Sustaining iMarine: a Public Partnership led Business Model

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An activity to define the mission statement of the initiative,
assess the type of business model centred on a public partnership,
propose a business plan for sustaining the iMarine baseline activities, and
prepare the ground for a business plan under a growth scenario

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The findings included in this report are the result of a large consultation among the iMarine members and of the analysis of the views and opinions of different stakeholders of the Marine community at large, collected via questionnaires, face-to-face interviews, and two dedicated plenary meetings. This way, the findings in this White Paper reflect no only the ideas of the authors of this document, but also the ideas and goals of a large number of stakeholders.

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Executive summary

The sustainable management of fisheries and conservation of marine living resources through the ecosystem approach is a societal issue of global dimension. More and more, data is needed to support evidence-based decision making and adaptive management, a challenge that no single institution or country can address in isolation. The European Union's programme for e-infrastructures and data infrastructures has been the pathway to integrating data services and tools in a seamless way, increasingly at large scale.

As a data management infrastructure, iMarine (http://www.i-marine.eu) ensures that computational resources, specific tools, and data services are open to many different actors and complementary initiatives. With a long-term vision for providing the comprehensive data management solutions required to support the full policy cycle of the ecosystem approach to fisheries at a global scale, iMarine proposes a public partnership centred business model.

This proposed partnership is literally an Enterprise. It is supported by the present White Paper, to describe how such a partnership would ensure various sources of income to create, deliver and capture value. This business model allows for global coverage, open technologies, knowledge transfer, inclusive networks and sustainable development. It develops a mission statement for the partnership and assesses a baseline business model, considered along with growth scenarios. The main principle underlying the business model is the voluntary contribution of resources by institutional stakeholders. Public institutions will be responsible for maintaining the core infrastructure and the services they have a stake in, while other partners, including private companies can provide specific functionalities and support services which will also generate income to iMarine. All infrastructure partners are committed to complying with the iMarine policies (e.g. data access and sharing policy, legal interoperability, terms of use and privacy policy, technology security & confidentiality arrangements, community Best Practices & Guidelines). This includes a commitment to developing and maintaining the infrastructure by sharing resources on fair terms. The public partnership relies on the principle that Members, among which key user representatives, expect to gain benefits from collaboration. While seeking to realize the benefits, the partner institutions commit to contributing according to their capacities. The benefits for users are identified in the Business Model while ensuring that the efforts and contributions remain in balance with the benefits.

One central idea is to focus the iMarine initiative efforts, and to initially address the Ecosystem Approach domain through the Fisheries entry point; this idea is referred to as the **iMarine "baseline" Business Model**. From this "baseline", a growth scenario is also developed, delivering complementary services to address the needs in two complementary areas: ecosystem services and environmental protection. Following this strategic path, the *Opportunity Analysis Canvas* has been used to identify and understand the critical needs and opportunities from the "Fisheries Management and Conservation of marine resources" domain, which the iMarine stakeholders can transform into sustainable operations. The aim is to ensure a proper fit between the sustainability endeavour and the identified market needs.

This White Paper is a living document that builds on the feedback gathered through its release process. The current version introduces the roles and functions necessary to implement the 'baseline' and the 'growth' scenarios of the iMarine sustainability Business Model.

1. Setting the scene

The project have put a lot of effort during the past two years in the outreach and liaison with the stakeholders of the Ecosystem Approach to fisheries and conservation of marine living resources. We dedicated ourselves to gather and understand which critical needs from these stakeholders are within our skills and mandates, and to build services matching these needs. We have all invested, as project partners, in methods and tools that can realize the vision of sustaining a simple, pragmatic, lean Business Model to solve a significant range of these needs. And along the lines, we have qualified our foreseen 'early adopter' consumers for these services. Through this work, we have collected and consolidated some key rationales for the sustainability of our developments. In this section, we will identify the critical needs that we gathered, the current barriers to their resolution, and will introduce our strategy, our "unique offering", for successfully delivering our solutions to this demanding market.

1.1. Domain issues and the critical needs to be solved

The sustainable management of fisheries and conservation of marine living resources is a societal issue of global dimension which the ecosystem approach intends to tackle. More and more, data is needed to support evidence-based decision making and adaptive management, a challenge that no single institution or country can address in isolation. The European Union's programme for e-infrastructures and data infrastructures has been the pathway to integrating data services and tools, increasingly at large scale. Progressively pre-operational or even now operational services are foreseen to build on that legacy, and then emerge as customer-oriented services.

As a data management infrastructure built on top of the D4Science e-infrastructure, iMarine ensures that computational resources, specific tools, and data services are open to many different actors and complementary initiatives, and is providing solutions to some critical needs that have been raised by four typical communities and/or stakeholders of the three Business cases selected to drive the development of iMarine services.

Let's start with the European Fisheries Policy and Management bodies. Critical needs exist today in this area for a more systematic, objective use of ship tracking data in order to get reliable information and indicators of fishing activities in time and space, and for the setting up of different regional databases in EU, like through the new DCF program starting for 2014-2020 (for implementation by all the member states).
For example, Vessel Transmitted Information (VTI) and Vessel Activity records shall be more systematically processed into key geospatial products, that combine information on vessel activity and environmental conditions, so that a better understanding of the impact of spatial distribution of fishing effort and related catch over the resources can be obtained, and consequent management measures adopted.
After two years of active cooperation, early adopters of our services, that represent sources of funding for our take up on the market, have been identified and engaged with are the EC DG MARE, NEAFC, ICES and the French ministry MEDDE.

Another key community is the marine research institutes working on Biodiversity. Here we have identified recurring needs for species distribution modelling (e.g. ecological niche modelling), in order to create global or regional distribution maps of marine species and be able to combine them with other environmental information.

For example, large-scale model-based predictions of currently known natural occurrence of marine species (e.g. Aquamaps, based on the environmental tolerance of a given species with respect to depth, salinity, temperature, primary productivity, and its association with sea ice or coastal areas) shall be leveraged to better support studies of changes in marine biodiversity, like the impacts of climate change, or better contribute to the protection of ecosystems from excessive rates of exploitation.
Early adopters of our services have been identified and engaged with at different levels, such as with FishBase and SeaLifeBase (in collaboration with FIN, the Fishbase Information & Research Group Inc., a non-governmental organization established in the Philippines), IFM-Geomar, and the Leibniz Institute of Marine Sciences.

Third there is a set of critical needs from the international arena and actors within Regional Fisheries Management Organisations (RFMO) regarding the management of ecologically sensitive areas. Guidelines are heavily needed, such as the ones developed by FAO for deep-sea fishing in areas beyond national jurisdiction. This requires the identification of sensitive areas or Vulnerable Marine Ecosystems (VME's) for which special precautionary measures need to be adopted.
For example, the collaborative editing and dissemination of Fisheries Fact Sheets based on integrated vulnerable marine ecosystems data can provide for better geographical identification of the biodiversity issues and evaluation of the adverse impacts that different fishing activities might have on deep seas fragile ecosystems, that have to be addressed at the regional scales.
Early adopters of iMarine services in this topic are the RFMOs in charge of the management of Deep sea fisheries (CCAMLR, GFCM, NAFO, NEAFC, SEAFO, NPFC, SPRFMO), through the FAO Global Database for Vulnerable Marine Ecosystems.

Fourth, to conclude, are the needs from the international arena for monitoring capacities, and for dashboards of indicators. Application of ecological niche modelling in EU jurisdictional waters and at the international level, through RFMOs, in areas beyond national jurisdiction, requires enhanced monitoring capabilities, many of them in near-real time.
For example, with this purpose in mind the iMarine partners contributed annotation and indexing tools to enable the SmartFish Chimaera portal (http://smartfish.d4science.org/) as a distributed service seamlessly accessing information and data scattered in three independent source information systems (FIRMS, Statbase and WioFish).
Through collaboration between the SmartFish and iMarine projects, early adopters of the iMarine services in this domain are the Fishery Resources Monitoring System Partnership (FIRMS) which disseminates worldwide inventories and status/trends indicators of marine resources and fisheries, and the South West Indian Fishery Commission (SWIOFC) in collaboration with other regional actors (KMFRI, Oceanographic Research Institute - ORI) involved in the development of fisheries information systems in the region, respectively Statbase and WioFish.

In summary, Marine scientists and policy makers need timely access to wide ranging and reliable data in order to meet the high demands of the ecosystem approach to fisheries and the conservation of marine living resources. This is essential to foster better understanding, support knowledge exchange and improve governance. To exploit these data, researchers need to apply complex models. They face huge challenges in managing the differences in multidisciplinary data sources, different data formats and temporal and spatial scales. This puts a high demand not only on the computational resources, but also on the scientists collecting, preparing and curating their datasets.

1.2. The iMarine advantages

The iMarine partners developed a unique offering and human expertise to address the domain issues and critical needs presented here above. They also have a shared goal that motivates their contributions for a sustainable initiative.

That shared goal is to deliver significant support to the fishery policies implementation, at a global scale, with the aim of strengthening the contribution of fisheries to the food security and poverty alleviation efforts of a number of global and regional initiatives.

To keep this advantage ahead, three main areas of volunteer actions are consequently identified as:

(1) The establishment of a public-led partnership, in order to capitalize on capacity building at the global scale and promote a sustainable exploitation of aquatic resources;
(2) A clear recognition of the need to plan "from the very outset" for a role of industry in the partnership and for the future growth of the partnership, in order to expand the footprint of the iMarine solutions and gain a wider outreach and recognition;
(3) A strong commitment to further develop an offer able to improve the cooperation at different levels of the fisheries activities, in order to better achieve exchange of knowledge and be able to influence other related domains, like food security and nutrition (FSN), illegal, unreported and unregulated (IUU) fishing, or large marine ecosystems (LME) management.

Our vision

" To continuously interconnect open data management solutions that can empower communities, generating knowledge through collaborations for the fisheries and ecosystem services, globally "

In the EU projects landscape, the iMarine unique features include:

- The Ecosystem Approach (EA) scope, implying a range of Community Partners with strong human expertise across the Fisheries, Biodiversity, and Environment disciplines;
- The Global dimension, enabled by the institutions of the consortium involved in the Board;
- The strong IT component represented by institutions specialized in computing science and services.

The delivered benefits, as perceived through the current collaborations with the institutions of the EA community, can be threefold:

1. The ability to access cost effective Information Technology and Knowledge Management (IT/KM) services that an organization alone is not able to provision for its users. Among these services, some will concur to improve data quality, most likely through data sharing. Data curation, and Taxonomy matching are two examples; within the iMarine Sustainability Business Model, any organization would benefit from advanced IT services, and the related expertise and support, which can be delivered through the fee arrangements defined by the iMarine partnership policies.
2. The ability to leverage data sharing and the related derivative products. A community of users and data providers (meant as Community Partners sitting in a Board) can establish their own policies on top of what the infrastructure enforces as a common behaviour. Such community can deliver as a start one or two products of common interest (e.g. Code lists and their

management), and commit to make regular updates, thus ensuring a continuous data feed for the infrastructure.

3. The ability to consume computing resources on-demand (data, applications, compute power) and to get a facilitated access to them through user friendly services and operations support teams.

While seeking to realize the benefits, the community partner institutions commit to contribute according to their capacities. The iMarine public-led partnership model builds on the uniqueness of the iMarine offering, and relies on the benefits that the involved institutions expect to draw from a close collaboration.

Several mission statement options were discussed at the second iMarine Advisory Council in October 2012, giving us the foundations to start with. Primarily, we are taking care of shaping a mission statement that declares to the outside world the purpose of the partnership, and that can be addressed to different audiences. This mission statement also fits into the objectives of the partnership sponsors, with a long-term and stable perspective. From there, a collaborative effort has lead us to the iMarine Public Partnership mission statement:

The iMarine Partnership mission

" We enable richer, better quality and timely science-based knowledge related to aquatic resources, to serve policy developments and implementation.

We operate over the European Research Infrastructures that are facilitating the sharing, retrieval, access, and collaborative production of harmonized information.

By interconnecting people via common data, information and knowledge-building tools, the public partnership promotes a unified and effective Ecosystem Approach to fisheries and conservation of marine living resources"

The iMarine Public Partnership's mission statement is addressing both the EA community of practice, which benefits from the generic data infrastructure capacity of iMarine, and the IT stakeholders supporting the maintenance, development and operations of the underlying D4Science platform which benefits from the active and highly visible user community of iMarine. Moreover, it is designed as a "public-led" initiative with provisions for cooperation with industry.

2. A public partnership for sustained services

How do we commit on our mission

This White Paper develops a business model describing how a public-led partnership would create, deliver and capture value. Such a partnership would enforce global coverage, open standards, knowledge transfer, inclusive networks and sustainable development.

2.1. Drivers for a Public-led Partnership Business Model

The main drivers for a public partnership centred approach are threefold: **decision-making processes**, **available technologies** and **flexible collaborations**. They serve the goal to deliver the comprehensive data management solutions required to support the full policy life-cycle of the Ecosystem Approach to Fisheries, at a global scale.

Decision-making processes in the marine domain are long-term processes, in that their impact may occur years after actions have been implemented. Only public institutions have the long-term mission to provide a reliable framework for global implementation. This includes collaboration with private entities and scientists who need reliable data in standardized formats in order to contribute meaningfully to the Ecosystem Approach. An active community across the Fisheries, Biodiversity, and the Environmental domains already provides the human infrastructure.

Available technologies and resources: relates to the need for provisioned and available technology framework and computational, storage and data resources covering the period of activity. This elements are best maintained provided wide usage is made of a supporting data infrastructure. This will necessarily be a long process, which needs a motivated core of influential institutions, receiving the support of funding bodies such as the EU as well as commonly used procurement processes at the institutional level.

Flexible collaborations: the proposed partnership can leverage on the **unique features** of iMarine and on its partners' expertise and skills. The opportunity to combine human & technology aspects of the infrastructure requires flexible collaborations, which eventually will also enable broader buy-in. The global dimension of the issues that are addressed calls for collaborations that can either be very close and long-lasting or short and lightweight. This requires flexibility in the model, where core responsibilities may need value-add or problem resolving actions. An approach where contributing partners can opt for different types of collaboration (human and technology), requires a flexible model that can manage contributions from both public and private partners.

