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Nota

In the following pages, the European Coastal Research Infrastructure will be named JERICO-RI, the project funded in the framework of the FP7 JERICO-FP7 (2007-2011) and the one funded within H2020 JERICO-NEXT (2011-2019)

1. The JERICO-RI: The context, Mission and Vision

1.1. The Worldwide context

In the context of UN-SDG #14 and the G7 EO recommandations based on the GOOS strategy, the OECD identified three trends of change that will strongly affect our future and urgently need improved knowledge and understanding:

1. Acidification and its impacts on the ecosystems: corals, shells, plankton and the consequences on fisheries and farming of marine species, leading to the need to improved measurements of the carbonate system, i.e. pCO_2, O_2, alkalinity and pH.
2. Rising of the sea temperature and sea level and their consequences on coastal regions and biodiversity (e.g., overvalue, migration of biological population, loss of biomass)
3. Pollution – organic and inorganic, metallic and plastics - and its impacts on coastal ecosystems.

In line with the here-above trends, the series of EU-funded JERICO projects made the point from 2007 to improve observations in the coastal marine domain where most of the world population lives with objective to buid a pan European Research Infrastruture: the JERICO-RI. *The **JERICO-RI** is a long-term framework providing **high-quality marine data**, **expertise** and **infrastructures** for **Europe's coastal seas**. The data are **multidisciplinary, standardised, quality controlled, sustained, inter-operable** and **free** to access and use.*

1.2. The EU landscape and the JERICO-RI history

1.2.1 The EU landscape

Focusing on the coastal areas, observations led by JERICO-RI are in-line with the EU Marine Strategy Framework Directive, the EU Water Framework Directive and with regional conventions such as OSPAR and HELCOM. The added-value of JERICO-RI as a pan European initiative, in supporting the application of these directives and conventions stands in its capacity to provide high quality integrated data and related services in a harmonised way, as a single entry point.
The marine observation landscape in EU is composed of several initiatives and infrastructures, driven by different interests and with different degrees of integration from national to European dimension, often with well-established international cooperations. Amongst the marine EU observation and research initiatives, one can name EMSO-ERIC (bottom and water column observatories in open seas), EuroARGO-ERIC, Eurofleet, or the European Ocean Observing System (EOOS), under elaboration, to which JERICO-RI is foreseen to be the coastal component (figure 1).

Located at this key place in the EU landscape, the user community of JERICO-RI will benefit of collaboration with other RIs to get information on driving pressures like e.g. information on the river discharges, and on boundaries conditions like e.g. open sea current and hydrology properties. Conversaly JERICO-RI would inform terrestrial RIs on coastal properties such as forcage parameters, e.g. coastal currents for littoral erosion, or pollutants transport to the shore.

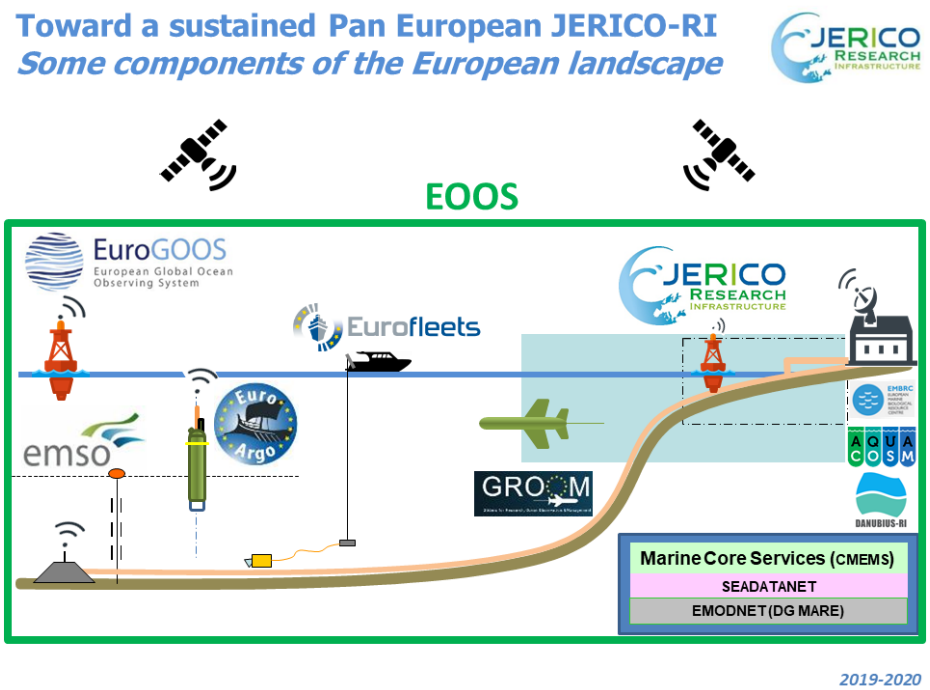

Figure 1: The EU landscape of observation systems and RI in the marine domain

In addition AQUACOSM, Danubius, EMBRC are providing complementary information and services applicable in the coastal domain. Thus, JERICO-RI occupies a specific place in this EU marine landscape, between the open sea RIs and more terrestrial ones. As such, it is targeting to act as the coastal component of the EOOS initiative and to collaborate with surrounding RIs of the landscape.

Figure 2: Position of JERICO-RI in the landscape of EU environmental RIs and initiatives (ENVRI Community)

These considerations also introduce the complexity that JERICO-RI has to face because of its inbetween position: coastal marine processes are related to those of the open sea and to those of the terrestrial and atmospheric domains. In some other words, by essense, JERICO-RI has to respond to the challenges of the coastal domain, i.e. the complexity and variability in time and space at various scales of the invoved physical and biogeochemical processes, and the diversity of the purposes that the RI should serve, which are often regionally driven.

Consequently, JERICO-RI put emphasis on the mutidisciplinarity of observations, acknowledged the need to deploy complementary observation systems such as fixed platforms, gliders, ferryboxes, HF Radars, cable observatories, floats, to operate specific facilities as metrology laboratories, and dedicated equipements to be deployed on demand. In addition, scientifically sound sampling strategies in space and time are necessary to tackle key questions of the coastal domain,

1.2.2 <u>The history</u>

<u>The ID card of JERICO-RI:</u>

JERICO-RI is a marine infrastructure to observe the coastal sea in Europe. It is composed of several types of observation systems:

- Type A: gliders (look like drones, but they are "flying" in the sea water
- Type B: ferryboxes (package of sensor implemented on board ferries and other ships of opportunity)
- Type C: fixed platforms like buoys
- Type D: cable observatories (it is like a set of observation systems seated on the bottom of the sea, connected to a junction box then to a ground station to exchange energy and data)
- Type E: HF Radars
- Type F: specific equipments
- Type G: metrology and calibration facilities

Because of the permanent evolution of JERICO-RI needed to stay at the state of the art, some other potential observation systems will be considered for the future, by firstly assessing the needed harmonisation requierements to be agreed in the consortium.The entire concept of JERICO-RI really bornt in 2014, after a preliminary phase in 2011-2014: JERICO-FP7. It was applied in JERICO-NEXT (2015-2019) according to the following statement.

JERICO (Joint European Research Infrastructure of Coastal Observatories)
"Strengthening a European network of coastal observatories and **providing a sound operational service for the delivery of high quality environmental (physical, biogeochemical and biological) data and information products related to the marine environment in European coastal seas**."

These are the keywords that have been guiding the development of the JERICO-RI for almost 10 years. The strategic approach has been to make progress on integration, harmonisation, service access, structuring and sustainability at EU scale in several JERICO phases, justifying the series of JERICO-projects (figure 3).

The JERICO-FP7 project provided a preliminary definition of coastal observation systems that deliver high frequency in-situ covering physical and/or biogeochemical data, from the seashore to the shelf break. The JERICO-FP7 consortium, 27 partners from 17 countries in 2011-2015, built on the existing communities which were mainly relying on automated high frequency observation systems: the ferryboxes, the gliders, and fixed stations like buoys.This was the first European wide effort towards the harmonisation and coordination of the major coastal observing platforms.. Nevertheless, this initial stage was mainly technology driven and the observation of the biology compartment was embryonic. The consortium agreed on the need to include the observation of the biology compartment with an ecosystem approach.

This led to the second step in the process, with the JERICO-NEXT project funded under H2020 involving 34 partners in 15 countries. The ecosystem approach was organised according to **five main scientific topics: pelagic biodiversity focused on phytoplankton and eutrophication, benthic biodiversity focused on habitat, chemical contaminants (mainly organic), carbon cycle and carbonate system, hydrography and transport with some applications to operational oceanography and forecasting as the 6th topic**. The JERICO-RI also integrated new systems: HF radars and coastal cable observatories. With these two previous projects, the JERICO consortium reaches the status of an Advanced Community. This project also brought the first bricks to build a sustainable RI by elaborating a cost business analysis and proposing a first scientific approach complying with the general JERICO-RI mission. This collaborative work contributed to sketch out the next phases to progress on building and implementing a sustained JERICO-RI.

As a result of the good progress and remaining challenges for the JERICO-RI, a 3rd elaboration phase, called JERICO-S3 (as for "JERICO Science, Service and Sustainability"), has been granted by the EU-H2020 framework programme (2020-2024). The present document describes the roadmap for the future of the operational JERICO-RI, beyond the further JERICO-S3 step. JERICO-S3 is putting emphasis on regional structuration of the RI and on testing the concept of e-JERICO with preminary dedicated developments whereas a complementary Design Study project, JERICO-DS, if funded, will engage nations and design the RI: from the technology design to the business plan and a proposed governance.

