations in and provide support where necessary to nodes. Transfer service to another node if required.
R6	Insufficient infrastructure in consortium for testing relating to offshore wind	All	2	Engage with offshore wind sector to confirm infrastructure required and work to bring relevant facilities into the DRI
R7	Lack of progress in the wave and tidal sectors	All	3	Drive progress in these areas through funded access to MARINERG-i facilities in which priority research areas are addressed
R8	Access policy does not match user needs	Operation	2	Conduct regular reviews of access policy based on user feedback

R9	Failure to maintain quality and standards	Operation	2	Conduct regular monitoring and obtain customer feedback
R10	Difficulty discerning MARINERG-i from RI	Operation	1	Ensure MARINERG-i brand and added-value is clearly communicated
R11	Issues with prioritising industrial versus research activities	Operation	2	Regularly review access policies and research programmes to balance requirements
R12	External perception that MARINERG-i just caters for wave and tidal sectors, not offshore wind	All	2	Investigate changing the name of the proposed DRI
R13	Failure to get political and financial commitment	All	3	Get DRI up and running and brand established as quickly as possible. Stay engaged with ESFRI reps and relevant national bodies
R14	Brexit impacts ability of UK facilities to participate as well as wider ORE sector	All	2	Stay engaged with UK ESFRI reps and relevant national bodies
R15	Insufficient funding to implement MARINERG-i scientific agenda	Implementation/ Operation	2	Funding for scientific research will be carefully allocated based on funding available
R16	Failure to achieve critical mass of membership/ paid access to achieve sustainability	Implementation/ Operation	3	DRI finances, business model and required national support will be constantly reviewed to ensure sustainability
R17	Gaps in funding affects DRI implementation	Preparation/ Implementation	3	Gaps in funding will be planned for in advance and the DRI sustained through in kind contributions
R18	Insufficient access weeks in test infrastructures to meet demand	Operation	2	Access agreements with individual facilities will be reviewed regularly and access units redistributed across DRI where necessary