Together these drivers help create value through a public led partnership with the institutions of the EA community. These benefits can be threefold:

1. **Affordable IT/KM services:** from a user organization view point. Value can come from the ability to gain efficiencies with Information Technologies (IT) and Knowledge Management (KM) services. Currently, not all organizations are able to offer users cost effectiveness, as an issue raised by the community consultations ran during the iMarine project. The proposed services can improve data quality, reduce the burden of data sharing, reduce costs of data storage and curation.
2. **Community Data services:** with mutual understanding or agreements, the benefits of data sharing and of generating derivative products result in Community of Practice data services, where the infrastructure supports a seamless workflow and manages metadata lifecycles. This enables complementary and synergetic roles across the community. Moreover, community partners can specialize in a particular step of the workflow, while relying on others to provide them with quality-controlled data and processing tools. It

implies that the community of users and data providers (indicating Partners sitting on a Board) establish through Data Management Policy on top of the infrastructure.

3. **Global services:** the on-demand availability of infrastructure resources (data, applications, computing) makes it easier to interact with the global community in need of data. Dissemination at the Global scale can rely on infrastructure services such as Linked Open Data or shared repositories that fragmented communities cannot afford to maintain individually.

There is evidence that demand exists and that the situation is mature for iMarine to successfully create and deliver value to a number of Communities of Practice.

2.2. The iMarine approach to sustainability

The way we go

iMarine provides the vision and tools to create synergies in the **Communities of Practice** involved with the **Ecosystem Approach to Fisheries Management and the Conservation of Marine Living resources**. We are as entrepreneurs in the process of building an Enterprise. This is the main motivation of our stakeholders. This is the most critical activity for us now.

We have developed innovative assets and gathered a large community. The data management & infrastructure services, the data access and sharing policies, and the stakeholders' skills & expertise are the means through which to enact the vision and the synergies. The emergence and sustainability of a unified **Ecosystem Approach Community of Practice** (**EA-CoP**), defined through a set of iMarine Business Cases, is the central driver.

To support typical needs within the EA-CoP, iMarine provides an advanced, user-friendly and flexible e-Infrastructure. The iMarine approach is both **efficient** and **cost-effective** as it integrates existing technologies and resources that capitalise on EU investments in e-infrastructures. Integration ranges from grid and cloud computational service provisioning access to **biodiversity**, **climate** and **environmental data** and through **interoperability** with resources such as GBIF (Global Biodiversity Information Facility), OBIS (Ocean Biogeographic Information System), and the FAO-FI reporting schema. The e-infrastructure provided by iMarine facilitates the **sharing of a multitude of data**, collaborative analysis, data processing and mining, open standard software interfaces, as well as tools for the publication and dissemination of newly generated knowledge. It allows coordination with many actors and initiatives across different scientific and operational domains. Furthermore it helps to tackle data heterogeneity issues that are typical when relying on a multitude of resources and technologies.

A key role in ensuring the effective exploitation of the e-infrastructure has been and is played by the **iMarine Board**: The primary goal of the iMarine Board is to define the data e-Infrastructure governance model, with a sustainability focus, and to formulate a set of organizational and technological policy recommendations regulating the resources shared and the services provided by the infrastructure.

The iMarine Board provides a governance framework, which is key in terms of shaping direction. The Board plays a dual role: i) it brings expertise from the fisheries, biodiversity and environmental domains, including requirements to deliver the tools and services within iMarine and ii) it helps in defining the EA-CoP iMarine business cases.

The Board represents different key communities within the EA-CoP. Board Members contribute in terms of realization of the defined business cases, adoption of standards, and advices on general sustainability issues as well as policies that iMarine supports. Board Members have also been

instrumental in establishing several new collaborations, where the availability of the iMarine operational data infrastructure is a fundamental enabler.

The D4Science infrastructure (http://www.d4science.org) is the operational platform underpinning iMarine. Other liaisons and communities (EUBrazilOpenBio, Lifewatch, ENVRI,) revolve around D4Science. The D4Science e-Infrastructure works as a virtual aggregator of resources available in interoperable e-infrastructures, as well as a provider of these resources back to other e-infrastructures. On the platform, elaborated **virtual research environments** (VREs) are serving various and cross-domain scientific communities.
gCube (http://www.gcube-system.org) is the key enabling technology, an innovative service-based, autonomic, data infrastructure management system. It supports the declarative and interactive creation of VREs that aggregate and deploy on-demand content resources and application services, by exploiting computational and storage resources of the D4Science infrastructure.
The iMarine Gateway (https://i-marine.d4science.org) leverages the D4Science distributed infrastructure to integrate resources as a unique gateway to scientific resources, offering access to a complete group of data, VRE management services and compute facilities for scientists, data providers and researchers.

The iMarine approach has capitalized on earlier investments by maintaining and expanding the D4Science infrastructure and related technologies, for the benefit of enhanced policy making, supported by a diversified and growing scientific community.

2.3. Principles underlying the Public partnership

How users benefit from iMarine

Becoming an iMarine user means you can take advantage of a powerful data infrastructure supporting marine ecosystem research that also provides a science-policy interface. Whether you are working as marine and biodiversity scientists, conservationists, fisheries managers, statisticians and data mangers, or policy makers, the iMarine partnership is open for organizations at many levels, with already a large support from stakeholders enabling Data Infrastructure services that are reliable and easy to use.

The voluntary contribution of resources by institutional stakeholders is the main principle underlying an iMarine business model that is centered on a public partnership. Public institutions will be responsible for maintaining the core infrastructure and the services they have a stake in, while other partners, including private companies can provide specific functionality and/or support services (e.g. Terradue, Engineering, or Microsoft as with the CNR user scenario in VENUS-C) which eventually generate income to financially support the governance, management and operations components.

All infrastructure partners are committed to complying with the infrastructure policies (e.g. the open data EC policies like the European legislation on reuse of public sector information, the iMarine data policies developed during the project as the "EA-CoP Data Access and Sharing Policies"). This includes a commitment to developing and maintaining the infrastructure by sharing resources on fair terms.

The public partnership led model requires that Sponsors[1] and partners jointly support the infrastructure[2]. This premise requires that sponsors receive a reward for their efforts. As a follow-up, a Governance model will ensure that the partners' interests are taken into account.

[1]Recently Jean Claude Guedon, one of the fathers of OpenAIRE, spoke of the need for infrastructures for scientists to be "subsidized" through public funding.
[2] In other words, this is the "basis for a follow-up project proposal", as part of the business model that allows to go beyond the scenario "maintain in minimum state".

The **public partnership** thus relies on the principle that users expect to gain benefits from collaboration. While seeking to realize the benefits, the partner institutions commit to contributing according to their capacities, while ensuring that the efforts and contributions remain in balance with the foreseen user benefits.

Examples of contributions from public institutions

The community is the owner or manager of many relevant data sources, which can benefit from a wider visibility through a collaborative platform. Community partners may also be experts in specific software development or can mobilize resources through project collaboration, or by identifying funding opportunities to enrich the infrastructure. The Partnership's business model may also facilitate the co-development of Open Source Software (OSS), proposing the infrastructure as a platform for community contributions to OSS activities. The community has an important role in providing the personnel to maintain the partnership (e.g. secretariat activities, working groups, etc...), thus enabling the human infrastructure. In many cases currently, expensive or complex activities such as infrastructure management can be outsourced to an infrastructure consortium on a fee base or through a contribution for IT and communication services. Through its membership of public and other governing bodies, the community can advocate for further expansion and exploitation of the infrastructure, and thus to the business model success.

Examples of contributions from public IT organizations

The IT research partners can contribute in various ways, such as the continuous integration and delivery of results from ICT innovation, or the optimization of hardware resources to provide a cost-effective infrastructure solution. Their contribution also covers the human resources and skills for infrastructure middleware maintenance. Moreover, they can identify, design, develop and implement community and infrastructure services. A long-term commitment to an infrastructure may prove very effective in offering training and support facilities (e.g. training as a service), by building expertise and a knowledge corpus around shared resources eliminating overlap and duplicates. A technology secretariat can negotiate better prices and resource allocation for technical activities.

These Public Partnership principles relate strongly to the contributions required for a sustainable technical and human infrastructure. In addition, several high-level business sustainability principles should be addressed when defining the **business and governance model**. These relate to the need for embedding the proposed partnership in the commercial and policy environments:

- An SME work force able to "sell" the iMarine platform, and to provide technical support/capacity building, plus the required flexibility to respond to the demand and to offer the broad range of functions and expertise required.
- An SME work force provider of IT services with an interest in commercializing either the generic iMarine services, or solutions to specific and highly specialized needs.
- A legal entity (either an existing entity, or new one) representing the partnership, set up as non-for-profit organization, with the capacity to sign contracts and take on financial commitments.
- An effective and strategic representation of "senior users", which could take the form of an Advisory Board.
- Depending on the scope, declared commitments to GMES, EEA, GEOSS, EMODNET, MSFD, INSPIRE, FISHERIES.

3. A unique offer

3.1. Our services and the Ecosystem Approach

The iMarine public partnership aims to expand its scope of data management solutions in support of the Ecosystem Approach to the Fisheries and the conservation of marine living resources. This includes tools to describe Ecosystem Services and information management for Environmental protection. This white paper presents a roadmap with the growth objectives for the partnership.

The current Products & Services bundles of iMarine cover the data needs for the entire EA policy life-cycle: from fisheries data collation, , to fisheries integrated data assessments, and to fisheries data policy development strategies.

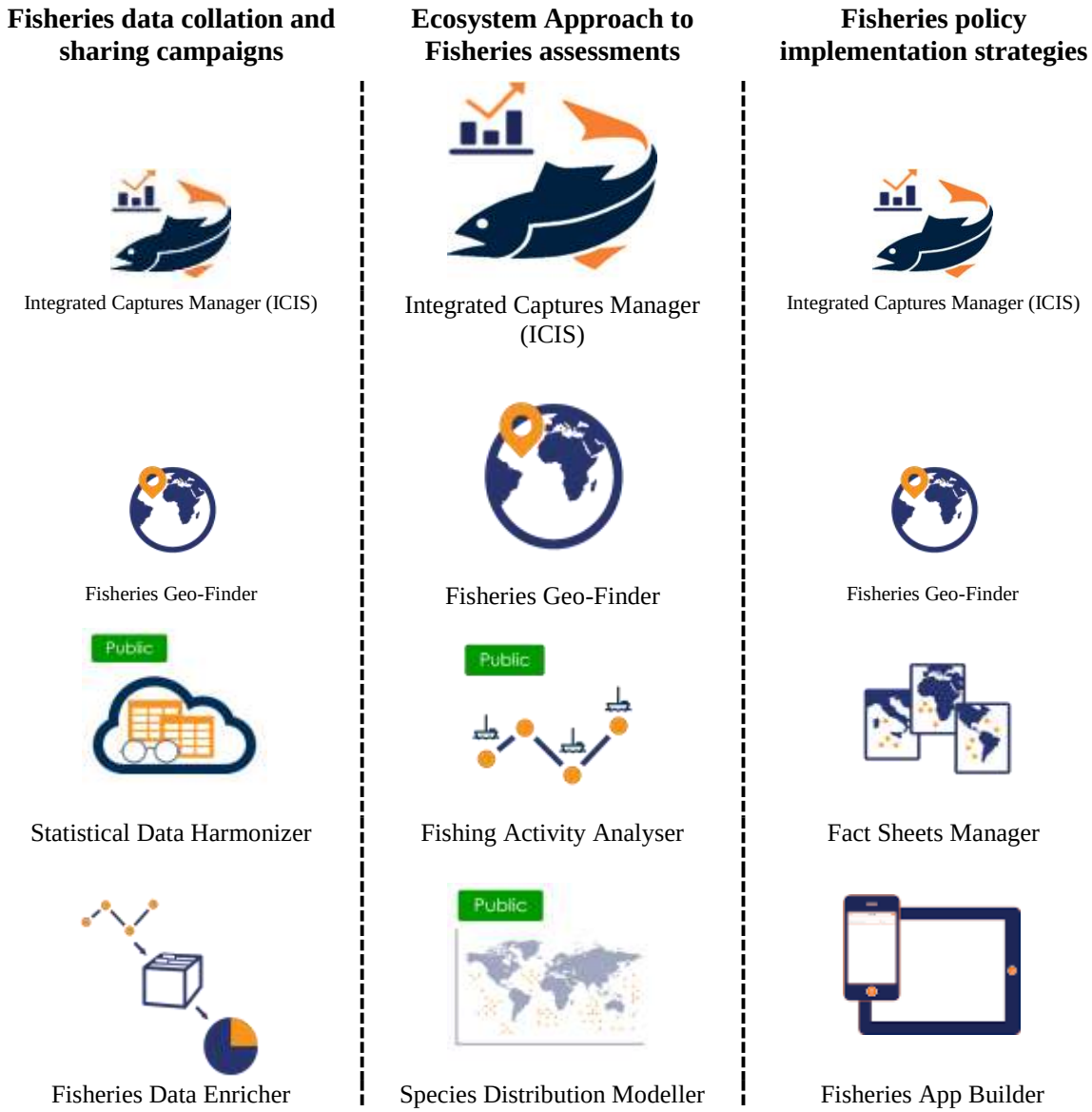


Figure 1: The iMarine offer for Fisheries

These Products & Services values are further defined as Customer Segments section in the Business Model. Their description includes the needs and wants of customers, including community communication and data sharing tools . On the economic side, Customer Segments also include economic exploitation models, and the costs and funding opportunities of the iMarine infrastructure usage in the future.