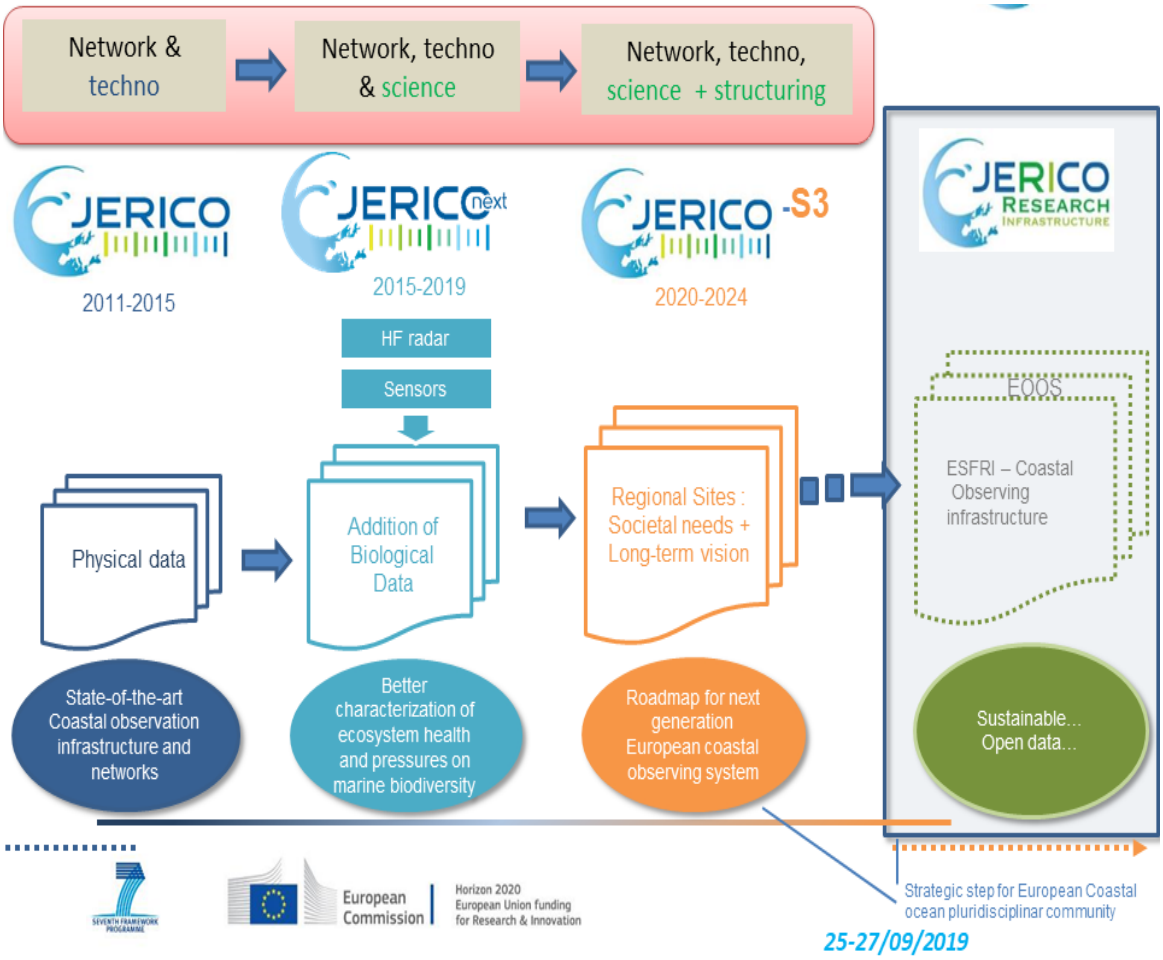

Figure 3: The history of JERICO-RI

1.3. Mission and Vision of JERICO-RI

Scientific mission: JERICO-RI is an integrated pan European multidisciplinary observing system of European coastal seas interfaced with the open-ocean and continental systems. It relies upon a strong scientific concept and expertise. The RI delivers high-quality FAIR data and services in support of research and innovation.

- JERICO-RI contributes to a better understanding of the functioning of coastal systems and thus to a better assessment of their trajectories through the combined effects of natural and anthropogenic changes. By doing so it contributes to an efficient management of major ecosystem services and environmental risks, leading to an improved knowledge framework for sustainable development in coastal areas and the emergence of a coastal blue economy.
- JERICO-RI provides fit-for-purpose innovative services to monitor the complex marine coastal seas and offers open-access to a large set of state-of-the-art technological platforms and facilities, for international science collaboration.
- JERICO-RI holds an expertise for operational data acquisition, delivery and processing.

The Vision of the JERICO Research Infrastructure

By 2030, JERICO-RI will provide a cutting-edge EU research Infrastructure dedicated to observe and monitor European coastal seas. It will introduce a paradigm shift in the assessment and the understanding of the key processes controlling the functioning of marine coastal systems. JERICO-RI will support a quantum leap in knowledge building and value creation and contribute to the European leadership in coastal ocean observing.

Such an EU RI dedicated to the coastal domain observation and research will support national policy bodies to apply national environmental policies and EU ones like the MSFD by benefiting of the experience and know-how shared with other nations, specific services to get information, data, practices and expertise from a single shopping point.

In order to serve both the scientific community and societal and policy concerns, JERICO-RI needs to progress towards a structured operational European RI, supported by the EU member states (and associated members) and the EC, and recognised as an added-value RI to be registered on the ESFRI roadmap 2021 (or 2024). This should lead for the JERICO-RI to be run as an operational RI near 2030.

To reach this target, the JERICO system of systems will progress towards:

a) Achieving a degree of harmonization to deliver services and solution
b) Achieving the delivery of services and solutions
c) Setting up a network of structured and organized observations (governance etc)
d) Setting up a collaborative framework with European RIs from the environmental domain and at national level as well
e) Implementation phase
f) Operation phase

Items a) to e) are main milestones JERCO-RI must achieved in a stepwards process. The present document will present the strategy to reach them (chapter 4) after having considered its main structuring elements (chapter 3).

Marine coastal facilities, observatories, expertise and data for Europe

2. Structuring considerations and elements for the JERICO-RI Business plan

2.1. The values of the JERICO-RI community

A strong joint effort at EU level to **harmonise observations**, from the sensors to the data analysis to provide **top quality data, supporting excellence in research,** stands in several key values:

- ✓ **Scientific Excellence**: The importance of complex processes in the coastal zone means that the JERICO-RI invests in scientifically sound simultaneous observations of physical, chemical and biological parameters, innovation in key areas of biogeochemical observing technologies
- ✓ **Co-creation**: synergy and collaboration enhance efficiency and power of the coastal community
- ✓ **Effective collaboration** with other marine RI is important to correctly approach the ocean environment, from the coast line to the open sea, as a global ecosystem
- ✓ **Openness**: FAIR data and access to the system
- ✓ **Prospectivity**: need to keep the RI up to the state of the art and anticipate changes. Need to be visionary
- ✓ **Service-oriented** to support operations and users.
- ✓ **Protecting** our marine environment

Equality of opportunity: the JERICO-RI Consortium is aware of the importance of attracting more high quality female researchers into the sphere of marine sciences, research and research management. It will ensure that it will act following the EC recommendations listed in the "Gendered Innovation" to stimulate and promote the progress of women in scientific careers. The promotion and monitoring of gender equality throughout the project will be the direct responsibility of the coordinator.

2.2. The ESFRI Methodology

The ESFRI methodology is framing and supporting European RI project to progress along the life cycle of a Research infrastructure (ESFRI 2021 guidelines). The progression of RIs around the cycle is mainly considered for the so-called Scientific Case and the Implementation Case, and then each along 5 dimensions such as e.g. the Socio–economic impact and the User Strategy for the first one, or the stakeholder commitment and the governance for the second one /former. This methodology is applied in this document to establish the Roadmap of JERICO-RI towards an operational and sustainable RI as expressed in the last chapter of this document. For more information about the methodology the reader can refer to the recently edited Roadmap 2021 public Guide (Sept. 2019, https://www.esfri.eu/esfri-roadmap-2021).
In the next 2 sections, we show how JERICO-RI progressed for both cases, and next steps are briefly outlines.

2.3. The scientific case

2.3.1. *Considerations for the User Strategy and expected impacts*

The JERICO-NEXT H2020 project was implemented to address different key environmental issues and/or policies such as the Marine Strategy Framework Directive (MSFD), the regional Seas conventions and inititatives (OSPAR, HELCOM, ICES …). Here we make a focus on the MSFD that previously strongly structured JERICO-RI in 6 scientific topics here after named JERICO Topics.

2.3.1.1. JERICO-NEXT focused on 7 descriptors of the MSFD:

MFSD policy	JERICO-NEXT Contribution
D1: Biodiversity	Use and harmonisation of methodology to assess benthic and pelagic biodiverisity, with focus on algae blooms and benthic populations.
D2: Non-indigenous species introduced by human activities	Ocean changes (e.g. ocean warming) induced by the climate change (partly induced by human activities) could be the reason of the arrival of non-indigenous species with low swimming abilities and whose spatial distribution is highly depending on hydrodynamics.
D5: Human induced eutrophication	Application and assessment of several complementary methodologies to observe development of algal blooms in different trophic conditions around Europe.
D6: Seafloor integrity	Development and application of a trawled floating system to monitor the seafloor with limited impact. Development of a Sediment Imaging profiler to observe the sediment life.
D7: Permanent alteration of hydrographical conditions)	Application of a multiplatform continuous monitoring of hydrographic conditions
D8: Contaminants and Pollution effects	Harmonisation of organic contaminant observation around Europe with Ferryboxes and passive sampler.
D10: Properties and quantities of marine litter	Marine litter is advected or drifted by marine currents. = provide information about hydrodynamics and derived transport to infer the spatial distribution (e.g. convergence areas and coastal arrivals) of this not-desirable material

2.3.1.2. Expectections and Uses in JERICO-NEXT

- **Two tools to investigate expectations and uses: the Virtual Access (VA) and the TransNAtional Access (TNA)**

The so-called "virtual access" activity was dedicated to set up and assess access to data and information from in situ systems such as HF radar, FerryBox and fixed platforms but also other information from discrete samplings or archives. The data and information access is intended to enable scientists to carry out high quality research using data from a variety of coastal observation systems. It also promotes the improvement of existing services and potentially the development of new services. As a test case of the JERICO virtual services,

15 virtual infrastructures were selected in JERICO-NEXT (http://www.jerico-ri.eu/virtual-access/). All the virtual infrastructures provided physical data and some biogeochemical data and 4 provided biological data. In JERICO-S3, 22 services will be proposed by 18 providers from 12 nations.

The Virtual Infrastructures in JERICO-NEXT contained 4 types of expertise:

Expertise Type #1. Data access, quality-controlled processes and expertise.
Expertise Type #2. Tools for visualisation/data handling/cataloguing.
Expertise Type #3. Expertise on sensors/measurements types and their compatibility.
Expertise Type #4. Thematic expertise on what is observed in terms of physical, biogeochemical and biology parameters.

The activity for Trans-National Access (TNA) is described in deliverables D7.1 (Sparnocchia et. al, 2016) and D7.3 (Sparnocchia and Ferluga, 2019). JERICO-NEXT offered researchers from academy and industry to access original coastal infrastructures for measurement campaigns and instrument testing in a coordinated 'free of charge' TNA. These opportunities are expected to help building long-term collaborations between users and JERICO-NEXT partners, and to promote innovation and transfer of know-how in the coastal marine sector. An on-line catalogue in http://www.jerico-ri.eu/tna/ describes the TNA offer to help potential users evaluating, among the available infrastructures, those suitable for the purposes of their research. It proposed 30 proper observing systems, 4 supporting facilities (laboratories) and 1 special equipment. Currently in JERICO-S3, 43 systems will be available in TNA, provided by 21 partners in 15 nations.

❖ Outcomes of VA and TNA: expectations and uses

About VA:

The User Engagement Panel was set up be a dynamic communication channel with key stakeholder groups: public authorities, policy, research, education and operational communities including industry. The User Engagement Panel (D6.2, Creach et al. 2019) expected a specific scientific knowledge and technical expertise, which could be useful in their sector of activities. Data access, quality-controlled processes and expertise (1) as well as visualising, handling and cataloguing (2) were the main activities in the virtual access and data management in the project.

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Recommandations:

- Harmonise the visualisation between partners.
- Brand and advertise JERICO-NEXT products: the programme will gain in visibility with thestakeholders.

- Expertise types 1, 3 and 4 are specifically requested by users.
- Provide data and information without any charge,
- Insist on & provide good metadata,
- Provide transparent QA and QC processes,
- To involve experts groups (such as those from OSPAR) in case studies and observations actions.
- To develop the application of Digital Object Identifier (DOI) to enhance the traceability of data in an interoperable way as considered in data aggregator initiatives such as SeaDataNET.
- To carry on progressing on data interoperability with the Pan-European data infrastructures (ex: EMODnet, SeaDataNet, CMEMS) but also to collaborate with other exploitation platforms (e.g.: ESA Thematic Exploitation Platform, and DIAS) that can be used to bring data to the users/researchers for developing testing and optimisation processing and QA/QC (e.g: algorithms for EO) through virtual IT environment.
- To support the visibility of data from the virtual infrastructures particularly the biological data (data visualisation tools).
- To improve the flow and the quality of the data for validation of numerical models and providing ground truth data for remote sensing products.

From an OSPAR perspective the most likely users will be the specialist scientific working groups, for example on contaminants, ocean acidification, eutrophication, species and habitats, offshore industry (oil & gas and renewables). For them the QA and QC of data and information are of utmost importance. Operational oceanography and real time data are rarely required. OSPAR Contracting Parties have national monitoring programmes that contribute to the OSPAR Coordinated Environmental Monitoring Programme (CEMP). This provides the data used by the experts to conduct assessments. It is quite likely that many of the national virtual infrastructures are already part of the CEMP, for example, much of the data available in the Cefas data hub are already used in OSPAR monitoring and assessment programmes. New sources of quality-controlled and quality-assured data, information and innovation are welcomed, but the experts are unlikely go looking for it, unless they have identified information gaps. **Therefore, JERICO partners need to approach the experts if they really want their data and information to be taken up by OSPAR expert groups**.

Conclusion on provided Virtual Access (Deliverable D8.14, Creach, 2019)

- The interest is at the national level and the data are mainly used for scientific purposes.
- All the actions carried independently by the providers agreed with the FAIR principle for data aiming to improve the flow and the quality of the data for validation of numerical models and providing ground truth data for remote sensing products.
- As a project activity, the virtual access activity represents an opportunity to share practices, tools (ex: development of algorithms for processing data from HF radars) and repositories (GitHub) to process more efficiently data and to create specific services for the JERICO research infrastructure.

These considerations drove ideas towards the e-JERICO part to complement the physical part of the RI as a key element of the strategy to provide services and solutions for users

About TNA

Statistics affairing TNA in JERICO-NEXT are reported in the table hereafter whereas figure 5 illustrates the success of TNA offers. Figure 5 shows the TNA routes highlighting so the exchanges of expertises, equipments and systems across Europe.

	JERICO-NEXT	JERICO
Facilities in the catalogue	35	18
Targeted facilities (% vs offered facilities)	24 (69%)	13 (72%)
Submitted TNA projects	40	24
Supported TNA projects (% vs submitted projects)	28 (70%)	19 (79%)
Number of users (Women, %)	102 (29, 28%)	55 (14, 34%)
Access provision (days) DoA %	4137 4128 100%	2670 1044 256%

From JERICO-FP7 to JERICO-NEXT the access provided doubled to 4137 days over 3 years of access.

Figure 4 from D7.3, Sparnocchia and Ferluga, 2019: JERICO-NEXT facilities targeted by user's proposals.
The circles lined up identify routes of the ships carrying ferrybox systems; the white squares identify fixed stations and cabled observatories; the red triangles identify the laboratories on the ground of the gliders; the yellow circles identify supporting facilities. The number of proposals approved for the relevant facilities is indicated within the white circles.

Figure 5 JERICO-NEXT transnational research routes. The thickness of the lines is proportional to the number of users, as indicated in the insert.

TNA proved its effectiveness in supporting and mobilizing researchers and industrial companies through Europe, even if most of the routes are inside the Mediterranean region and towards the northern ones. In doing so, it contributes to the advancement of knowledge and technology and plays a role in strengthening research capacity within the European Research Area (ERA), a unified area open to the world, where scientific knowledge, technology and researchers circulate freely.

Research infrastructures play a crucial role in the development and maintenance of the ERA. The boost to research capacity, strengthened by the productive circulation of knowledge, talented researchers, technical experts and engineers, should generate broad and lasting benefits for the economy and society and increase cohesion among the Member States. The JERICO joint research infrastructure has contributed to this important task over the past eight years with projects funded by the European Commission (JERICO-FP7 and JERICO-NEXT) and the consortium intends to continue in this direction in the future.

2.3.1.3. Preliminary list of users of JERICO-RI and impacts

- **Expected users**

Expected users categories represented by the JERICO-NEXT User Engagement Panel are national and EU levels: public authorities, policy, research, education and operational communities including data aggregators and the Copernicus Marine Core Service and industry. In order to define the business plan of JERICO-RI, users should be better defined, as well as their needs and demands.

- **Some expected sotieto-economic impacts from JERICO-RI**

The work led across WPs of JERICO-NEXT helped assessing preliminary societo- economic impacts as it follows.

- Support decision making with regards to Protection of marine environment from oil spill accidents, taking into account the future plans for oil drilling activities in the area
- How to intereact with decision makers to support handling of coastal erosion problems, which are critical in specific areas?
- How to secure ecosystem health, ecosystem services and sustainable blue growth?
- Integrated management of commercial Fishing species
- Forcasting of transport of flotting marine litter and plastic pollution, transport of pollutants
- Support to management of hazards and coastal risks and adaptation measures to the erosion of the coastline in a climate change context as well as management of impacts of Extreme and high energy events.
- Support to Marine spatial planning and management for renewable energy, marine natural resources (biodiversity, HAB, eutrohication and seafood quality).

2.3.1.4. Next steps for a sustainable JERICO-RI

Users and impacts have been roughly appraised in JERICO-NEXT whithout consideration of the regional specificities: regional ecological issues and hazard and the releted impacts nor of the national expectations including for instance national regulations, scientific priorities and economical needs. The regional needs will be investigated in JERICO-S3 project whereas the national ones will be the case for the Design Study.

The VA service in JERICO-NEXT was successful despite its fragmentation in between institutions and the lack of demand analysis. To progress towards an operational RI, JERICO-NEXT will survey the actual demand of services, to operate a central service access, e-JERICO, and would offer a single entry point for coastal research services.

How products and expertise services offered by the JERICO-S3 consortium are tailored towards User needs will be assessed: knowhow and knowledge gathered in a virtual library of protocols, practices and computing codes, and offered computing facilities (i.e., for data processing). User requirements will feed the user strategy as a starting point. Feedbacks of the User committee will be analysed in the face of the user's environments to establish an optimize user strategy.

2.3.2. <u>six scientific Topics of JERICO-NEXT: from a proof of feasability to key questions</u>

The initial scientific concept of JERICO-RI was tested during JERICO-NEXT. The aim was to foster a joint observation of European coastal seas through an original approach also aiming at further improving the scientific and technological expertise of the RI. The implemented approach considered the data cycle in its entirety: from sensor and method developments to data management, flow and processing across 6 scientific topics. The selection of the six scientific topics was based on both sound scientific questions and relevant policy needs (e.g. EU policy: Marine Strategy Framework Directive).

❖ **A proof of feasability with the 6 topics**

1- Topic#1 on pelagic biodiversity: to support the study and the monitoring of phytoplankton, including harmful algae in European Sea.
2- Topic #2 on benthic biodiversity: to the study benthic macrofauna diversity and its interactions with disturbances and functions (i.e., organic matter mineralization).
3- Topic #3 on chemical contaminant occurrence and related biological responses: to identify new contaminants in coastal waters, to describe the spatial distribution of chemical contaminants, exploring the drivers controlling spatial distribution and co-linearities between contaminant concentrations and biological responses
4- Topic #4 on hydrography and transport: focuses on the 4D characterization of shelf/slope circulation and its time variability year-round in trans-boundary areas through the joint analysis of multiplatform data of surface currents and hydrology and information from the water column
5- Topic #5 on carbon fluxes and carbonate system: aims at understanding and quantifying the influence of biological activity on carbon release or uptake, relative to physical and chemical processes affecting sea-air carbon fluxes.
6- Topic #6 on operational oceanography and forecasting: shows the importance of JERICO-RI observations for the assessment of operational regional models implemented in the coastal ocean, leading to recommendations for coastal forecasting system improvements, both in terms of models and observations.

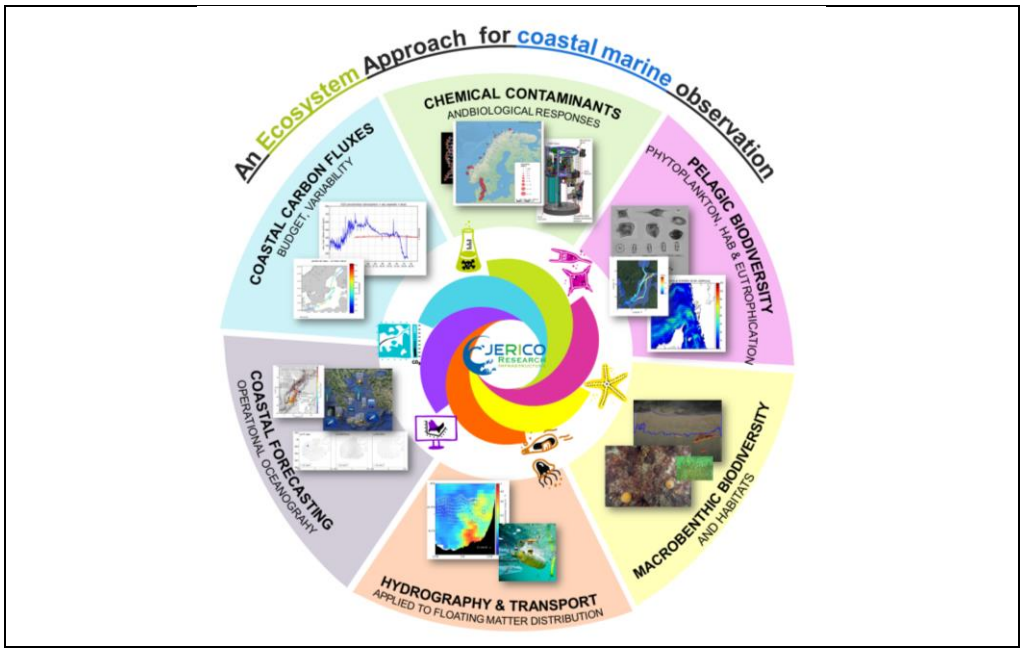

Figure 6: The 6 scientific topics of JERICO-NEXT

Based on policy and societal needs, during the JERICO-NEXT project, 6 cases were applied, the so-called Joint Reseach Activity Projects (JRAPs), to elaborate on the topic concepts, test JERICO-NEXT developments and apply data management procedures and assess the further needs (Deliverables D4.1 D4.4 and D4.5 of JERICO-NEXT).