The Products & Services of the current iMarine offer are defined for an audience of fishery statisticians and marine biologists. However most of the tools are generic and can support many other practitioners. These are:

1. **Statistical Data Manager**: a collaborative toolset to collate, harmonize and manage tabular data (e.g. fishery time series, code lists) to produce datasets relevant to the ecosystem approach to fisheries and the conservation of marine living resources. The harmonization includes conversion from private formats to international formats such as SDMX and / or FishFrame.
2. **Fisheries Data Enricher**: enrich geo-referenced data with environmental and administrative geographic data from a comprehensive array of content providers, including the World Ocean Database and the World Ocean Atlas.
3. **Species Distribution Modeller**: create species distribution or biodiversity maps using species preference and occurrence data with environmental niche modelling or neural network approaches.
4. **Fisheries geo-finder**: search data catalogues of species or fisheries information including their geographic dimension and use iMarine map visualization.
5. **Fishing Activity Analyser**: a service processing datasets related to fishing activity (e.g. vessel tracks) using state-of-the art analytical functions and data-mining capability, with special focus on the generation of indicators.
6. **Integrated Capture Information System** (ICIS): define, improve and persist workflows for the collation, pre-processing, analysis, and dissemination in standard formats of fisheries statistical data (e.g. Catch and Effort, Vessel Density). The data are easily shared, stored in statistical data repositories using SDMX, and projected on maps.
7. **Fact Sheets Manager**: support the [structured] compilation of factsheetsthat can contain static content and/or dynamic outputs (i.e. on-line) from the above services, enriched with proper metadata.
8. **Fisheries App Builder**: create web-portals (e.g. Chimaera) or mobile applications (e.g. AppliFish) to disseminate integrated information, exploit web-services to discover content related to the EAF, such as species factsheets, reference data, administrative boundaries or official names and other content. The collection of data with mobile apps will be possible in a few months with user defined forms.

These Products & Services have been consolidated in the past year by early adopter organizations. Several testimonials have been presented during public events and are accessible from the iMarine project website.

3.2. The iMarine data catalogue and data services

The iMarine Data Infrastructure also offers services for seamless access to a wide spectrum of data including species data, geospatial data, statistical data and semi-structured data from multiple data providers and information systems.

- For taxonomic data, the infrastructure offers access to occurrence records and nomenclature data from currently 11 data sources.
- For spatial data, the infrastructure offers seamless to currently 4 data sources.
- For statistical data, the infrastructure offers access to currently 3 data sources.
- For other data, the infrastructure offers access to currently 20 data sources including knowledge bases and repositories.

You can consult the details from the iMarine website, under the section “Catalogue of Data Providers”.

The catalogue contains predominantly global data sources covering the Physical oceanography, Biodiversity, Fishery resources, and Fisheries domains. They represent a comprehensive array of data types and authoritative sources – governed and managed by different Communities of Practices.

The data catalogue offers a consistent gateway to a large volume of data that are currently difficult to access from a single infrastructure. Bringing these together removes the expensive effort to establish these links, enables to combine the data in harmonized datasets, and eventually results in a broad range of data services.

3.3. Roadmap

The Products & Services roadmap defines, a Baseline offer for the Fisheries domain, with a concrete action plan to sustain its business model, and a growth scenario offer, addressing a larger user community covering Ecosystem Services and Environmental protection. We summarize here these two major steps of the roadmap.

A strategic plan, that naturally combines the two scenarios, is then presented in the next section. It introduces the overall business model that shapes the institutional arrangements and functions required to operate the partnership, and deliver the iMarine value proposition to its users.

3.3.1 The iMarine Baseline business model: the initial operational state

The iMarine baseline business model is presented in Roll-out document "Roll-out 1 – the baseline scenario". It is defined according to a stakeholder analysis and the related opportunities analysis for iMarine.
The baseline scenario is the minimum "survival" baseline, and lists the required resources that will enable the current Community of Practice to continue to exploit the infrastructure after the project's end.

3.3.2 Planning for growth: Ecosystem services & Environmental protection

The iMarine growth business model is presented in Roll-out document "Roll-out 2 – the growth scenario', and will be completed in a next stage, according to the commitments made by stakeholders, and expanding on the opportunities for serving the environmental protection and the ecosystem services domains.

The growth scenarios will also envisage options for development of services beyond the initial objectives of the infrastructure. These will be included after the closure of the project.

4. A strategic plan for sustainability

*As Mike Tyson (the boxing icon from the '80's) liked to say: "**Everybody's got a plan until they get hit"** and no matter why, we all get hit, usually sooner rather than later.*

How can success for partners & consumers be achieved ?

The sustainability of the initiative is primarily a process. As such, it is dependent on the participation of all the stakeholders, possibly at different growth stages, and is implying a funding model that can evolve over time. Nevertheless, the iMarine sustainability model builds on a well-established ground: ensuring opportunities for researchers and data providers to contribute scientific data to multi - disciplinary research, and thus overall supporting data exploitation by a larger user base.

4.1. Opportunity analysis

This section analyses input and guidance received from a series of iMarine Board meetings and the expectations of the current partners with regard to the exploitation opportunities of the iMarine infrastructure. It extracts the market segments that have a match with the iMarine products list. It qualifies these market opportunities accordingly to the support capacity of the iMarine partnership, to the reusability of its assets and to the implementation timeframe of its custom extensions.

One central idea is to focus iMarine efforts, and therefore initially address the Ecosystem Approach domain through the Fisheries entry point, as the iMarine "**baseline**" **Business Model**. Growth scenarios will be considered at a later stage by delivering complementary services to address the needs for environmental protection and ecosystem services.

Following this strategic advise, the **Opportunity Analysis Canvas**[3] is followed as a nine-step experience. It is used here to identify and understand the critical needs and opportunities from the "Fisheries Management and Conservation of marine resources" domain, which the iMarine stakeholders can transform in a sustainable scenario. The aim is to ensure a proper fit between the sustainability endeavour and the identified market needs.

Figure 2: The Opportunity Analysis Canvas (adapted from Univ. of Maryland)

[3] University of Maryland, http://opportunityanalysiscanvas.com/jamesvgreen/

The approach basically articulates three parts:

1. Considering the sustainability of the partnership: a well-defined identity.
2. Positioning the partnership for sustainability: a strong vision statement.
3. Establishing the partnership for sustainability: a clear value proposition.

4.1.1 The identity of the partnership

When building for the partnership sustainability, it is of upmost importance to ensure that the partners are on the same wavelength. A clear understanding of each the partner's mind-set is critical to decide on how to take forward the iMarine sustainability endeavour. The outcome is the identification of a clear and shared goal, that is, support of the Ecosystem Approach and the sustainable use of aquatic resources. The partnership ambition also covers the goal of achieving the open exchange of knowledge and information for the benefit of marine communities of practice. To some extent, it covers the need to demonstrate the usefulness of the iMarine approach, and being able to also influence other related domains, like food security and nutrition (FSN), illegal, unreported and unregulated (IUU) fishing, or large marine ecosystems (LME) management.

One the main motivations of the partners is to contribute significant support to the fishery policies implementation, at a global scale, with the aim of strengthening the contribution of fisheries to the food security and poverty alleviation efforts of a number of global and regional initiatives. Three main areas of volunteer action are consequently identified: (1) the establishment of a public led partnership model; (2) a clear recognition of the need to plan "from the very outset" for a role of industry in the partnership and for the future growth of the partnership; (3) provide a strong incentive to develop an offer able to improve the cooperation at different levels of the fisheries activities.

Altogether, these elements define the main characteristics of the partnership's identity, which can be shaped to address a set of critical needs and opportunities from the "Fisheries Management and Conservation of marine resources" domain. They can also be used to communicate to the targeted market segment why our partnership provides the right answer to its needs.

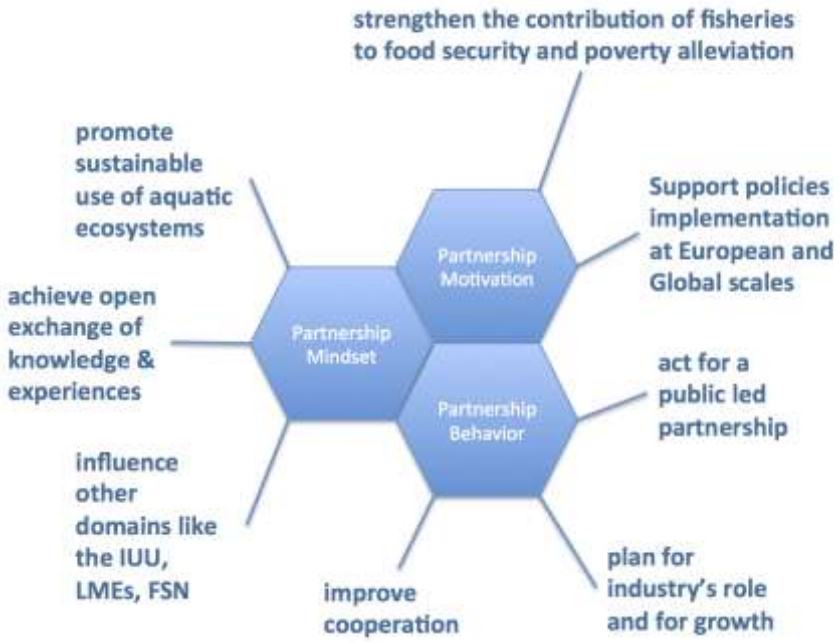


Figure 3: Defining the partnership Identity

The definition of the iMarine partnership identity shows that it is delivering assets for a consistent branding and communication plan. Currently, we can propose to consider the following assets as being key to assert a clear identity to the 'outside' world, in line with the partnership mind-set, motivation and behaviour.

The partnership name would evolve to "iMarine.org" in order to reflect all the community coordination and liaison activities undertaken during the project. A change in the logo seems a practical and easy way to draw a clear separation with the EC project. The new logo could either retain some of the project's design features or colour scheme to convey the idea of continuity (the 'sustainability' phase, through a 'public-led partnership'). The design and re-branding should be further studied. The partnership mantra will have to summarize the main findings as defined in *Figure 3* for the partnership mind-set, motivation and behaviour.

Summarizing the iMarine partnership Identity:

- **Partnership name**: building on the current name and evolve as "*iMarine.org*" is appropriate.
- **Partnership logo**: a new logo is necessary for the transition from the current FP7 project.
- **Partnership mantra**: a tailored tagline summarizes the essence of the partnership. At the current stage, options that encompass the notions of 'knowledge', 'global', 'alliance', 'collaboration', … should be combined within a set of propositions (e.g. "*a global knowledge alliance*", "*the knowledge platform for collaborations*", …) and be submitted to a selected panel of prospects and domain experts and request them to feedback on their perception of the message.

4.1.2 The vision statement of the partnership

The next step is to start tailoring the vision statement for the partnership with a strong focus on the creation of added-value services. In this sense, the Vision statement is evolving over time (e.g. it can be revised every two years, to accompany a growth scenario), as the objectives and goals evolve.

Next, it is important to consider the conditions and status of the Marine Communities of Practice connected to the partnership, and how it is affected by the major changes in the iMarine landscape. These Marine Communities of Practice are being defined, in order of priority and maturity, by the fisheries, the environmental protection, and the ecosystem services.

Most of the stakeholders consulted recognize a high stake and demand for data management solutions that can lower the costs and reduce the IT deployment efforts for Communities of Practice, empowering them to focus on their core competencies, which are neither computing nor application development, but people, economics, science and policy in the fisheries and marine biodiversity domain.

This need is especially strong when it comes to crossing the gap between data management systems and the actual production of actionable knowledge in support of on-field practitioners (including fishermen) and policy makers. All stakeholders also recognize that no one single organization is able to tackle this challenge alone and therefore confirm the existence of favourable conditions for the creation of a partnership of public institutions, teaming up to fill these needs. Moreover, in recent years we have seen the transition from long term funding and visibility to short-term project-based approaches, which are affecting the production and capitalization of real impacting results.

Finally, some recent macro-economic changes are advocating for the urgency of a global alliance to address the critical needs raised by the marine community:

- **Changes in the global economy**: globalisation would seem to be the main change with high impact. iMarine (as everything else) is subsidiary to these macro-economic and geo-political changes. Everybody, including FAO, EU, its member states, is affected by large-scale changes. Nevertheless, they are not immediate or proximate (i.e. acting in the short term and at the small scale). Globalisation has been selected by the Intergovernmental Panel of Climate Change (when drafting the next IPCC Assessment), as the major driver for most of the changes we experience socially. For example, increasing demand for energy, for other natural resources (including protein from fish), use of sensitive habitats (Coastal, Deep-sea), but also "changing patterns of consumption" (large middle classes in China and India, with new levels of purchasing power). In a different context, the next First UN World Ocean Assessment also is using globalization as the main driver of change. In this UN assessment, there is a full section devoted to food security from the ocean and a lot of biodiversity assessment (6 Parts, 57 Chapters).

- **Changes in society**: alleviation or reduction of poverty plays a similar role to globalization here. More populations having increased purchasing power are entering globalized markets, creating a gigantic migration of wealth. The subsistence fisheries (isolated poor rural fishermen) are facing increased competition from small-scale fisheries, which are now supplying international markets (not only local consumption), therefore satisfying a new demand for fresh, high quality fish from fluent segments of society. Another important societal change is with citizens at large, more aware of environmental issues, and willing to support the enforcement of good practices in fishing and agreeable to pay for conservation (not in cash but refraining from consuming certain products). This supports the application by managers of "an ecosystem approach to management". This population is sociologically "middle class", more affluent than the statistical average (or geometric mean) incomes in each nation, e.g. Europe.

- **Political changes**: unfortunately, political change has followed, not led, these processes affecting directly the fisheries and marine conservation actors. The only political change that will affect the public partnership is the strengthening of a "federal" Europe, if it happens. This because until now, the policies in Brussels are technocratically defined, and therefore a little ahead of the purely politically defined policies at the national level.

- **Regulatory changes**: This is the most important proximate and immediate driver for the iMarine partnership. First on Fisheries and then in marine environmental policies.

Hereafter, *Figure 4* summarizes these three aspects, the conditions and the status of the Marine Communities of Practice connected to the partnership, and the major macro-economic changes that they are facing.