Thanks to this preliminary topical structure, JERICO-NEXT proved the feasibility to set up and perform:

i) a study of the phytoplankton distribution at EU scale, and more specifically of Algea blooms based on the deployement of complementary observation systems,

ii) a study of the carbon cycles and of carbonate systems at EU scale, but with periodic calibration and intercomparison of systems

iii) monitoring of contaminants in an interoperable way at EU scale

iv) the possibility to use low coast sensors to observe high frequency hydrodynamics and the benefit to jointly deploy experiment at sea with application of remote information and modelling.

It also demonstrated with a strong case the need of in situ data vs models, specifically for coastal processes.

In addition, as this work was based on the identification of some key multidisciplinary scientific objectives and questions per JRAPs and per region to examplify how JERICO-RI could progress on, a synthesis can be extracted here after.

- **Some key scientific objectives and questions elaborated from the JRAPs**.

- ✓ **A better understanding of the coastal marine ecosystem processes and the impacts of the complex coastal dynamics on the marine life and marine ecosystems.**
- ✓ **A better assess the influence of coastal & terrestrial activities and urban sewages on coastal ecosystem and then on the open sea fertilization and pollutant impact**.
- ✓ **A better understanding how do climate change and human activities on long term affect the state of coastal seas on biodiversity and eutrophication.**
- ✓ **The improve in situ observation for numerical models and to develop new tools or improving of applications of operational oceanography to relevant societal needs**

Consequently, the scientific purposes of JERICO-RI progressed from a topical view to a more integrative one, strengthening the multidiciplinarity. Results highlighted in Deliverable D4.4 acknowledged the existence of regional specificities in scientific objectives and questions as well as policy and societal needs. Preliminary recommendations for further regional deployment strategies were given, with consideration of the further technology developments as well as of the observing systems and regional modelling needs and possibilities.

As one of the main conclusions, JERICO-NEXT highlighted the need to develop an observation system based on an ecosystem approach in agreement with regional specificities, fostering multidiscplinarity..

2.3.3. Pillars of the Science Strategy

As one of the main conclusions, JERICO-NEXT highlighted the need to develop an observation system based on an ecosystem approach in agreement with regional specificities, pushing further ahead the multidiscplinarity.

These considerations were important to specify how to build the science strategy of JERICO-RI for the future according to 5 pillars (Figure 6) described here after (Deliverable D1.2.

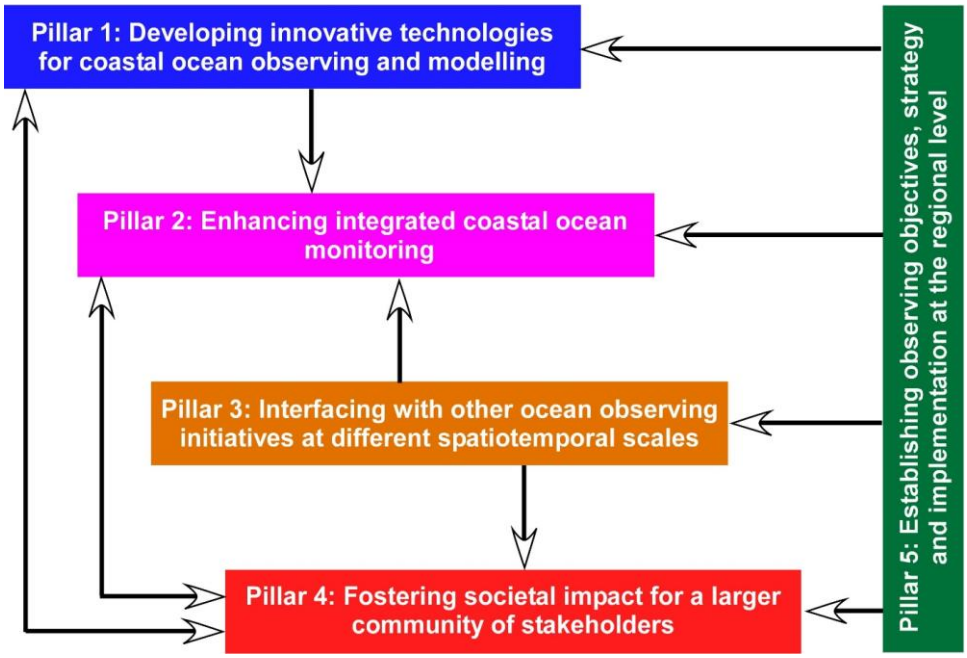

Figure 7: General structuration of JERICO-RI science strategy showing its five main pillars together with their main interactions.

2.3.3.1. Pillar 1: Developing innovative technologies for coastal ocean observations

❖ Scientific and technology innovation

The medium term strategy of JERICO-RI (JERICO-S3) put focus on:

1) *TRL enhancement of biological sensors* – more specifaclly those based on imagery technologies to be automatized and deployed for measuring biodiversity of phytoplankton (flow cytometry) and algae toxin (Surface Plasmon Resonance) JERICO-RI will enable consolidating and testing biosensors developed in the framework the Ocean-of-Tomorrow, for heavy metal and microplastics, respectively

2) Developing an automated and smart water sampler and preservation device for *measurements of biodiversity (metabarcoding, eDNA)* and contaminants, to improve the frequency of sampling of important but poorly monitored environmental variables, such as low trophic-level biodiversity and a range of contaminants.

3) *An integrated benthic observation platform. IoT/AI based smart technology* will be implemented as appropriate in dedicated sensor package facilities, aiming at optimally observing specific processes. The use of Internet-of- things and web-sensor enablement technologies will be promoted for interconnecting sensors, also providing an innovative technological framework for automated steering and triggering of sensors, based on machine learning data analytics for e-JERICO.

On the long term, JERICO-RI will keep track of and incorporate emerging technologies to ensure a sustained scientific relevance.The Design of the RU will necessarly consider the potential of emerging technologies (e.g. IoT/AI, automation, biotechnology, photonics) for coastal observations. For this JERICO-S3 will investigate how disruptive innovations, emerging technologies and cross-disciplines endeavours is likely to give appropriate responses to current and long-lasting environmental challenges in Europe, and lead to a paradigm shift in the way marine coastal ocean will be observed in the future and conclusion will feed the Design Study.

- Innovation in product and services for Science and Society

JERICO-RI ambitions to deliver high-quality multidisciplinary datasets and services for science and society. The consistency of the datasets providing by the JERICO-RI is of highest value for science and for further re-use of data for products and downstream services. Several tools *tools for users* and innovations will be developed and implemented to ensure the traceability and visibility of JERICO-RI data and dataset and to provide news products available in the Virtual Access environment of the e-JERICO (Virtual Research Envionment: VRE).

On the medium term, the embryonic version of an e-infrastructure, the Pilot e-JERICO, will be developed in JERICO-S3 as a Virtual Access (VA) scalable framework that allows visibility and easier access to JERICO-RI capabilities. It will:

1) *create Pilot Data-to-Products Thematic Services* as exemplars for future thematic services and for demonstration and evaluation of Portal effectiveness
2) *provide access* to the most important JERICO Resources (Catalogued) and Pilot Data-to-Products Thematic Services (D2PTS).
3) *demonstrate benefits* of the JERICO RI information life cycle through four pilot-focused regional/thematic services, bringing the D2PTS to TRL7.
4) *strongly engage with COPERNICUS and EModNet* in the elaboration of coastal products for a range of stakeholders by establishing the formal framework of cooperation with CMEMS, while servicing CMEMS and EModNet in terms of data provision will be further consolidated through WP6.

On the longer term, after development of the e-JERICO pilot from the resources made available by some partners and maintained for 2 years as a fundamental component, the J-DS will target the technical design of the full e-JERICO. It will indicate the needed new developments, with the approved access policy and drafted security policy, the draft strategy for JERICO data integration, the draft operational planning for service delivery, draft partners agreement for delivering of services and data, the whitepaper establishing a future Data Management strategy, integrated in the EU landscape, that may be incorporated within the e-JERICO, and extension of the J-S3 Data Management Plan.

2.3.3.2. Pillar 2: Enhancing coastal ocean integrated observing

A major issue regarding Coastal Ocean integrated observing consists in enhancing the harmonization of observations achieved by different operators at various locations so that they become comparable. A way forward then consists in defining and applying best practices procedures allowing reaching satisfactory quality standards, but also in supporting their application.

On the medium term, in the framework of the JERICO-S3 project, JERICO-RI will:

1) Facilitate the application of Best Practices (BP) already developed as a legacy of JERICO-RI, but not restricted to, by setting up functional tools (e.g. repository of BP information and documents, computing libraries, and links to computing facilities…),
2) Monitoring their application in the JERICO-RI (Specific KPIs),
3) Ensure this harmonisation will spread around beyond the boundaries of JERICO-RI by enhancing the spread of technologies and products for coastal ocean,
4) Foster an integrative observation based on an ecosystem approach across the hereabove JERICO-NEXT topics. For this it will implement a limited number of pilot sites representative of the main hydrodynamical regimes of the coastal European ocean (see pillar 5).

On the long term JERICO-RI will frame the following:

1) The applications of BP thanks to the application of the so-called JERICO Label, a document that will gather a set of criterias defined to ensure some standardisation and interoperability, and the quality of data for coastal observatories, their application modalities and the related JERICO application policies and access policies (access JERICO-RI, both physical and virtual parts). This living document has been initiatied in JERICO-FP7, updated in JERICO-NEXT and then will be revisited during the Design Study to include a long-term framework for the future JERICO-RI.
2) The application of an integrating observing approach in JERICO regions and sites after testing the concept in JERICO-S3. The feedback will feed JERICO-DS to design its possible organisation and functioning by proposing scenarios and concepts to select one in agreement with involved institutions and nations.

2.3.3.3. Pillar 3: Interfacing with other ocean observing initiatives at different spatiotemporal scales

The coastal environment is by its nature, complex, driven by and impacting local to large scale phenomenas. Its undersanding necessarly relies on cooperation with: (1) European observing infrastructures/initiatives on Open Ocean and riverine/terrestrial systems, (2) other European world-class ocean observing infrastructures/initiatives, (3) local observation providers, and (4) other providers of Coastal Ocean observations and (4) major non-European national ocean observing national systems.

On the medium term, thanks to JERICO-S3, JERICO-RI will foster these cooperations by:

1) Developping collaborations with Open Ocean (e.g. EMSO, EUROARGO…) and river-sea systems (e.g. DANUBIUS) infrastructures. Interactions will be achieved at high level with the ultimate aim of signing Memorandum of Understandings. Joined collaborations will also be explored at the regional and sub-regional levels within both a limited number of supersites and Integrated Regional Systems.
2) Interacting wirh European world-class ocean observing infrastructures/initiatives including ERICS such as as EMBRC (biology) and ICOS (carbonate systems) as well as other relevant infrastructures such as AQUACOSM (*in situ* experimentation).
3) Develop bilateral interactions with local observation provders and collaboration with major non-European national ocean observing national initiatives.

To implement this **on the longer term**, the JERICO Design Study will include agreements developed in J-S3 in its design and this will be alined with the national strategies as nations also invest in other EU RIs.

2.3.3.4. Pillar 4: Fostering societal impact for a larger community of stakeholders

On the medium term, in JERICO-S3, JERICO-RI will contribute to enlarge and deepen the involvement of the coastal ocean observing stakeholder community by: (1) mapping this community and better identifying its needs through active interactions; (2) comparing these needs with currently available products/services. These two actions will be achieved over a large range of spatial scales from global to local with a particular emphasis put on the regional and sub-regional levels. By doing so JERICO-RI will enlarge its current user committee and better interact with its members. JERICO-RI will for example achieve an analysis of expectations from the policy realm versus products derived from coastal observing. It will identify the needs from EU directives and Regional Sea Conventions in relation to current monitoring programs and identify products that can contribute to meeting these needs. A similar approach will be developed for the actors of the private sector. In JERICO-DS the stakeholder analysis will be enlarged to include national stakeholders to consider national regulations and needs supported by national RIs.

On the long term JERICO-RI needs to keep up to date the stakeholder analysis to stay in line with societo economical changes in a changing policy context. This will be supported by establishing Key Performance Indicators (KPIs) appropriate to the coastal observation.

2.3.3.5. Pillar 5: Establishing observing objectives, strategy and implementation at the regional level

On the medium term, JERICO-RI, through pilot initiatives, will implement a set of Augmented Regional coastal observatory network in JERICO-S3 to:

1. Transnationally share and manage platforms/equipments and plan joint missions,
2. Jointly manage the whole data lifecycle, following the FAIR principles,
3. Increase the societal and scientific value of observations through data fusion and integration,
4. Transfert knowledge within and between regions, and between research infrastructures.

In addition, JERICO-RI will prepare less mature regional areas for future implementations.

As such, JERICO-S3 is proposing an organisational model that addresses and links together observations performed at pan-European scale down to regional and local scales in order to maximise its relevance for society. In JERICO-DS, the study will consider how to operate these regional nodes with responsabilities and roles distributed amongst nations and institutions.

On the long term, new sites may be integrated in the regional design as explained here after in the description of the regional approach.

2.3.4. Regional approach proposed by JERICO-S3

Outcomes from the JERICO-NEXT JRA provide evidence on how to further shape the European coastal observing system, and allow us to propose an ambitious project for Europe. A main lesson learned is that societal challenges and priorities at regional level are important elements for the structuring of a coastal observing system. Therefore, the **regionalisation of the observatories is a key step for a better understanding of the processes and an improved fit-for-purpose** JERICO-RI. Furthermore, the observatories need to be

consolidated in terms of performance, reliability and variables to be observed for optimally answer to key regional and pan-European environmental questions. The two above-mentioned aspects, regional integration and addressing environmental questions, are the integration challenge that ***JERICO-S3 will address by implementing a regional structure of JERICO-RI***. This structuring process will face the difficulty that all the observing facilities do not have the same organisation, objectives and means.

All the observing facilities have not the same organisation, objectives and means. The coastal observing systems can be represented in the following triangle:

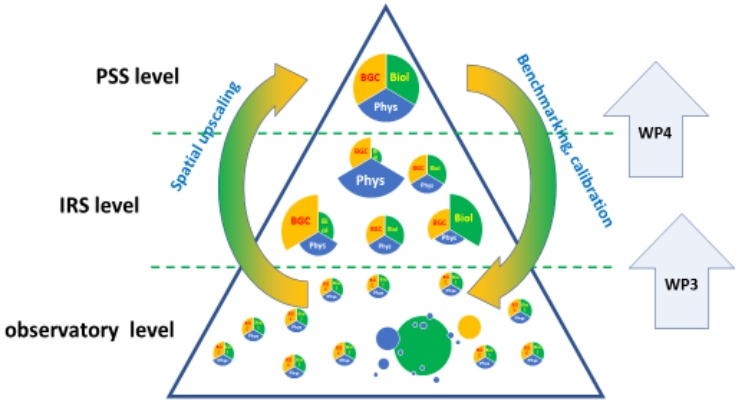

Figure 8: Possible structuring of the coastal observing system in JERICO-S3 (Tamminem, 2019)

The lower level represents the observing facilities in their regional or national configuration, built to answer to specific questions generally asked by their government or assembly. Reaching the second level of integration was the focus of the two former JERICO projects i.e. more coordination, more coherence but with inadequacies in the spatial and/or temporal scales at which observations occur, as well as inadequate selection of parameters - referred to as IRS (Integrated Regional Site). The upper level of integration, hereafter referred to as PSS (Pilote Supersite), enables an efficient observation and innovative monitoring of complex multidisciplinary processes at regional and European scales.

The JERICO-RI systems will be further harmonized and performance indicators will be developed for better assessment of the inherent quality of the proposed systems. Progress towards IRS will be pursued in six regions where integration of platforms and disciplines are less advanced for the time being (Kattegat/Skagerrak-Eastern North Sea; Norwegian Sea; Bay of Biscay, Northern Adriatic Sea and Iberian Atlantic Margin). Progress towards PSS will be realised in four regions (Gulf of Finland, Baltic Sea, South North Sea-English Channel, NW- Mediterranean and Cretan Seas). Innovation will be tested in PSS. Cooperation and partnership with other providers of coastal observation will be sought; Valorisation towards sustainability is an important endeavour of the project, as well as elaborating a 15-year vision for coastal observation.

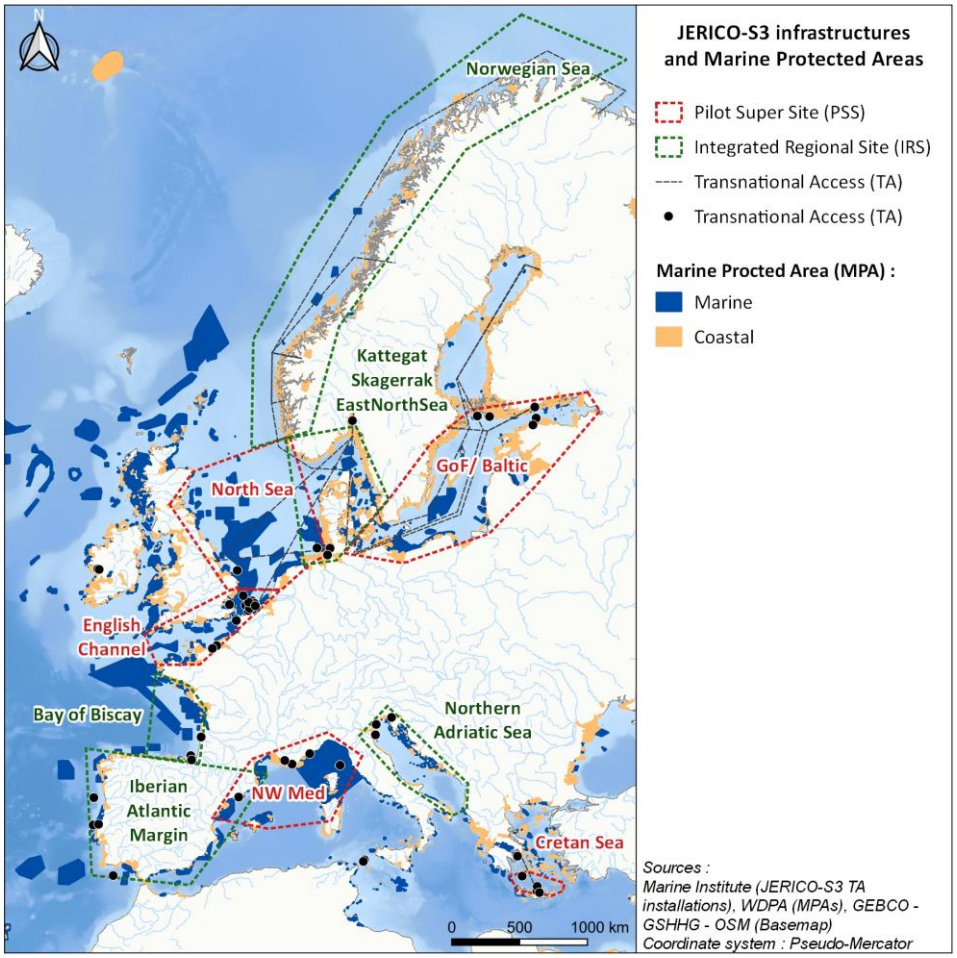

Figure 9: JERICO-S3 sites and infrastructures (L. Cocquempot, 2019)

An extended data management process will be proposed for easing access to JERICO-RI data, In JERICO-S3 we will also implement an ambitious outreach programme, leading to an efficient communication, supporting dissemination and impacts.

Data management activities have to be led by experts in international cooperation regarding marine data management who are already working with several (environmental) Research Infrastructures to provide compliant data services. ***JERICO-RI*** will use efficient and **FAIR data management practices** across the project and has a dedicated activity focused on data management in the research infrastructure. Data management **guidelines and best practices** will be produced for the data providers of the coastal observatories, and marine data management experts will **monitor and influence data management activities** of specific platform and sensor working groups.

2.4. The Implementation Case

In the JERICO series, the implementation case mostly started to address the governance and its economical considerations, and to set up a framework document including references to best practices and criterias of an operational RI with capability to deliver qualified data, information and services, the so-called JERICO Label.

2.4.1. *The governance and economical considerations*

Nowadays, most important stakeholders of JERICO-RI are:

- Oceanographic institutions owning observation systems of JERICO-RI
- Scientists of the marine domain
- Ministries and national agencies
- Regional agencies in nations
- EU/EC

Gathering 19 countries with more than 40 partner institutions and SMES since 2011, JERICO-RI has to respond to a variety of expectations and to face several types of challenges in its governance

2.4.1.1. Main governance challenges

As a summary we can list various types of governance challenges:

- Cultural: 17 countries are represented in JERICO-S3 (next project, H2020 funded)
- Heterogeneity in the institution decision processes: 39 partners
- Heterogeneity in the accounting rules: 39 partners x 17 countries...
- Heterogeneity in the scientific scopes as several disciplines are involved: hydrodynamics, biology, chemistry and even in each disciplines.
- Heterogeneity in the observation systems: some are fixed, some are moving ones, some are ground facilities, and others are to be deployed at sea...

EU/EC Nations have different calendars of objectives, for instance some countries are progressing to the merging of environmental infrastructures including marine ones, whereas other did not yet start to engage in any formal International RI. Some nations are facing a competition in between marine RIs to reach the national RI roadmap. In our consortium, amongst 17 nation involved in JERICO-S3, 6 countries engaged a coastal RI of the marine domain on the national roadmap: Spain, Greece, Finland, Estonia, Ireland, France. Norway and Germany are progressing. In addition, some systems are engaged at regional level as the nation is working as a federation of regions with more regional power (e.g. Spain, Italy).

2.4.1.2. Economical considerations

The purpose of the economic strategy is to appraise the balance of costs and benefits associated with the permanent establishment of the JERICO-RI as a sustainable long-term RI, in both the ERIC and AISBL legal forms, as compared to the potential discontinuation of the JERICO project.