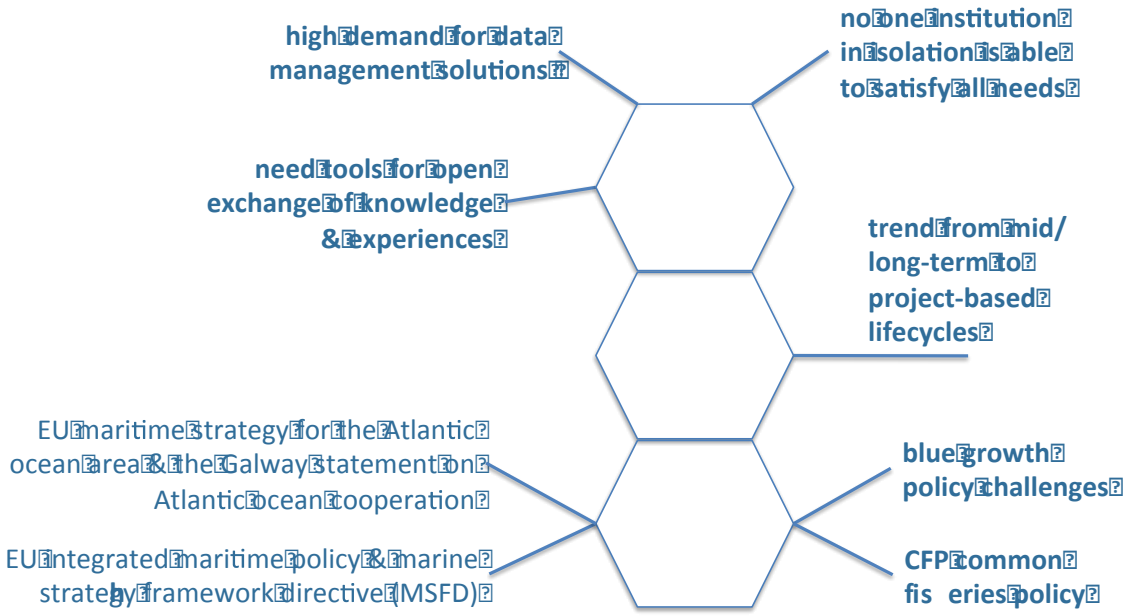


Figure 4: Defining the partnership Vision

The **vision statement** of the iMarine partnership clearly points to the attractiveness of the fisheries policies implementation domain for iMarine sustainability. At the current stage, we can suggest considering the following assets as essential in asserting the partnership vision statement to the 'outside' world, while meeting with the knowledge and demand conditions required for success.

The iMarine partnership Vision statement:

- Shall be clear about the nature of the Partnership: about what it delivers in its first years. It can evolve in the future, e.g. when the partnership is transitioning into a growth scenario.
- Shall provide a reference for day-to-day operations; must help to set the priorities, as well as make clear what the foreseen effects are for the markets segments that are addressed.
- Shall be inspirational for the partners involved in delivering the Business Model services.

An example of **vision statement** for the iMarine partnership:

- *"Our vision is to continuously interconnect open data management solutions that can empower communities generating knowledge through collaborations, dedicated to fisheries and ecosystem services, globally"*

4.1.3 The value proposition

To complement the partnership vision statement, we need a strong formulation of the real benefits offered through the Partnership. In defining these benefits, we need to take into consideration the constraints to be mitigated, and the breakthrough opportunities the partnership should engage with.

The ultimate goal is to ensure a good fit between the iMarine partners' know-how and the critical needs they can satisfy through the partnership.

In the marine services landscape, the unique selling points of iMarine include the **Ecosystem Approach**, covering a range of community partners across the fisheries, biodiversity, and environment disciplines. They also include the **global dimension**, enabled by the institutions involved in the iMarine Board, and the strong IT component represented by organizations specialized in computer science and professional services.

The main landscape forces in the current setting are without doubt the other marine-related FP7 funded projects. There is a stake in maximizing all these investments in a proposition that clarifies where the iMarine Partnership can deliver its best value. This has to be done also in the perspective of the future alliances and funding opportunities that the EC Horizon 2020 programme will bring. The *Figure 5* summarises these considerations.

Considering other initiatives like LifeWatch or EMODNet, one could question the need to further chase any role of coordinator (e.g. EMODNet provides a coordination effort) but there are cascading levels and community clusters to be addressed:

- The generic D4Science level.
- The Global fisheries level (Fishery itself is likely to be further sub-divided between science, MCS, …).
- The Global marine biodiversity level.
- The European biodiversity level.
- The Global State of the Environment level.

Moreover, the potential to deliver **Value Innovation** is important to differentiate the iMarine partnership on key factors, which can imply to carefully eliminate or reduce non-critical factors (e.g. some community coordination levels can be well addressed already and should not be duplicated by iMarine) that might be already present in other initiatives. Some other factors can be aimed at exceeding users' expectations (e.g. in building trust on data; policy makers making better decision from data; researchers advancing science more rapidly and efficiently; industry creating data services). Moreover, new factors can even be created in order to satisfy user needs in new ways (e.g. helping create new products and industrial applications, especially when positioning for Horizon 2020 calls, or mitigating the impacts of climate change through active support to emerging ecosystem services).

This is where the opportunity identification effort can be summarized with the market needs uniquely served by the iMarine partnership. It shall present a clear understanding of critical community challenges, and focusing on customer benefits first.

Explaining and presenting the fundamentals of the proposed solution then requires a perfect understanding of the customers' perception of the partnership **Value Proposition**. Not the features, and not the functionalities, as they are simple means only to create that value, but the actual benefit delivered.

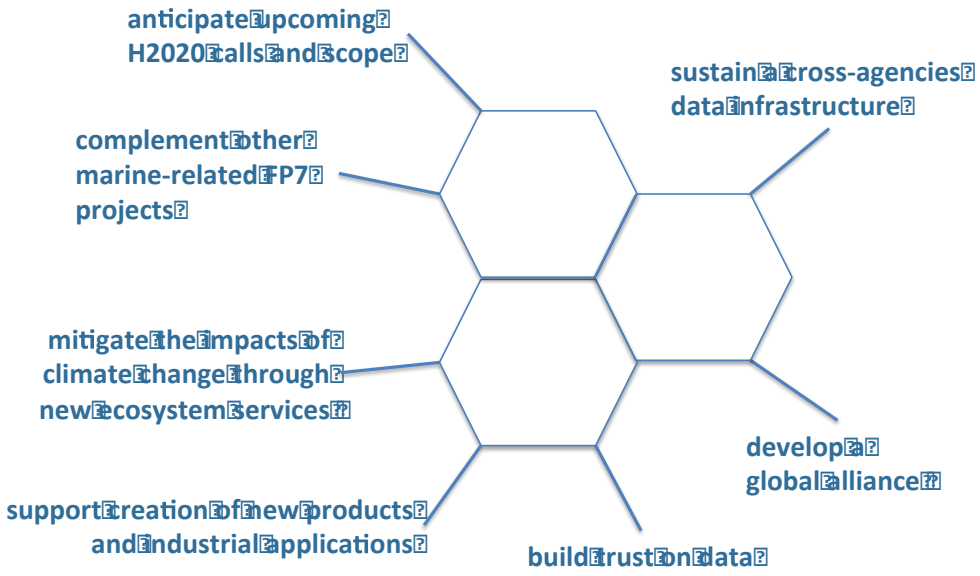


Figure 5: Defining the partnership Added-Value

In summary, the iMarine partnership **Added Value** is a combination of two main benefits made accessible to the user communities: the benefit of a trusted and well-sustained data infrastructure that complements community efforts within a coherent coordination framework, and a lower risk approach for the production of real impact results and applications.

The iMarine partnership Added Value:

- A trusted and well-sustained data infrastructure that complements community efforts within a coherent, global, coordination framework
  (e.g. an EC-FAO strategic partnership under the new EC-UN Financial and Administrative Framework Agreement)
- A lower risk approach enabling for the production of real impact results and applications.

4.2. Stakeholders analysis

Who are the people who will benefit from the proposed development activity? And whose interests might be harmed by it? Identifying the Partnership's stakeholders, large and small, individuals & organizations, in the perspective of the expected sustainability is an essential aspect.

Stakeholder definition: "Any individual, group or institution affected by a project in a positive or negative way; or... any individual, group or institution that has an interest (or stake) in the project".

The purpose of the Stakeholder Analysis is to gain an understanding of the overall system, by identifying the key actors in the system, and assessing their respective interests.

4.2.1 Overview

The initial analysis of the iMarine initiative stakeholders has led to the identification of eleven macro categories as shown in the figure 1 below.

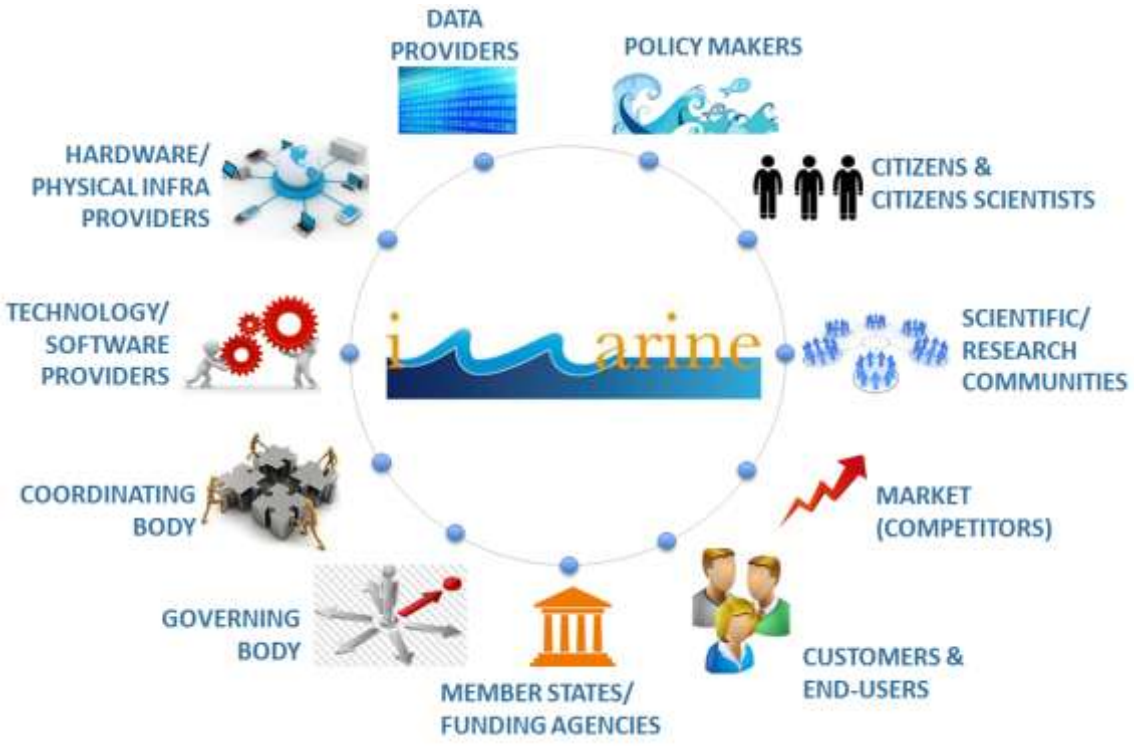


Figure 6: iMarine Stakeholders, macro categories

The Stakeholders analysis seeks to differentiate and study these macro categories. Five major attributes are important for the iMarine stakeholder analysis:

1. The various stakeholders related to iMarine sustainability.
2. The group/coalition & network they belong to and can be reasonably associated with.
3. The kind and level of interest (and concerns) they have.
4. The importance and influence each stakeholder has.
5. The multiple "roles" they can play.

Stakeholders Types	How they can affect iMarine	How they can be affected
Data providers	Provide data for new insights and scientific discovery. Provide data for offering comprehensive EA data catalog.	Benefit from standardized quality data formats and metadata and re-use. Benefit from new collaborations. Gateway to open data.
Citizens & Citizens Scientists	Provide data & contribute to scientific validation process.	Acquire new knowledge / participative science.

Scientific Research/Communities	Bring new knowledge and tools/algorithms as part of a collaborative research effort. Test & validate the new services.	Speed up publications & scientific advances. Open data / Open access journals.
Market (Competitors) - Research software providers who have developed a specific solution within their organisation. - Independent Software Vendors. - Resource Providers. - Other data e-infrastructures.	Barrier for the uptake of the e-infrastructure and its services.	Vice versa (reduced influence).
End-users - Biology community (marine biologists, fisheries biologists); - Large organizations with data harmonization needs; - Small organizations or research groups with limited resources; - Data generators (research projects, big research infrastructures, medium size labs, simulation centres, individual researchers). - Discipline-specific data service providers; - Policy Makers; - Providers of generic common data services (i.e. Computing centres, libraries); - Scientific / Research Communities; - Data journalists; - etc.	Bring new revenue stream whether as pay per use or free at the point of access through institutional or external funding. Bring resources stream in the form of co-funding in support to development of new services, or directly in-kind software contributions. There exists a threshold of end-users beyond which the reputation of iMarine will grow by simple recognition of this existing user base.	Leverage the iMarine data-infrastructure to generate information that leads to new knowledge to support decision making. i.e. Organizations that need to collate and analyse data for the effective management of the EAF (fisheries monitoring, scientific observers on fishing vessels, ecosystem monitoring , fish stock assessment, environmental indicators, etc.). Easy access to Open data.
Policy Makers, Member States & Funding Agencies - EU; - WorldBank; - GIZ; - International & Regional commissions; - Member States; - etc.	Bring new areas for investments. Policy decision making support & reporting.	Address grand global challenges.
Governing body	Provide strategic directions. Identify major needs, partners, and customer segments.	Creation of new start-up companies, legal entity, foundation, or alliance or other types of collaborative models.