The quantitative component of this economic appraisal has found (Deliverable 1.3 by Gaughen at al, 2018) that both the JERICO ERIC and JERICO AISBL options considered return a surplus of benefits to society. The present value of the stream of benefits resulting under the JERICO ERIC option returns a surplus of benefits to society with a value of **€24.4M** over the period 2020-2028, while the JERICO AISBL option returns a value of **€18.7M** over the same period. The single largest contributing factor to the strong **NPV (Net Present Value)** results in both scenarios is the substantial data cost savings for the JERICO partners that stems from the centralised data standardisation and data sharing practices that are facilitated, at a very low cost, by the JERICO project. The higher NPV for the JERICO ERIC option is the result of higher data cost savings under this scenario, higher public procurement cost savings, a slightly larger TNA programme budget and more commercial access service activity.

Additonal Non-Quantifiable Benefits

There are a number of other significant benefits associated with the permanent establishment of a Jerico-RI that are not readily quantifiable financially, these qualitiative benefits will result in a strong positive socio-economic impact.

Improving the efficiency and effectiveness of scientific research	Coastal observatory services support the environmental protection work of public authorities and national, local and regional governments. The data provided by coastal observatories allows bureaucratic authorities to formulate, implement and assess policies for environmental protection with increased effectiveness and with greater confidence that the underlying information is quality assured and scientifically validated.
Commercial and industrial applications	By improving the management and exploitation of coastal environments for commercial and societal purposes, coastal observation systems meet the needs of end-users by generating information related to societal economic needs and resource requirements. By enhancing the effectiveness of coastal environment marine observatories, the JERICO-RI contributes towards the achievement of more sustainable marine resource exploitation.
Social and producer surpluses	The commercial benefits of coastal marine observation systems stem from the economic value of the data generated by such systems and the effects that such information has on the behaviour of commercially active individuals and organizations
Supporting environmental protection	Coastal observatory services support the environmental protection work of public authorities and national, local and regional governments. The data provided by coastal observatories allows bureaucratic authorities to formulate, implement and assess policies for environmental protection with increased effectiveness and with greater confidence that the underlying information is quality assured and scientifically validated.
Understanding and adapting to global climate change	Coastal observation systems can mitigate the socio-economic risks of climate change by improving forecasting of conditions in coastal environments and by assisting in the design of climate-proof coastal infrastructures that prevent coastal flooding and associated property damage.Such data can improve guidance for public policy-making on environmental management and climate change adaptation, mitigating the social and environmental costs of climate change.
Responding to public environmental and other public safety hazards	Coastal observatories also improve health and safety in coastal areas by improving the responsiveness and effectiveness of search and rescue services. Particular coastal observatory RIs can monitor conditions in coastal environments in real-time, providing rescuers with information on the location and condition of distressed individuals as well as data on sea currents, sea surface conditions and wind conditions.
Providing secure financial support to the research network	One of the key benefits of JERICO-RI is the fact that the programme provides secure multi-annual funding for scientific research endeavours. Sustained and consolidated long-term funding commitments, whether from participating member state governments or in the form of EU funding, helps to ensure the sustained operation of observatories and multi-annual research projects that may suffer cuts in their funding streams in the event of an economic crisis or a change in government.

Additional Non-quantifiable benefits associated with the permanent establishment of Jerico-RI

2.4.1.3. Governance options for a legal entity

Both the ERIC and AISBL options result in high positive BCR values. The high BCR value for Jerico-RI is unsurprising in light of the fact that the projected running costs of the permanent JERICO bodies considered are small relative to the substantial data cost savings that are achieved for the wider JERICO network. However, the BCR is slightly higher in the ERIC scenario than under the AISBL scenario. This explained by the fact that the ERIC option results in more substantial costs savings.

As the ERIC option returns a higher NPV result and a higher BCR (Benefit/Cost Ratio), this analysis finds that the permanent establishment of JERICO as an ERIC is the preferred investment option. The fact that the ERIC option has an approximately equivalent cost to the AISBL option, while also resulting in greater financial savings for the JERICO network as a whole suggests that it is a stronger option in financial terms.
The permanent establishment of the JERICO-RI under the ERIC legal form would result in the most advanced form of centralised research coordination, management and administration among all options under consideration in this analysis. As compared to an AISBL, the ERIC legal form enables the achievement of greater economies of scale and more advanced forms of resource allocation and research coordination.
By acting as a single-point access system for users and a vector for integration tailored to EU RIs, ERICs provide a more comprehensive common reference strategic framework, greater international visibility, greater interoperability of service protocols and data collection, and a closer connection to the EU's research and industrial policy frameworks.

As the AISBL option is no more efficient in purely financial terms, while also being less functionally effective, there is no basis for recommending the AISBL option as preferable. Also, many of the key benefits associated with the permanent establishment of JERICO are not readily quantifiable. As an ERIC is a more advanced form of organisational structure than an AISBL, it is reasonable to expect that the JERICO ERIC option would result in more comprehensive outcomes when coordinating scientific research, collaborating with industry, environmental protection endeavours, and climate change research and providing financial support to members. **If these superior outcomes can be achieved without significant additional costs being incurred as compared to the JERICO AISBL option, then the permanent establishment of JERICO as an ERIC is the preferred investment option.**

2.4.2. *The JERICO label*

For about a decade, the JERICO Projects support the harmonisation of coastal observing systems towards their integration in a European observatory. Early on in this process, the concept of a JERICO Label was introduced.

2.4.2.1. The technical label

The JERICO Label, in its technical part, is integrating a set of criteria defined to ensure some standardisation and interoperability, and the quality of data for coastal observatories. Observation systems certified by the JERICO Label will be internationally recognised. It includes definition of best practices, modality to apply them, with objectives to guarantee delivered data are intercomprable or at least sufficiently described from the acquisition systems in order to characterise their quality and eventually progress on it, to their delivery.
During the JERICO-FP7 project, the precursor to JERICO-NEXT, it was envisioned that the newly constituted transnational network of coastal observatories would progress towards greater and greater harmonization with respect to technologies, methodologies and procedures, leading to continuing improvements in operational transparency, and thus to more uniform services and products. The possibility of introducing a "JERICO Label" to showcase these qualities of the JERICO RI to the outside world was therefore debated, and a scoping study on the characteristics of a similar construct was completed by the end of the project (JERICO-FP7 deliverable D1.4):
http://www.jerico-ri.eu/download/filebase/jerico_fp7/deliverables/D1.4_Jerico-Label-V3_0.pdf

According to the study, the Label had to accomplish the following:

- acknowledge the consensus on guidelines for best practices in the design, implementation, maintenance, data policy and valorization of the coastal observing elements of the JERICO RI;
- allow fair recognition of the quality of the managed observatories within JERICO RI;
- help stakeholders to become aware of the European interest in the development of high quality coastal observatories;
- foster a wider market for industry in the fields of sensor technology and platforms based on agreed recommendations.

And, it needed to be able to do all of the above without neglecting:

- the heterogeneity of the coastal observing systems in JERICO RI, and their abilities to address the space and time scales characterizing environmental variability;
- the necessity to comply with other normative efforts in marine observing (e.g. EU initiatives such as SeaDataNet & MyOcean, EMODnet, etc.);
- the specificities of the coastal marine environment;
- the heterogeneity of coastal processes, and the many interacting scales that they can encompass;
- ongoing advancements in instrumentation, platforms and data management technologies;
- ongoing progress in scientific knowledge relating to marine ecosystem processes.

The Label itself was specified as "... a set of criteria defined to ensure some standardization and interoperability, and the quality of data for coastal observatories". Three qualities were chosen as yardsticks:

- **Sustainability:** intended, essentially, as funding for keeping a system running in the long-term (5 years); this will be addressed in a Strategic Operational Plan (SOP).
- **Operationality:** intended, essentially, as the level of efficiency of the process taking acquired data from raw to quality-assured and available for use in real-time and/or delayed mode;The operational viability by recounting the details of the infrastructure presenting an asset inventory with a cost statement for the RI.
- **Observing/research purpose ("fit for purpose"):** intended, essentially, as the completeness of the list of parameters handled by a system in relation to scientific and/or other operational goals. For the purposes of the JERICO Label, infrastructure will be classified into three categories (Regulatory, Routine and Reasearch), depending on the end-use attributes of the measurements that they are providing.

2.4.3. The scientific context and Integrative consideration of the JERICO Label

In 2014, concluding the JERICO-FP7 project, the JERICO-RI community emphasized that we cannot understand the complexity of the coastal ocean if we do not understand the coupling between physics and biology. Fostering such an understanding requires new technological developments allowing for the continuous observation of a larger set of parameters. It required an *a priori* definition of the optimal sampling strategy in view of coupling data over very different spatial and temporal scales. According to the above considerations, a major challenge, for the coastal observing community is to implement scientifically sound strategies to acquire and integrate observations of Coastal Essential Variables (cEOV), supporting increase of knowledge and understanding of physical, biogeochemical and biological interdependent processes, at appropriate spatial and temporal scales, and in a sustained manner. It was concluded the need to specify the scientific purpose of observations in order to guarantee the technical aspects are in line with the expectations from science. Consequently at the end of JERICO-NEXT phase, the JERICO Label includes a scientific approach to consider purposes (common and site specific ones) according to the 6 scientific topics of JERICO-NEXT (Deliverables D1.2 and D4.5 of JERICO-NEXT).

The JERICO Label presents internal and external benefits. It is a way towards operationality of an EU harmonised system of systems, thanks to the definition of generic parameter acquired for all observation systems plus specific parameters according to regions/local purposes (to be defined in JERICO-S3). It will also formalise data availability with data access policy, QA/QC; for external users it will offer an acknowledged expertise, available as services that are organised and operational.

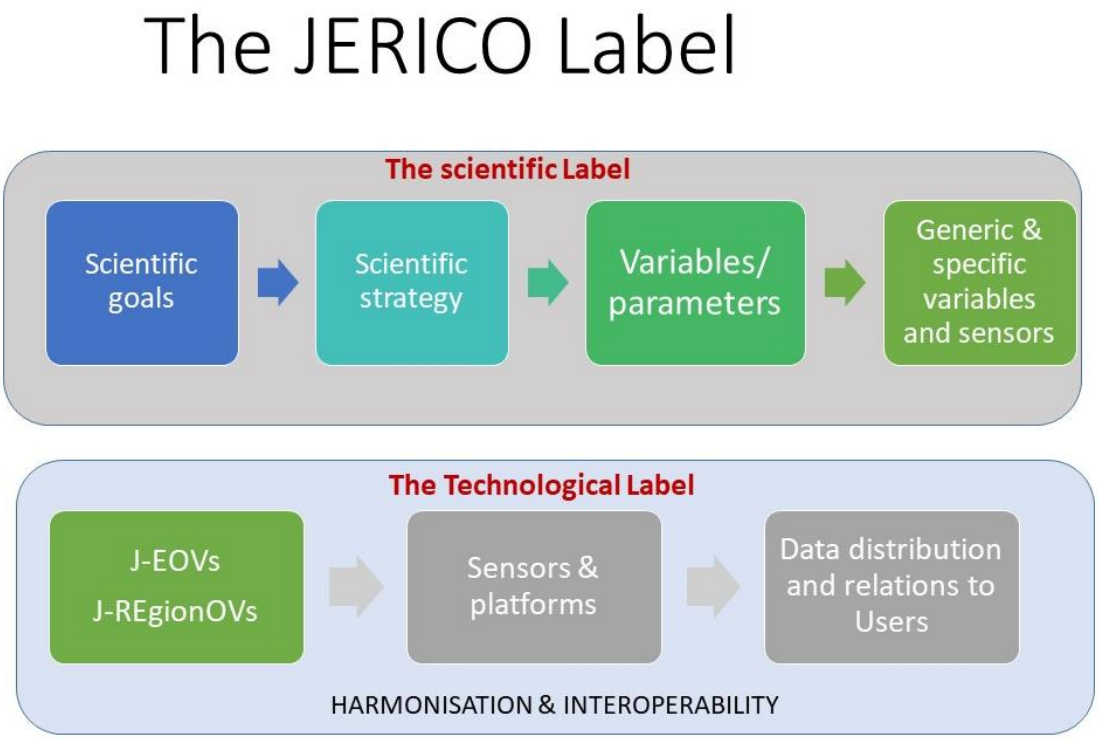

Figure 10: Integrative framework of the JERICO Label

On order to set up the application of the JERICO Label and to manage it on long term a dedicated Label committee is being implemented (Nair et al., 2019, Deliverable D2.7 of JERICO-NEXT). It is composed of 2 groups. Whereas the "Research Excellence group" is gathering scientists representative of regions/sites (or observation sites), as main users, with an important advisory role, the "Data and operation Group" (D&O) has also to implement decisions taken by nations and owned of the systems. Indeed, D&O will deal with operations of observation systems at sea and with the development and implementation of services and solutions, according to the decisions agreed. They will also deal with the data and access policies.

2.4.4. Possible structure

The governance structure proposed here after is a preliminary version to further elaborate on with involved institutions in a full Preparatory phase.

- **At the governance level**

The possible governance structure at the decision and executive levels can be composed of:

- The assembly of members gathers national representatives of the RI. They take decisions with the CEO (or RI director), approve annual reports, agreements etc. In the current stage of JERICO-RI project they are gathered in the Nation Committee.
- The Steering committee can be a board of representatives per region/site of the RI. Indeed JERICO-RI is structuring in regional/local sites involving 1-5 countries. Involved people are, in general, used to collaborate to achieve common targets in term of scientific or monitoring objectives of the local/regional coastal water.

- The RI Board is the board of directors to support the Assembly and the steering committee. It manages day to day actions of the RI, get reports from the Head of financial affairs, get support of administrative unit, get feedback from the 2 committees (Scientific, Eng. and Tech) to inform the Assembly and propose procedures.
- Label Committee: it will be essential to interact with both the executive and the operation levels as operational Expert Centers will give feedback and propose next developments, deployments and implementation to the Label Committee.The Label committee will monitor the application of policies and will gather feedbacks to advise the decision level.

- **At the operational level**

The ambition is to organise i) the hardware operations in *Technical Expert Centers* (violet box) and ii) the virtual part in *Thematic Expert Centers* (orange box).

Technical expert Centers are expected to gather platform experts to operate systems of platforms types (A-F). This work needs be prepared in a preparatory phase to timely take on board the structuring existing initiatives and working groups (HF Radar group and the Fixed Platform group of EuroGOOS, the Glider community after the GROOM project, the Ferry box community, well established at EU level, the coastal cable observatories of EMSO-ERIC, etc.).

Thematic Expert Centers are expected to propose in the e-JERICO services that can relate on the previously listed JERICO scientific topics but also on some specific data processing (e.g. images) based on some shared protocols, computing codes and facilities. This is also to be investigated to timely take on board the rapidly evolving Information Technology and the European DIGIT infrastructure category.

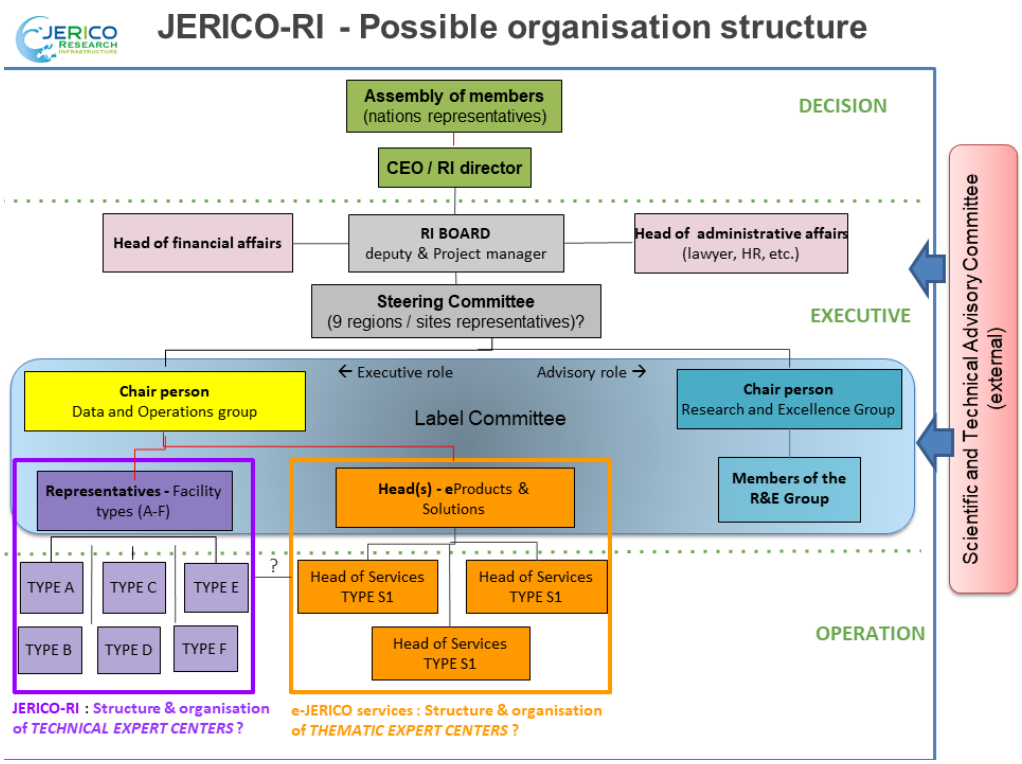

Figure 11: Possible JERICO-RI organisation structure

3. Roadmap for the future

3.1. Methodology and calendar of JERICO-RI

In order to become a fully operation RI, sustainable on long term, JERICO-RI will follow the usual life cycle of Ris according to the ESFRI methodology.

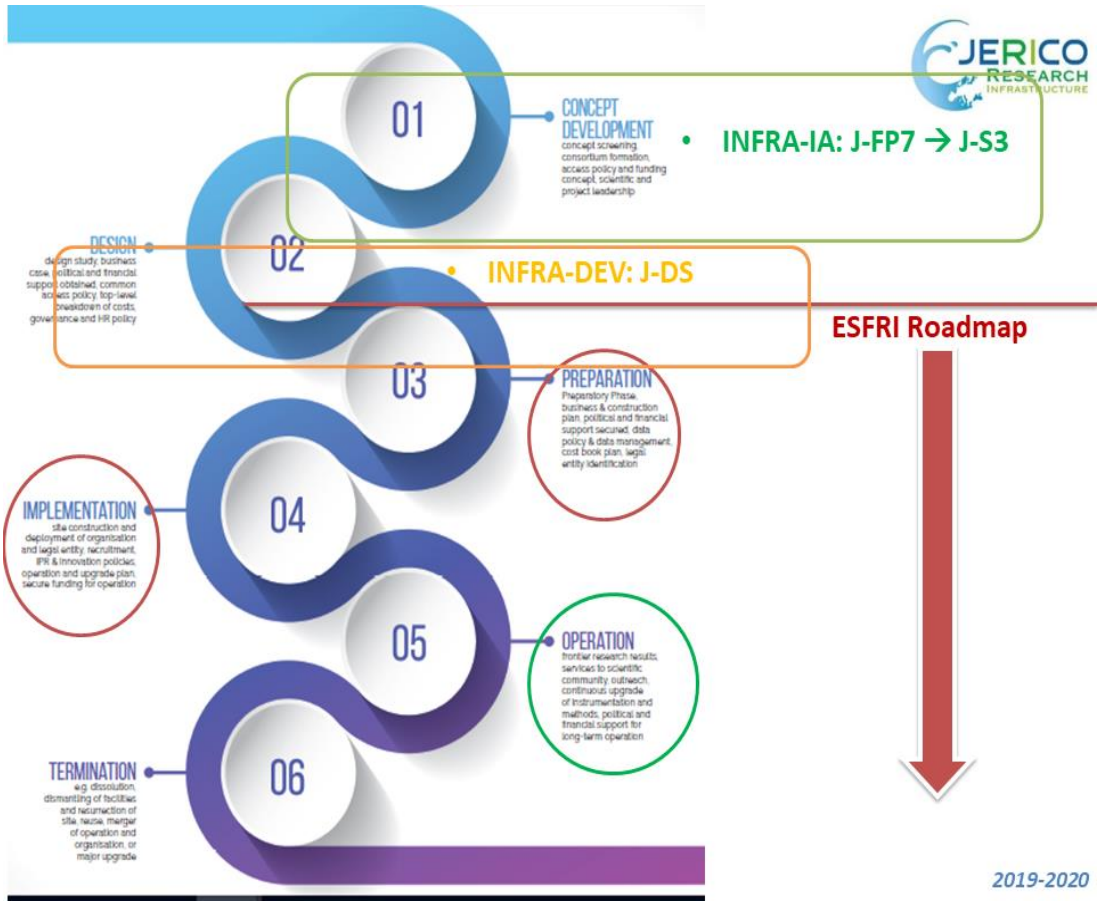

Figure 12. Position of the JERICO Series of projects in the ESFRI process.

Considering most of the concept development will be achieved the first 18 months of JERICO-S3, the consortium agreed to apply to a Design Study for the call INFRA-DEV 2019-2020 with JERICO-DS for a 3 years projects.

2021 – 2023: A design study will aim at taking on board the National considerations for the scientific concept including the nation visions with local observation systems, the study of the Design of the RI for both the physical part and the virtual part (e-JERICO, after a development in JERICO-S3).

2024 – 2026: Preparatory phase to finalise the initiated items with up to date informations.

2027 – 2028: Implementation phase including a pre-operatonal phase.

This is inducing the following main milestones to be reached.