		Revenue-stream / societal challenges support.
Coordinating Body	Manage the e-Infrastructure resources. Coordinate contracts & agreements, access policy, bi-lateral agreements. Bring human expertise. Provide training services. Provide consultancy services to assist the end users with the e-Infrastructure use.	Provide new services based on sustainability assessment.
Technology/Software providers - Public or private organizations - Computing science institutions	Public or private organizations that provide software applications can solve specific problems including for niche markets Organizations conducting Research in IT can provide constant innovation to the infrastructure (including e-infrastructure managers who maintain & operate the e-infrastructure).	Revenue-stream launching new products. Economies of scales through reuse. Constant opportunities for scientific IT publications.
Hardware / Physical Infra Resource Providers - Public or private organizations	Provide servers, CPUs, storage, management and accounting systems to operate the e-Infrastructure.	Revenue-stream and/or user test environment for new services. Public: computing research testbed.

*Table **1** - Stakeholders analysis and classification*

In order to understand their current perception of the iMarine initiative, their positioning towards its sustainability and their assessment of the iMarine e-infrastructure (its strong points and its weaknesses), several rounds of interviews have been conducted through a consultation process. Two different questionnaires have been shared with the stakeholders, one for internal members and one for [external] participants to the workshop (March 2014).

4.2.2 Stakeholders consultations

Two rounds of stakeholder consultations helped to consolidate this strategic plan: a large circulation of a questionnaire to the project partners, and then a workshop presenting the initial ideas of the partnership to the current stakeholders and a panel of potential future partners.

4.2.2.1 Views from the current project partners [See Annex 1]

At the end of February 2014 the "iMarine Questionnaire" was created and circulated to a selected list of iMarine partners and board members. The interviewees list has been validated by the iMarine Steering Board.

The aim of the questionnaire was to gather information on the current perception of the iMarine services, on the vision for the future and on the role they could play. A second consultation phase is foreseen after the first collection of feedback in May 2014 in which all the consortium partners and board members will be involved.

The main findings coming from the questionnaire are reported below.

Main convergence points:

- **Commitment for iMarine sustainability.** All the respondents have committed in some way to sustain the iMarine e-infrastructure providing data, resources and expertise for the short to mid-term.
- **iMarine management.** There is a need for a management body. This could be a legal entity established for this purpose, one of the iMarine partners, or an organization acting as an independent group.
- **Clustering the partners' remarks on the sustainability of iMarine the outcome is the following.** The need for funding from the EC is considered as the main route to sustainability.
- **No similar initiative is present on the market.** No other similar initiatives emerged from the survey. However, competitors for specific services have been identified and include BioVeL, which is an EGI community project.
- **The iMarine services are perceived as adding value services.** Most of the respondents think that the services could be relevant for their organizations or for their business, depending on their specific requirements.
- **The need to establish a vivid community before launching any service and offer training as an incentive.**
- **All the interviewees agree that the solution offered must be cost-effective.**
- **Start with a niche by picking a specific target market and try to dominate it.** The fishery sector seems to be the potential starting niche market. iMarine as a start can deliver IT solutions for Fisheries experts (can be researchers, can be national, regional or international fisheries experts – mainly public institutions, ministries of fisheries, regional commissions, i.e. ICCAT) or for IT experts developing solutions for these people.
- **iMarine unique selling points.** Three main aspects emerged from the answers of the majority of the interviewees
    - A key differentiator of iMarine is that it is domain specific (thematically focused) rather than a generic approach, with its strong focus on marine environment. It benefits from the participation of major (marine) stakeholders within this field.
    - A key benefit of iMarine is that there is no need for users to invest in hardware and software as they are already part of the infrastructure; it has computational power, it has already a strong infrastructure in place, so potential customer projects do not start from scratch.
    - The iMarine VRE concept and social facilities have proven to be a good selling point. Other initiatives have followed the same approach (http://www.marinexplore.org/) and they are becoming popular. The 2 key success aspects are that they are available online and social.

It is important to note here that opportunities for both sustainability and future developments refer to the value of iMarine from two different perspectives, i.e., as a domain specific infrastructure and as an ICT infrastructure for capacity building above and beyond the marine domain, including the federation of resources (growth scenario).

Options with fewer consensuses:

- **A public partnership business model** linked to the production of scientific papers thanks to the use of the infrastructure or aimed at addressing global challenges like the ones identified by the EC or the Global Blue Growth data Framework.

- **Exploitation of the iMarine e-infrastructure by research organizations** i.e. transferring innovative ICT results to third-parties; supporting the work of scientists operating in marine related domains; experimenting innovative IT services and algorithms; training new scientists; supporting some of the ESFRI European Research Infrastructures (e.g. LifeWatch).
- **Commercialization of the services to a broad community exploiting gCube**.
- **Adoption of the iMarine e-Infrastructure by organizations that can benefit of the iMarine services to accomplish their mandate**, institutional or otherwise (i.e. supporting local organizations with limited resources, assisting the organization in data management, setting-up Fisheries Information Systems at national/regional levels etc.).
- **A collaborative environment** where users give back to the infrastructure their knowledge and data in return for all those services that iMarine can provide.
- **Pooling hardware, software and data resources across-agencies**; there is also an opportunity for outsourcing services to a publicly controlled cloud platform.
- **A consultancy model:** it is D4Science, so aim at 4; 4 months to delivery, 4 key users, 4 key services in a VRE, 4 organization collaborating. If < 4, a local solution is probably better. If > 4, choose another business model i.e. not based on exploitation, but on development. The envisaged model foresees the capability to react to the user needs in a quite short timeframe like it has been done for VME-DB: nothing there at the start, assets in infrastructure, use case support, repository of software and adjust it to the use case. A small team of 4-5 developers can put it together (the business model is one thing, the infrastructure is another).
- **Linking with current European research infrastructure projects like LifeWatch and get government support**.
- **iMarine as a service provider animating a community**, and contributing to the development of the framework, which in return gets funds from the project using the framework (either by being part of the consortium developing the needed FIS or by a line in the proposal budget to support iMarine infrastructure, kind of license paid once). Then once the framework is well established, it can be expanded to other domains such as e.g. agriculture.

Another observation that has been made is summarised as: “there are different products behind it”. The business model can be different for each of them. Do we mean the D4Science infrastructure able to support different CoPs? Do we mean gCube or its bundles that can be exploited to build different infrastructures or to support specific application needs? Do we mean the e-infrastructure supporting the current iMarine CoP?

- **Commercialise services for a broad community as a start** (instead of specific target market as a baseline): some interviewed persons think that the success factor of iMarine is the capability to deliver services to the broadest community as possible, by exploiting gCube.
- **Customer size: there are different ideas on the ideal size of the iMarine customers.** Some interviewees think that managing a large numbers of small customers requires considerable efforts in terms of contract negotiations and following up on payment issues and so they do not recommended this approach. On the other side some interviewees sees the small customers as an opportunity easily managed by the iMarine governance outsourcing some activities to SMEs.
- **Customer type.** Different customer segments have been identified by the people interviewed. These segments include: small organizations with limited resources, large organizations with data harmonization needs, biologists and statisticians that needs support in data flow management.
- **iMarine services are considered by some partners not yet fully mature for market.** In some cases the perception is that there is a lack of organized workflows. In other cases, potential private users should first test and validate the services.

- **Marketability of services.** Not all the respondents agree that iMarine services are marketable because of the way they are currently packaged. Moreover, there are different opinions on what elements are most suited to commercialization. The main services identified are: StatsCube, ConnectCube, Time Series and Shared Workspace.
- **Type of services provided: interviewees have different views**. Some of them think that pre-defined packages and online payment could be a solution to provide basic services in a completely automated way – free 1 week trial and then automatically pay. Some others think that a consultancy model should be foreseen (i.e. iMarine cannot deliver services in a box but needs to assist customers with experts in the field). Beyond this direct feedback, iMarine could consider a Consultancy Service at cost but free usage.
- **Revenue streams coming from the iMarine services.** Even though most of the respondents think that iMarine services could be relevant for their organization or business, many of them are not able to identify any revenue streams coming from them.

Quite each of the interviewees see options and opportunities for the iMarine sustainability, but some of them still consider that there will be no sustainability at all if funding from the EC is not ensured.

Main recommendations identified for sustainability:

- The relationship between the different organizations needs to be very strong and it will require strong commitments and agreements on the operational and business side. It will need a central operations office.
- The solution offered must be cost-effective.
- Important to have a future perspective, being able to indicate duration of usage of the infrastructure.
- Have the iMarine infrastructure used by the private sector; It shall be assessed firstly by the potential customers as a good candidate for the services they need when designing a Fisheries Information System.
- Demonstrate an added value compared to developing a system from scratch.

In all the responses received, interviewees have been able to identify a role for their organization within the sustainability of iMarine. The roles identified so far are the following:

Marketing opportunities

- Giving the network of contacts, disseminating, promoting, engaging new user communities, therefore playing a facilitator role.
- Potential consumers.

Resources, maintenance and software

- Committing resources to support the technical team for VRE creation and the e-infrastructure maintenance and to continue the usage of the current services (i.e. Aquamaps by FIN).
- Feeding regular high quality data for research infrastructures (i.e. OBIS data provision).
- Providing computing resources, providing domain expertise, contributing to the development & evolution of the iMarine software components.

Organizational structure

- Participating to the iMarine governance

Sustainability support

- Providing dedicated funding.

Future competitive calls

- Participating to a new H2020 project.

The need for providing a community-oriented catalogue of services emerged from the questionnaire. All the people interviewed have identified service that they can use with different names in some

places referring to the same set of functionalities. This made difficult the analysis of the most marketable and requested services.

The questionnaire template and the full analysis are reported in Annex 1 of the document.

4.2.2.2 Views from participants to the March 2014 workshop [See Annex 2]

On 7th March 2014 over 50 managers, policy-makers and scientists from the fisheries and biodiversity domains and from 17 countries gathered in Rome to explore potential roles in the iMarine partnership model to sustain collaborative e-Science in the field of fisheries. On this occasion a questionnaire was distributed in order to collect feedback from the participants.

Main convergence points:

- The majority of respondents consider **the big data management needs and the data transformation services that deliver standard format outputs as main drivers for the uptake of the iMarine infrastructure** reflecting the point of view of the main target audience present at the event: data providers.
- With regard to open data and open access, the majority of interviewees have difficulty in understanding where the revenue streams for some services would come from and therefore perceive this as a barrier to uptake. This may also be due to the relatively new concept of services creation based on open data, including commercially viable services.
- **Given the audience mainly composed by data providers almost all the participants that** were asked how their organization can contribute to the sustainability of the iMarine platform, the answers were: as data provider or providing consultancy/domain expertise.

Options with fewer consensuses:

- Main iMarine assets: In response to the question "According to your knowledge and on the basis of what you have learnt today, what are the main assets of iMarine that you consider critical to sustain?"

  The answers reflect a quite distributed perception of the added value of iMarine: Capability to rapidly implement customer-specific requirements, supporting flows of quality controlled data, advanced computational capacity and infrastructure under central governance of public organizations.

The questionnaire template and the full analysis are reported in Annex 2 of the document.

A full analysis of the workshop outcomes is reported in the "Report of the iMarine workshop, 7 March 2014, FAO" available online at http://bit.ly/1ht21iE.

4.3. Roles and functions, a perspective on the governance

From the user communities point of view, various thematic communities could take shape as user oriented governance clusters, each of them being part of a higher level D4Science.org governing structure. This D4Science.org governing structure would have to some extent a function equivalent to the union of those fulfilled under today's [iMarine + OpenAire + EUBrazilOpenBio] projects.

Considering the size of each user community (iMarine is potentially a huge one), it is likely that sub-clusters will also emerge under each main community. There is a possibility that a three tiers governance structure might be necessary. This should be kept in mind, but if no one would contest the

need to set-up user oriented governance bodies, there should be no systematic attempt to define rigid and useless hierarchies among the user community from the onset.

In addition, the situation targeted at the end of the iMarine project might be that of one, maybe two or three, user community clusters, and therefore the functioning of the higher level D4Science.org governing structure might be articulated with respect to that.

It is acknowledged that flexibility is required, however the different levels of Governance are being described separately with the understanding that they conceptually belong to different levels.

In the Roll-out documents dedicated to the baseline and growth scenarios of the iMarine sustainability, we present and structure the key elements required for defining our envisaged Business Model. To do so, we apply the Osterwalder Business Model Canvas[4], a strategic management template for developing new business models, or documenting existing ones, and presented on *Figure 7*. It involves nine building blocks, and their relationships.