- ✓ **2019, November 12: application to a Design Study for JERICO-RI sent**
- ✓ **2020**: Starting of regional and local structuring of the JERICO-RI with JERICO-S3
- ✓ **End 2021**: Progress on the ESFRI roadmap (application by 5th May 2019). Starting of the Design Sutdy
- ✓ **2022**: Feedback on regional structuring on PSS / IRS, first phase of virtual research environment as a service prototype. In JERICO-S3
- ✓ **2023**: Achieving a degree of harmonization enabling the delivery of services and solutions including harmonized and quality data.
- ✓ **2024**: End of JERICO-S3 and of the Design Study: Organised and structured system of observing systems with gouvernance etc is defined.
- ✓ **2024**: Starting of a Preparatory phase to achieve pre-operational service and solution delivery, assess actual coast and to prepare funding plan.
- ✓ **2026**: End of Preparatory phase
- ✓ **2028-2031**: Operation

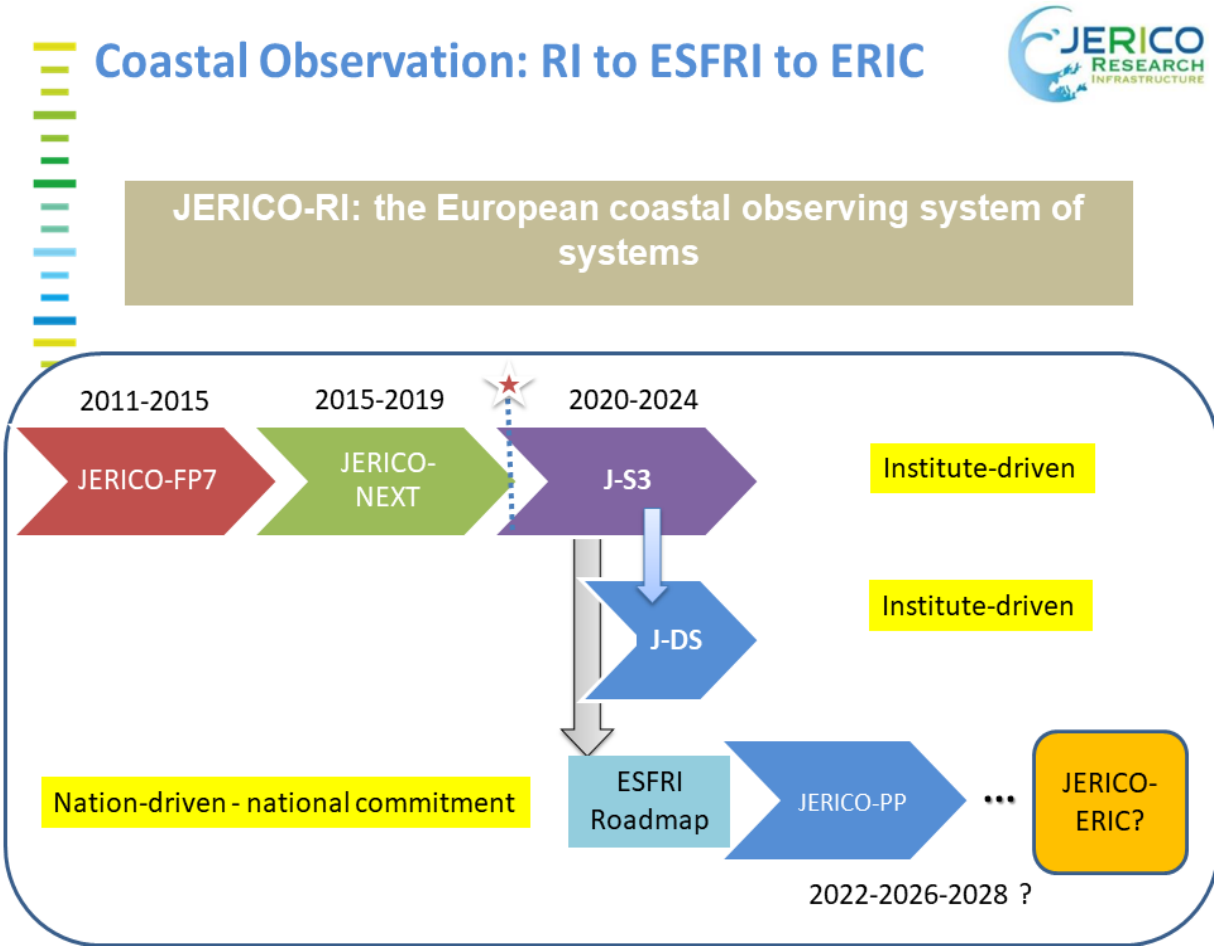

Figure 13: Roadmap of JERICO-RI until 2030

3.2. Specific milestones and actions of the JERICO Calendar

Specific actions are dedicated to achieve the key requirements listed in the ESFRI methodology after the ESFRI roadmap 2018. These are organised in 2 categories, the so-called Key Requirements for the Scientific case and Key Requirements for Implementation. Our strategy is based on assessing the regional with some of the local components of the JERICO-RI in JERICO-S3 on one side, and on assessing the regional with the national components of the RI in JERICO-DS (Design Study). The compilation of both JERICO-S3 plus JERICO-DS will support a full design of the RI.

They are synthesized in the 2 following tables.

Table: SCIENTIFIC CASE

Actions	Projects	Dates
Scientifc Excellence		
Long term science programme, including technology development (increase of TRL on strategic technologies)	JERICO-NEXT and JERICO-DS	2021
Science concept including open Science, cEOV to be measured, when, how, sampling in space and time , scale change.	JERICO-S3	2020
Services for the scientific community	JERICO-S3	2022
Vision, mission and identity revised	JERICO-DS	2020
Positioning in RI landscape and multidisciplinary scientific new frontier	JERICO-PP	2025
Pan European Relevance		
Targeted user community is pan-European	JERICO-S3	2022
Research capacity and geographical distribution	JERICO-S3	2024
Links to relevant RI and other large pan-european programmes.	JERICO-S3	2022
Technical maturity and feasibility	JERICO-S3	2024
Availabitlity of scientific human resource	JERICO-PP	2028
Distinct pan-european user community	JERICO-S3 (regional) & JERICO-DS (national)	2022
Socio Economic Impact		
Economic impact	JERICO-DS	2022
Case for impact	JERICO-DS then JERICO-PP	2028
E-NEEDS		
Vision on e-infra	JERICO-S3	2022
Interfacing with communication networks…	JERICO-DS	2024
Conceptual design of e-infra	JERICO-S3	2024
Contribution of e-infra resources at all levels	JERICO-DS	2024
Access policy and Data Management Plan	JERICO-DS	2024
Technical design of e-infra	JERICO-DS then JERICO-PP	2028

Table: IMPLEMENTATION

Actions	JERICO projects	Dates
Stakeholder Commitment		
Get Institutional letters of Intent signed	JERICO-DS	May 2020
Formal Agreement amongst partners for a Design Study	JERICO-DS	Nov. 2019
Get proof of Political support (Expression of Political Support)	JERICO-S3 to JERICO-PP	April 2019-2026
Get proof of Finanancial Commitment (EoC)	JERICO-DS & PP	2021-2028
Get proof of an inter-insitutional & multilateral Agreement(MoU)	JERICO-DS	2026
User Strategy and Acces Policy		
Vision about user community, access units and access modes described, open and FAIR Access	JERICO-S3 (TA, VA), JERICO-DS	2020-2024
User Strategy agreed and possibilities to develop a reasonably sized user community described (with cost, common access policy)	JERICO-S3-JERICO-DS	2020-2024
Survey executed demonstrating expected user community and description of it in term of origin and size	JERICO-DS	2024
Services based on a clear identification of demands and needs	JERICO-DS	2022
Single entry point for user outlined	JERICO-DS	2024
User community in terms of Origin and size consolidated	JERICO-PP	2026
Plans for training of Scientists and professionals (engineers, data managers etc) approved	JERICO-PP	2028
Common Acces policy approved	JERICO-PP	2028
Organisational structure and procedure for regulating access approved	JERICO-PP	2028
Governance and Management		
Project Organisation approved	JERICO-DS	April 2020
Scientific Leadership identified	JERICO-DS	April 2020
Measurable & Satisfactory KPI identified	JERICO-DS and PP	2024 & 2026
Governance for Operation with defined responsabilities defined, Advisory board defined	JERICO-PP	2028
Detailed plan for Sc, tehc & organisational implementation validated	JERICO Implementation Phase	2031
Legal entity Established	JERICO Implementation Phase	2031
Finances		
Funding concept and potential partners contributions outlined	JERICO-DS	2024
Top level breakdown of cost elements with overall order of magnitude estimates (including central hub &nodes)	JERICO-DS	2024
Funding opportunities identified and in kind contribution policy outlined	JERICO-PP	2028

For simplification sake these actions have been grouped in 6 items: the Scientific concept, the Technical Design (physical part of the observation system), the e-Design (including the data management), the Business plan (including societal impact), the Governance and the Communication that are driving JERICO-S3 and JERICO-DS

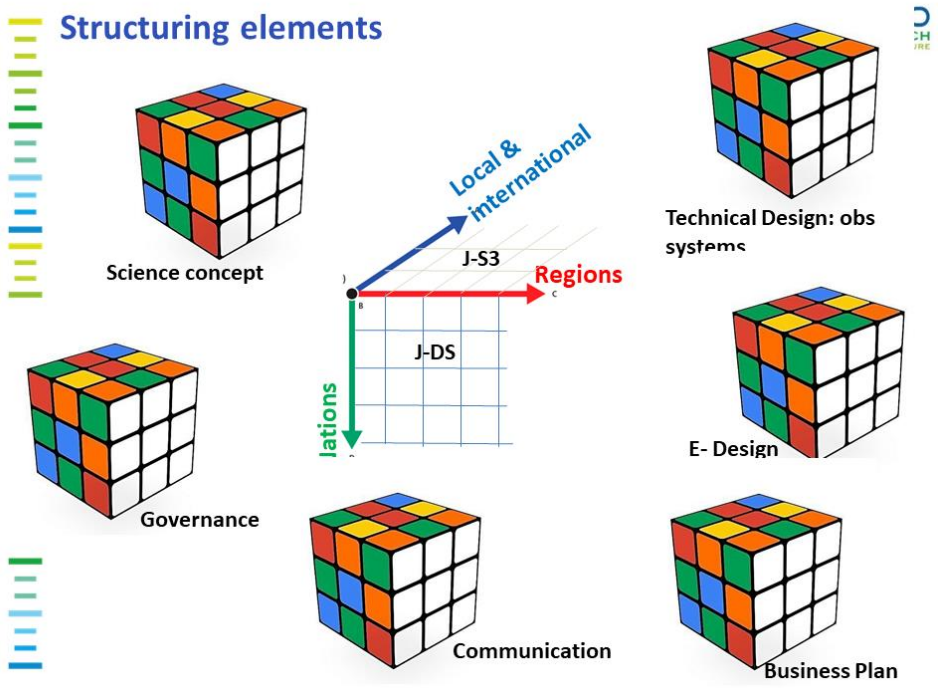

Figure 14: Structuring actions of JERICO-RI in both JERICO-S3 and JERICO-DS

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