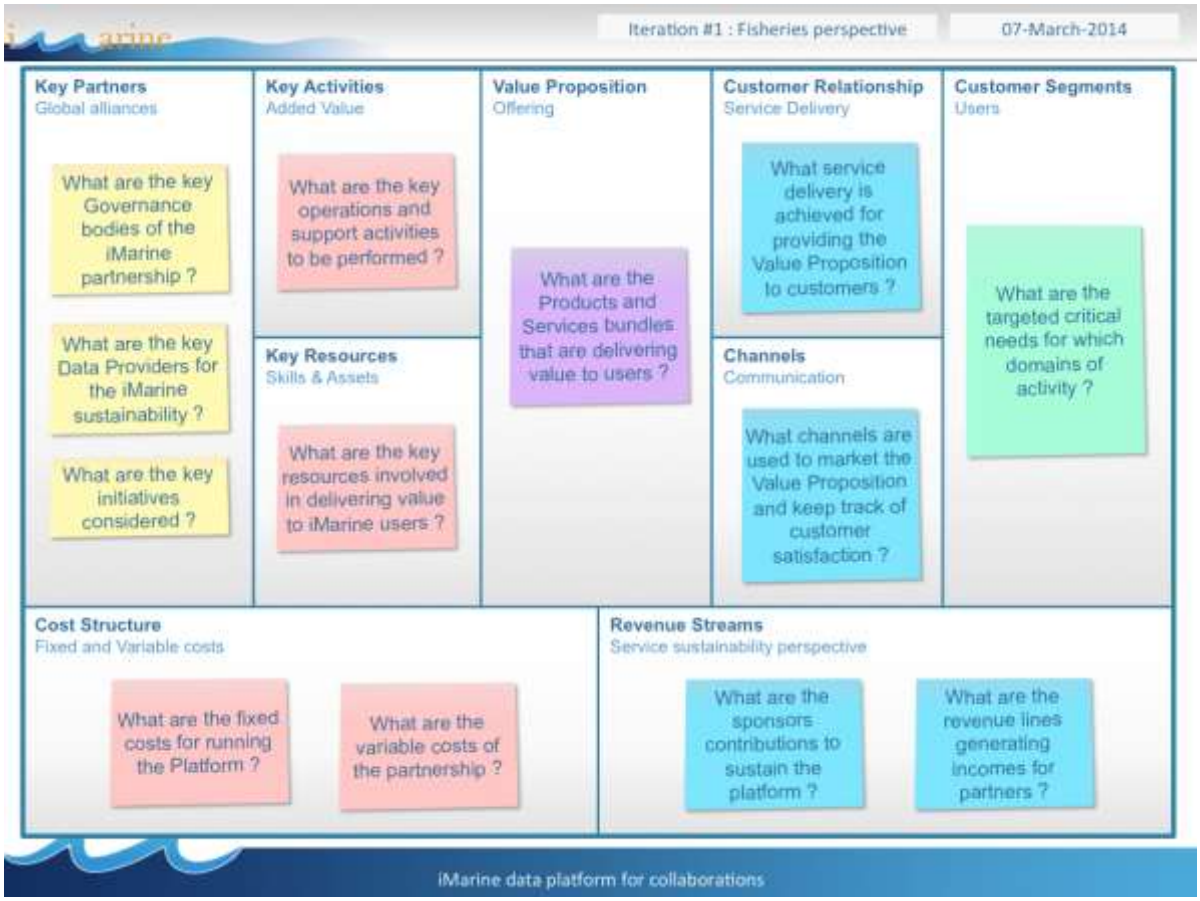


Figure 7: The Osterwalder Business Model Canvas

The roles and functions that will be undertaken by the stakeholders of the partnership, are orchestrated by the overall business model. They are serving it, so that the operations can flow to deliver the Value Proposition of the initiative. All these aspects are detailed in the Roll-out documents 1 and 2.

The functions that will be required to manage the iMarine baseline & growth scenarios are introduced hereafter. They are implemented with the stakeholders contributions in the Roll-out documents.

[4] http://www.businessmodelgeneration.com/canvas.

The *Figure 8* maps the functions and the governance bodies for the two different scenarios: the baseline scenario (the iMarine situation after the end of the project to maintain operational the seven VREs identified as part of the baseline scenario to run the seven services described in the previous chapters) and the growth scenario (including the engagement of new communities and the development of new services). For each function, the number of FTEs necessary to execute the work will be assigned. Regarding FTEs, it's clear that a single person can cover multiple roles (multiple functions can be performed by one person) or some of them can be outsourced, depending on the governance model selected.

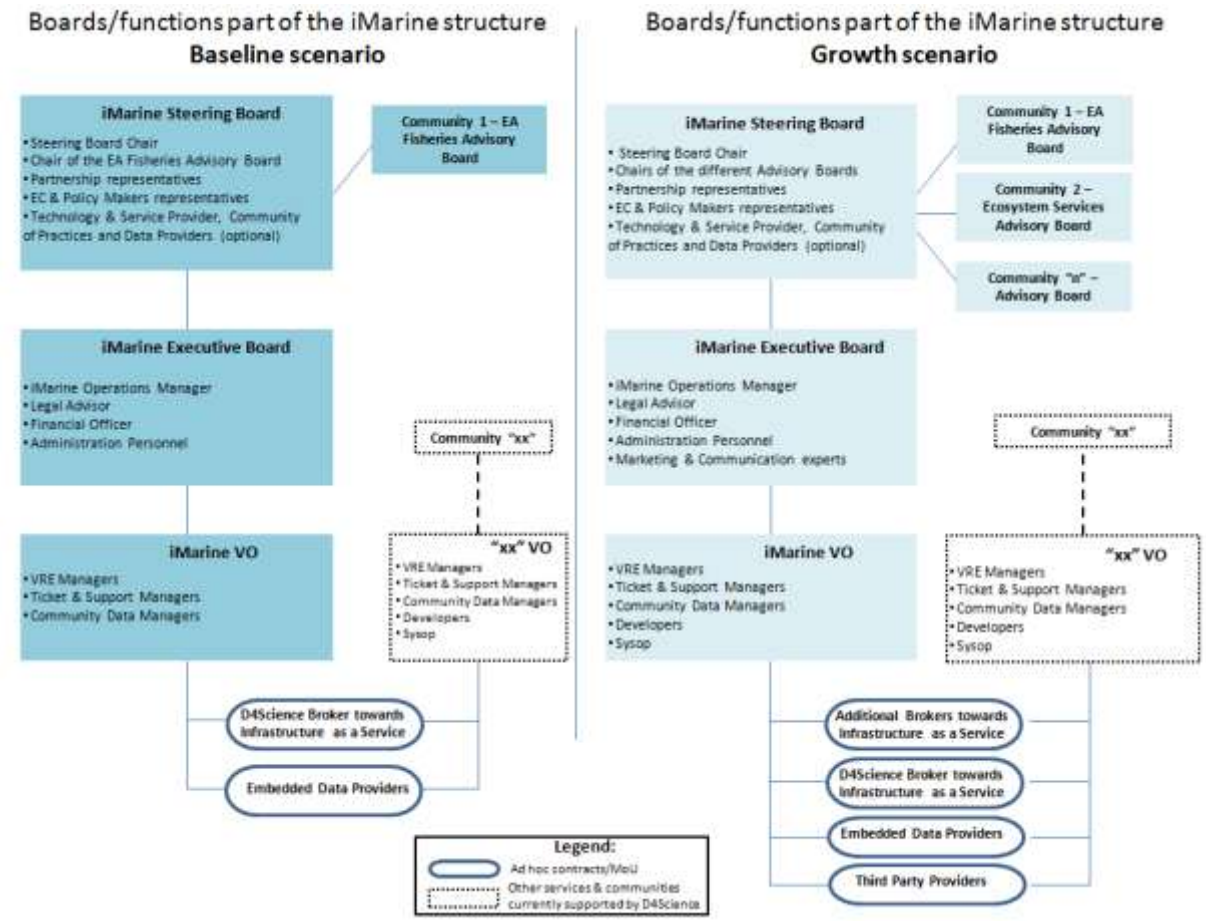


Figure 8: The functions required by the iMarine operations

- ***Advisory Boards*:** The various advisory boards are in charge of the discussion of the main challenges and requirements within the different communities, their prioritization and their communication to the Steering Board. The baseline scenario reflects the current situation where only one advisory board, ie. the EA Fisheries Advisory Board, is present. The iMarine project clearly demonstrated the effectiveness of having an Advisory Board and also the benefits for the Board members that have a forum to discuss common issues and future trends in the marine field, the participation to the board is on a voluntary basis. Each Advisory Board is composed by a series of Board Members and a coordinating Chair. Each advisory board has the following functions:
  - **Board member*:*** He/she is a high-level expert belonging to a strategic community. He/she provides regular consultancy aimed at identifying the priorities and the technological directions. New requirements may emerge from the board discussion. Board members meet once a year in a face to face meeting and contribute with advices and by providing feedback on the iMarine applications via email exchanges. Board members will have the

advantage to be the first on the market to test the new solutions. Participation in the board is on a voluntary basis. Individual Board members cover their own expenses.

- **Advisory Board Chair:** He/she is the chair elected by the board members. He/she is responsible for attending the annual face to face meeting coordination and for the reporting on the main outcomes of the meeting to the Steering Board.

- ***Steering Board***: This is the decision-making body of the initiative. The steering board is in charge of the iMarine vision, its strategic directions and related decisions. It includes at least one representative per member of the **Partnership**, the **Advisory Board Chairs** that will represent the perspectives of different communities of Practice and the **Sponsors at regional, national or international level (currently EC)** that will be involved to give advice on strategic directions. A **Steering Board Chair** will be elected by the members of the Steering Board and he will be in charge of communicating the decision taken to the Executive Board.
  Other participants that could be involved in the Steering Board discussions are the **"strategic" technology & service providers** (Industry, D4science, any other IaaS provider), **community of practice** and **data provider representatives**. The Steering Board will be responsible of the inclusion of new participants.
- ***Executive Board:*** This board is in charge of the day-by-day coordination of all the activities. This board will receive the strategic advice from the Steering Board, will evaluate their feasibility in terms of costs/benefits/technological development and will monitor their execution. It includes Operations Managers in charge of the supervision and coordination of the service delivery supported by a financial officer, a legal advisor and the administration personnel that will take care of the legal, financial and contractual issues. Marketing & Communication experts will also be part of the executive board (in the growth scenario) to create awareness and build brand recognition of the business, promote the services by expanding the customer user base and speeding up the iMarine services uptake.
  - **iMarine Operation Manager:** He/she coordinates and supervises the day-by-day activities and makes sure that the services are delivered. He/she is also responsible of putting the Steering Board decisions into practice. He/she will be supported by a financial officer, by a legal advisor and by an administrator.
  - **Financial Officer:** He/she manages the finances, the accounting and the investment activities of the new entity (if a new entity is established, or, in any case, of the financial flow management).
  - **Administration Personnel*:*** He/she manages the bureaucratic aspects: mainly contracts, fees, membership management.
  - **Legal Advisor**: He/she is in charge of the legal aspects.
  - **Marketing & Communication experts:** He/she is responsible for disseminating and promoting the services to increase the user base.
- **iMarine Virtual Organisation (VO)[5]:** This entity is responsible for concretely providing the right resources, software & VREs to the customers for the marine fields and delivery the services in a good way. It is composed of the iMarine Operations Manager which supervises the work of two teams. The first team maintains the service operations and includes VRE/Service managers, Community data managers and Ticket and Support managers. The second team (foreseen in the growth scenario) is dedicated to meeting new requests from the existing or new communities by developing new services. This team is composed of software developers and system operators.
  - **VRE/Service managers:** He/she is in charge of ensuring the delivery of the service to the marine community. He/she also provides consultancy on the new solutions to implement, by ensuring the maximum re-usage of existing services.

[5] Please note that in the diagram reporting the functions there is the box "XX" VO. This box refers to the existing governance structures in place for D4Science to support communities other than the marine community. It is important to note that the D4Science infrastructure is already used by other communities. Hence iMarine can benefit from developments already implemented in other sectors to increase its range of services.

- **Community Data manager:** He/she is in charge of controlling that data are correctly analyzed and processed for the marine community. He/she also provides consultancy on the new solutions to implement, by ensuring the maximum re-usage of existing services.
- **Ticket & support manager:** He/she is in charge of monitoring that the iMarine services are up and running and will provide support to the customer in case of inconvenience.
- **Software developer:** He/she is responsible for new implementations and developments.
- **SysOp**: He/she is the administrator of the online service virtual community.

- **IT/data external resources:** The services delivered by iMarine can build on different IT and technological service providers and different data providers. Their representatives will interact with the functions part of the iMarine VO.
  - ***D4Science broker towards IaaS*:** Technology & computing & storage resource provider.
  - ***Additional Broker towards IaaS:*** Technology & computing & storage resource providers.
  - ***Embedded Data Providers:*** Data & metadata providers.
  - **Third parties (SMEs, etc.)**: Mainly technology providers.

4.4. Costs analysis

4.4.1 Status of the iMarine data infrastructure today

At the technical level, iMarine relies on the D4Science infrastructure that combines the functionality of more than 500 components into a **coherent** and **centrally managed infrastructure** of hardware, software, and data resources. Together, these components offer a platform that can host a variety of applications. These **applications** share a common theme: **provide a service to a Community of Practice**.

Unlike other infrastructures that boast size, power, and technologies of computational resources, iMarine puts the community first. No other infrastructure equals iMarine in developing support to **real-life scenarios**, and in helping to overcome issues faced by communities that work to achieve the UN Millennium Development Goals. Typically these communities are facing issues such as low resources, low training, low connectivity, low data quality. This does not imply concessions on quality or performance. Rather, the mission is to offer quality and performance to communities that do not have resources of their own for scaling their expected impacts.

The infrastructure resembles an archipelago where applications emerge as islands of services, resting on an infrastructure bedrock. The islands specialize in one or more domains, but they are not isolated 'atolls' as they are ready made for sharing resources with other islands. Each application offers a standard set of features that can be extended by selecting services from several topical bundles.

The iMarine infrastructure currently offers a catalog of services with functionalities grouped in **four major software bundles**, that can be used to build flexible, purpose-built applications. Each application running on the infrastructure embeds some of the enabling gCube software and APIs, and can access and re-purpose data from other iMarine applications. All users benefit from Infrastructure Services that empower different types of profiles: data managers and analysts, biologists, spatial data managers, as well as policy oriented generalists.

These Applications can be configured to receive (and pay for) only those resources actually needed or consumed. An Application can also be extended with resources coming from other Applications.
The four key software bundles that iMarine has delivered and continues to enrich are:

BiolCube focuses on the management and interpretation of biodiversity data. It is available as a suite that typically packs many useful features in a research environment where marine ecologists are offered a complete private workspace to manage species names and occurrence data.

StatsCube is a complete data framework, covering the full data management life-cycle from observational data to aggregated data repositories enriched with validation and analytical tools.

GeosCube applications help practitioners dealing with geospatial information to properly access, consume, and produce data. It is based on OGC compliant tools and services including Web Processing Services, and manages the storage and interpretation of geospatial information.

ConnectCube brings semantic technologies for publishing structured data so that it can be semantically enriched and linked, and become more useful to end-users. It is enabling users to produce Linked Open Data to share information in a way that can be read automatically by computers. This enables data from different sources to be connected and queried.

The bundle approach is expected to offer more 'flavours' in the future. For instance, a focused approach for infrastructure support for Mobile Apps is foreseen. AppsCube, will offer an integrated approach to mobile app development. The infrastructure organizes the content and data-exchange with mobile Apps (note that the Apps are not developed by iMarine, rather they rely on the infrastructure to maintain and manage the data collected with and exposed through an App). Further, an Integrated Computing Environment (IceCube) will offer access to Cloud and Grid based computing resources "as a Service". An instance of such Cube will offer users access to predefined data, and algorithm that can be applied to these data.

4.4.2 The cost assessment methodology

A key aspect in defining and planning the sustainability of the partnership is the assessment of the costs and returns for potential end-users. A cost assessment is key to understand the economic viability of iMarine with regard to the sustainability of core services. Such assessment can also help identify potential revenue streams.

Allocating the true cost of a service is very challenging especially for distributed data e-infrastructures.

The iMarine e-infrastructure has three different cost components:

- **The costs of orchestrating and governing the iMarine initiative** (all the costs related to the Steering Board & the Executive Board);
- **The costs of delivering the services to the specific communities** (all the costs related to the different VOs. In the case of the baseline scenario to the marine VO);
- **The costs of IT (hardware & software) and data (data acquisition) resources necessary to deliver the services** (in the baseline scenario represented by *The D4Science processing center*, the gCube enabling software and the data acquisition costs).

It is important to note that the performed cost analysis focuses on the baseline scenario, it does not address a general cost analysis of the full D4Science infrastructure, nor the overall gCube sustainability, nor is providing a framework for e-Infrastructures.

Moreover it is important to highlight that a cost assessment tool for distributed data e-infrastructures doesn't currently exist. Therefore, it was deemed necessary to develop a new cost assessment tool for iMarine's needs.

For the D4Science *processing centre*, the cost analysis is based on the e-Fiscal[6] cost assessment tool. The e-Fiscal model is a hybrid model that builds on Full Cost Accounting (FCA) and Total Cost of Ownership (TCO) and adapts to real case constraints approximating the costs of maintaining services as their current level in the short to medium term[7]. It has been selected by iMarine because it balances ease of information collection with accurate results, it's easy to apply giving acceptable cost estimations precision and is transparent and auditable.

A completely new cost assessment model is used for the gCube enabling software and the data acquisition costs, the costs of delivering the services to the specific communities and the costs of governing the iMarine initiative.

The analysis will provide a total yearly cost of operation. The costs will be calculated on the basis of 2013 figures.

The data will be compiled and simulated according to the Baseline Business Model, and at least 1 other growth scenario to be defined during the Phase 3.

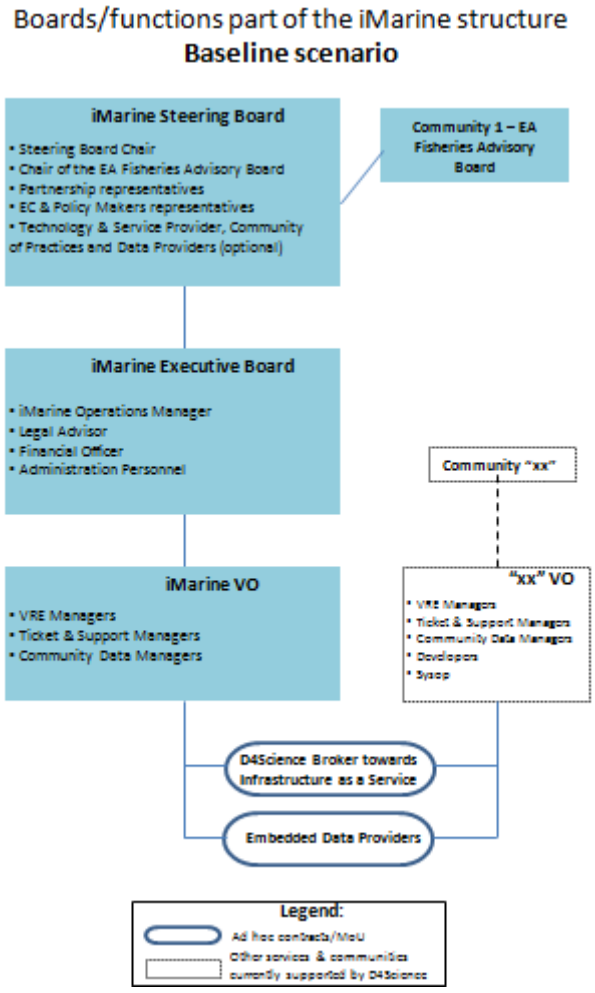
The list below summarises the procedure involved in making the cost calculation:

1. Cost calculation of the D4Science infrastructure to ensure the current iMarine services remain operational (costs to run the existing 19 VREs) using the e-Fiscal methodology
2. Cost calculation of the data acquisition process (personnel costs in the year dedicated to data collation, data maintenance, cost associated to data providers such as annual fees, costs per dump, etc.)
3. Cost calculation of the enabling software gCube (i.e. Personnel costs in the year dedicated to gCube Software Maintenance, Service monitoring , etc.)
4. Cost calculation of the iMarine Governance for the baseline scenario based on the diagram reported in picture below (i.e. Steering & Executive Board costs and iMarine VO costs including VRE managers, Community Data manager, Ticket & support managers, etc.).

[6] The e-FISCAL project analyzed the costs and cost structures of the European High-Throughput and High-Performance Computing (HTC and HPC) e-Infrastructures. These research infrastructures are facilitated by national entities participating in EGI and PRACE, and e-FISCAL compared their costs and cost structures with similar commercially leased or on-demand offerings. Understanding the overall costs of these European research services is a prerequisite in planning their long-term sustainability, e.g. by developing new business models for service provision. A quantitative analysis of the cost factors involved will help service providers and user communities to identify areas where the overall cost efficiency of ICT-enabled research can be optimized. The eFiscal study went beyond a simple "cost per core hour" comparison by analyzing qualitative differences in service between HTC and HPC e-Infrastructures and their closest commercial counterparts.

[7] It should be noted that the results should not be used to evaluate moving from in-house to commercial public clouds. Source: D2.3 Computing e-Infrastructure cost estimation and analysis – Pricing and Business models

5. Calculation of the depreciation costs (CAPEX) and of the operational costs of the D4Science processing center, gCube , data acquisition and governance of the current iMarine data e-infrastructure
6. Calculation of the breakdown cost per VRE
7. Calculation of the baseline scenario cost as the sum of the costs related only to the VREs which are part of the baseline (overall 7 VREs are part of the baseline scenario).



4.4.2.1 The costs of orchestrating and governing the iMarine initiative for the baseline scenario

In order to evaluate the cost related to the structure & processes to put in place to orchestrate and govern the iMarine initiative, the following cost categories have been identified:

- Advisory Board:
  - The Advisory Board is the entity in charge of the discussion of the main challenges and requirements within the different communities, their prioritization and their communication to the Steering Board.
  - The participation to the board is on a voluntary basis.
  - All the costs related to the **board members** are covered by the participating institutions.
- Steering Board:
  - The Steering Board is the decision making body in charge of the iMarine vision, its strategic directions and related decisions. Periodic virtual and F2F meeting will be set up.

- All the **partnership members** part of the Steering Board are strategic members that contribute in some way to the initiatives. For this reason no specific costs are allocated for them. **They contribute to the Steering Board at their expenses.**
- The **EA Fisheries Advisory Board Chair** that represents the perspectives of the communities of Practice, represent a cost for iMarine. His/her involvement and commitment is fundamental for the iMarine sustainability. The number of FTEs per year has been considered in the cost evaluation. His/her cost can be covered by iMarine or by the institution of which the Advisory Board Chair is part of.
- For what concerns the **Sponsor(s)** that will be involved in the iMarine initiative to give advices on strategic directions only at "milestones", the allocated costs are the ones related the travel & subsistence expenses to take part to 2 yearly meetings (7 representatives per meeting). These costs can be covered by iMarine or by the organizations of which the sponsors are part of.
- Costs have also been allocated for the **Steering Board Chair**: again as the role of coordinator of the board is key to guiding the full initiative an estimate of the number of yearly FTEs has been included in the costs to sustain.
- For what concerns other participants that would like to take part to the Steering Board ("strategic" technology & service providers, community of practice and data providers representatives) no costs have been considered in the baseline scenario.

- Executive Board:
  - The Executive Board is in charge of the day-by-day coordination of all the activities.
  - The **number of FTEs per year necessary to the work of the iMarine VO Operations Manager has been included** in the estimate. These costs will cover his/her effort in coordinating and supervising the day-by-day activities and make sure that the services are delivered.
  - The costs allocated with the Executive Board also include the **number of FTEs per year necessary to carry out the functions of Financial Officer, Administration Personnel and legal Advisor** (no budget for Marketing & Communication experts has been foreseen in the baseline scenario).

4.4.2.2 The costs of delivering the services to the marine community in the baseline scenario

The following cost components refer to all the costs allocated to carry out the activities related to the iMarine VO, in particular for the baseline scenario they refer to the activities to maintain the existing services operational.
Cost components:

- Number of FTEs per year for VRE managers
- Number of FTEs per year for Community Data manager
- Number of FTEs per year for Ticket & support managers

In the baseline scenario **no costs have been allocated for software developers and sysop** as they will play a role in the growth scenario when new services will be developed.

Please note that these costs have been calculated considering **ONLY the efforts necessary to sustain the 8 services defined in the whitepaper**. Please also note that these costs have been calculated as a portion of total cost of operating D4Science, **considering D4Science as the technology provider and gCube as the enabling software**: if they change also these costs need to be re-calculated.

4.4.2.3 The costs of IT (hardware & software) and data (data acquisition) resources necessary to deliver the services in the baseline scenario

The services delivered by iMarine can be built on different IT and technological service providers and different data providers. For what concerns the baseline scenario **the services will exploit the D4Science infrastructure (as IaaS) and gCube as the enabling software**. For what concerns data providers in the baseline cost estimate **ONLY the costs of the data providers necessary to deliver the 8 selected services have been considered**. These costs refer to the situation as is. The only extra cost that has been included is to address the development of new data acquisition methods in case the data provider changes its way to make data available.
In the following the cost components for the D4Science processing center, the gCube enabling technology and the data acquisition are illustrated.

Please note that also in these case costs have been calculated considering ONLY the costs of the resources necessary to sustain the 8 services defined in the whitepaper.

4.4.2.3.1 The cost assessment of the D4Science processing center

Between 2011 and 2013, the e-Fiscal project[8] analysed the costs of the current European dedicated High Throughput and High Performance Computing (HTC/HPC) e-Infrastructures for research, and compared them with the closest equivalent commercial leased or on-demand cloud offerings and evaluated the trade-off between in house solution and commercial procurement of cloud services.

Findings from e-Fiscal project found that in-house HPC/HTC e-Infrastructures are cost-effective with high utilization rates & depreciation rates with personnel ~50% of total costs and a ratio CAPEX[9]/OPEX[10]=30/70%.

Results of e-Fiscal are also in line with literature (Hawtin et al. 2012), Magellan (2011), and show relevance of economies of scale and utilization rates.

The *Figure 9* below shows the four main steps on which the e-Fiscal methodology is based on.

[8] http://efiscal.eu/
[9] Capital Expenditures (CAPEX) – incurred for future benefits (i.e. Assets acquired with a life beyond 1 year)
[10] Operating Expenses (OPEX) – incurred in the ordinary course of business (i.e. Salaries, energy expenses, overhead, etc)

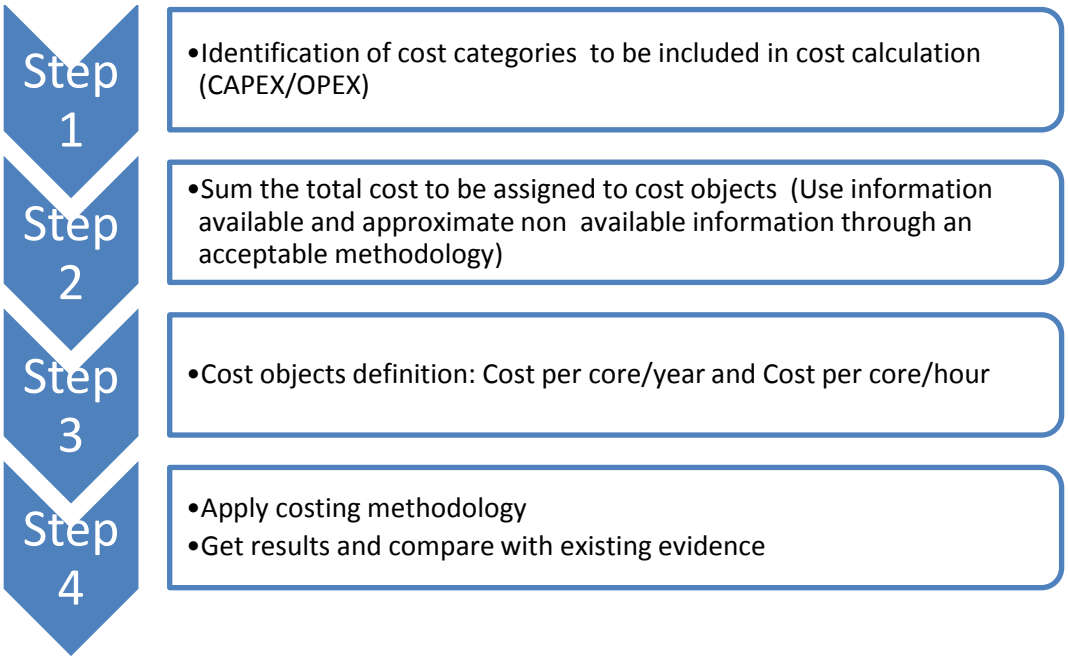


Figure 9: e-Fiscal Method

The following **cost categories** are included[11]:

1. *Computing and storage hardware costs*: This category refers to CPU cores (and corresponding boxing), storage devices (disk and tape storage facilities) and related interconnect equipment (network devices). Service support costs fall in this category.
2. Auxiliary equipment costs, that correspond to the investment in cooling devices (air or liquid cooling), UPSes, power generators, power transformers, etc.

The costs of (1) and (2) are used to simulate the physical infrastructure and they are then annualised through depreciation rates to come up with yearly CAPEX.

3. Software costs correspond to yearly costs for licensing and purchasing operating systems, middleware, support contracts, applications, 3rd party software, compilers, etc.
4. Personnel costs relate to the salaries and all extra burdens assigned on salaries of all related categories, such as administrators and operators, middleware and application developers, trainers, dissemination persons, policy makers, managers, etc.
5. Site operating costs correspond to rentals or depreciation costs of hosting premises.
6. Electricity cost refers to the power usage for the consumption of the in-house network devices like servers, routers, etc. It also includes the electricity consumed for cooling and hosting.
7. The network connectivity costs correspond to the yearly cost for having connection to the internet.
8. Other costs. In this category all costs not falling in any of the previous ones should be registered. Personnel training costs, training certifications, travelling expenses (participation to conferences costs, fees paid to the university/institute for hosting the site/centre, insurance fees, even fees for cloud services could be registered.

The costs of (3) to (8) refer to the operating cost of physical infrastructure. They constitute the yearly OPEX.

[11] Source: D2.3 Computing e-Infrastructure cost estimation and analysis – Pricing and Business models

4.4.2.3.2 The cost assessment of the enabling software gCube

In order to evaluate the cost related to the gCube enabling software and the services maintenance, the following cost categories have been identified:

1. Personnel costs in the year dedicated to gCube Software Maintenance for the 8 services of the baseline scenario;
2. Personnel costs in the year dedicated to Service monitoring (i.e. service availability 24h/7)
3. Personnel costs in the year dedicated to Ticketing & customer care assistance

All these costs refer to operating costs.

As the ticketing system is performed via a specific tool some hardware costs have been allocated. They are part of the CAPEX costs.

4.4.2.3.3 The cost assessment of the data acquisition component

In order to evaluate the cost related to the data acquisition to run the 8 selected services, the following cost categories have been identified:

1. Personnel costs in the year dedicated to data collation, data maintenance and related activities
2. Cost of software upgrade/maintenance for data acquisition per year
3. Cost associated to data providers (annual fees, costs per dump, extra data acquisition cost and personnel costs per year associated to a specific data provider).

All these costs refer to the operating cost of the data infrastructure.

4.4.3 The results of the cost assessment

Information on costs are confidential to the consortium and the EC. The cost figures of the baseline scenario are reported in the roll out 1 document.

The graph below shows the cost breakdown resulting from the cost analysis for the baseline scenario.

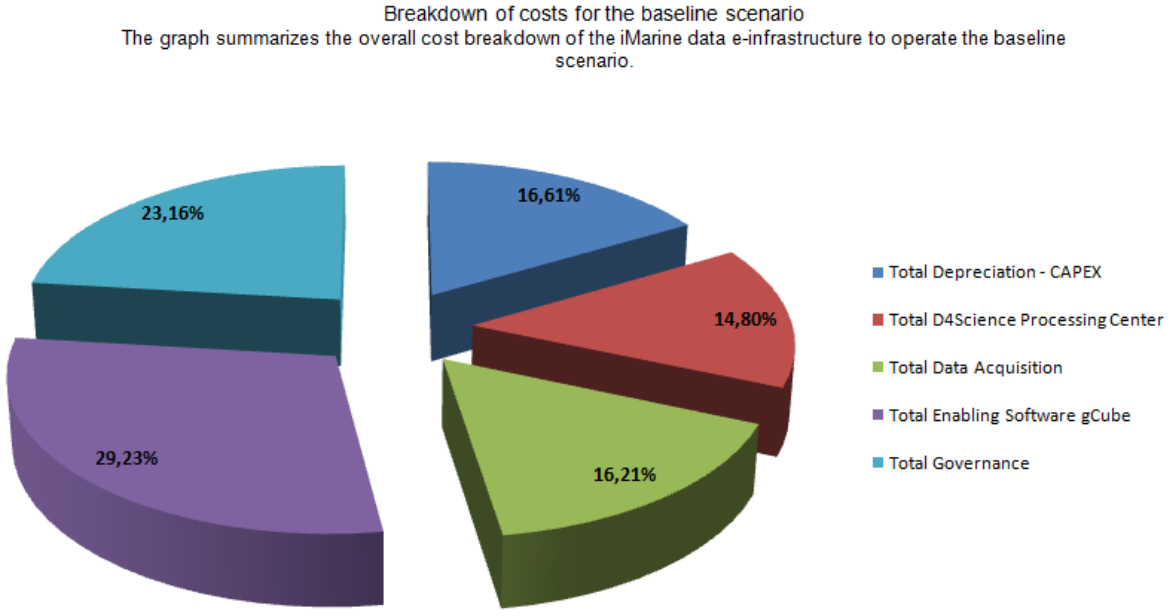


Figure 10: costs breakdown

As *Figure 10* shows, five cost components were identified. The highest of these related to enabling software gCube as the baseline scenario foresees the operation of only 7 VREs. By increasing the number of VREs, the cost component of the software decreases, as the same software can be used on more VREs. The second highest cost component is governance. The calculation is based on a relatively lean governance structure. It has been estimated that the same governance structure could serve a high number of VREs. Again, this means that by increasing the number of VRE's the cost of governance decreases.
The ratio CAPEX/OPEX for the baseline scenario is around 19%.

The cost assessment model developed to calculate the costs associated with the baseline scenario can be reused in the future to calculate the costs of the growth scenario or also to calculate the real costs when partnerships are actually established and running.

5. Next steps

The idea, the principles and the modus operandi for establishing an iMarine partnership that are presented in this White Paper explain how a large and well-coordinated Public-led community would ensure voluntary contribution of resources by institutional stakeholders and various sources of income to create, deliver and capture value.

In the resulting business model, Public institutions will be responsible for maintaining the core infrastructure and the services they have a stake in, while other partners, including private companies will provide specific functionalities and support services which will also generate income to iMarine. The benefits for the users are identified in the Business Model while ensuring that the efforts and contributions remain in balance with the value-adding to be provided.

The coming month will see the process of getting the current commitments into the further development and maintenance of the infrastructure by sharing resources on fair terms. This will initially address the Ecosystem Approach domain through the Fisheries entry point; From this "baseline", the envisioned growth scenario will be further developed, delivering complementary services to address the needs in two complementary areas: ecosystem services and environmental protection. Following this strategic path, which the iMarine stakeholders can transform into sustainable operations, an action plan and an innovative portfolio of services are set to match the sustainability endeavour and the identified market needs.

6. References

The [iMarine WS] references are not publicly available:

D4Science sustainability workshop: Action plan for exploitation and sustainability [iMarine WS]

iMB3 Survey on iMarine sustainability [iMarine WS]

iMarine e-Infrastructure for data driven decision making and research, Brussels, 14 - 15 May 2013

iMarine deliverable D3.3 EA-CoP Governance

iMarine deliverable D3.5 EA-CoP Validation

Data Access and Sharing policy - iMarine Policy and Guidelines - DRAFT [PDF] [iMarine WS]

Data Access and Sharing policy - iMarine Community best practices - DRAFT [PDF] [iMarine WS]

7. References from the public iMarine Wiki

EA CoP – D4Science Business Model Proposal: http://wiki.i-marine.eu/index.php/Ecosystem_Approach_Community_of_Practice:_D4Science_Business_model_proposal

EA CoP - Governance: http://wiki.i-marine.eu/index.php/Ecosystem_Approach_Community_of_Practice:_Governance

8. Final release references: Context and Motivation

Approach: the iMarine consortium requested the following approach and activity phases:

- *Consult extensively "selected interlocutors" (i.e., all consortium institutions through their representatives, iMarine Board members as well as selected members of the extended Board, and representatives of few strategic external initiatives) in the phased approach.*
  - *Each phase will aim at progressively refining the business model, accounting for real-life, early adoption feedback.*
  - *Each phase will also assess institutional Partners actual interest and lead to possible decision to change the list of participating institutions.*
  - *The list of contacts of members of the Consortium, iMarine Board, and the interested iMarine Board will be provided by the Steering Board. The consultant team may propose representatives of a few strategic external initiatives.*

- *Provide a facilitator role, which acts as a go between. In such a view, the iMarine partnership business model and business plan will not be created per se by the facilitator team and then proposed to the partners, but rather gathered and consolidated from the partners inputs (existing documents, interviews on expectations) with guidance and formalization by the facilitators;*
  - *When converging or complementary visions occur between partners, the facilitator role will be to use them as cornerstones of the work.*
  - *When non convergent visions occur between the partners, the facilitator shall develop arguments, rationales and examples to identify and elicit a common ground, and ensure the partners can be brought to it.*

Phase 1: "Design" Preliminary qualitative assessment of the business model type

- *Consolidate the detailed list of content for each phase, business model and plans, and documents with the iMarine Steering Board at the very start of the consultation.*
- *Review extensively the relevant documentation produced by the iMarine project.*
- *Consult with the "selected interlocutors" through interviews.*
- *Develop a terminology towards its shared adoption by participants; ensure that such terminology is clear to all.*
- *Develop fundamental principles upon which the partnership will rely:*
  - *for a public partnership model.*
  - *for sustainability dimensions: hardware, software, data, services.*
  - *for conditions governing collaboration with the private sector.*
- *Assess the partners' expectations, benefits, contributions, and the likelihood of these.*
- *Review most promising funded research, market opportunities and readiness of iMarine to serve these; and identify conditions for their servicing.*
- *Refine description of the most likely exploitation scenarios, with a focus on required functions.*
- *Document the conditions, the constraints and the consequences between establishing a legal entity (with main options) and relying on a loose partnership (e.g., based on a non-binding Memorandum of Understanding).*

Phase 1 outputs:

Draft White paper with a focus on the mission statement, and the type of business model; and elements for the baseline business plan, and the ground for a development/growth business plan. The draft White paper is a document reflecting the collation and synthesis of inputs from the Partners, highlighting the convergences and divergences to be discussed by the consortium and selected involved institutions.

It shall also include a proposal on further participants in the next phases (e.g., during the Phase 2 workshop).

Phase 2: "Debate". Complete the White paper, through organization of a workshop for discussing the Phase 1 draft White paper findings, and defining directions for phase 3

- *Prepare and facilitate an interactive Sustainability workshop involving (in principle, and as per conclusions of phase1) GA members, iMarine Board representatives, and external participants.*

- *The workshop shall be the forum to:*
  - *Discuss results of phase 1 in order to gather early feedbacks on the business model, confirm strong converging points, and strive to clarify directions where divergence is noted;*
  - *Refine the objectives, approach and activities of phase 3:*
    - *Identify various scenarios of business plan: the first scenario will be the minimum "survival" baseline enabling the current CoP to continue exploiting the infrastructure after the project; one or two other scenarios (as decided in "Debate" phase) will be growth scenarios;*
    - *Define some "pilot partnerships" involving voluntary "pilot partners' testing aspects of the business model that need being refined/assessed so to better define the identified scenarios; these pilots might e.g. imply the actual use of the iMarine infrastructure by a Partner with VRE in exploitation mode, or a SME which provide some services to the market, with or without an identified initial customer;*
    - *Lead "Pilot partners" to focus on aspects of the business model proposals that need to be refined or assessed.*

- *After the workshop: Define the functions necessary to implement the business model under the "baseline" and under the "growth" scenarios. The functions required for the baseline scenario will be described precisely.*

Phase 2 output:
The consultants shall deliver the White Paper, including the mission statement, the selection of the type of business model (based on readability and expressivity criteria), the baseline business model (including precise description of required functions) and plan, and the ground for development/growth business plan accounting from the outcomes of the workshop.

The consultants shall assist the iMarine SB to take decisions to proceed with Phase 3 outlining directions, objectives, approach, and activities in order to finalize the documents specified in Phase 3 output. In particular, the consultants shall provide information for the SB to inform on the future type of legal status of the Consortium.

This White Paper or a simplified version thereof removing possible confidential aspects is meant to be a project deliverable as per iMarine Project Review2 request.

Phase 3: "Roll-out". Finalize the complete document on the business model, mission statement, baseline business model & plan, and development/growth business plan

- *Establish a methodology to assess the costs related to the delivery of the required functions under the various scenarios, with priority to the baseline scenario.*
- *Assist partners in compiling costs, and collate those.*
- *Proceed with cost assessment of the operation of the iMarine infrastructure under the baseline scenario; describe identified resources meant to cover these costs, and identify gaps.*
- *Prepare the ground for a development/growth business plan under 1 or 2 other scenario(s) beyond the baseline scenario, that implements Phase 3 Document 2 deliverable.*
- *Deliver three case studies aiming at assessing the cost/income/benefit of the iMarine platform servicing.*

9. Final release references: iMarine Sustainability Questionnaire

At the end of February 2014 the "iMarine Questionnaire" was created and circulated to a selected list of iMarine partners and board members. The interviewees list has been validated by the iMarine Steering Board. The aim of the questionnaire was to gather information on the current perception of the iMarine services, on the vision for the future and on the role they could play. A second consultation phase is foreseen after the first collection of feedback at the beginning of May 2014 in which all the consortium partners and board members will be involved.

9.1. Questionnaire Template

The iMarine[12] initiative is studying a number of avenues for the future sustainability of the infrastructure, its services and applications. This includes the exploitation of the e-Infrastructure through a public partnership centred model.

iMarine builds on the services offered by the D4Science infrastructure (www.d4science.org) with gCube (www.gcube-system.org) as the key enabling technology. Over the years this has evolved to become an e-Infrastructure based on well-established terms of use, shared data services and resources and community collaborations. **This e-infrastructure facilitates open access and the sharing of a multitude of data, collaborative analysis, processing and data mining, as well as publication and dissemination of knowledge** for on-line communities dealing with multidisciplinary, scientific and societal challenges.

The e-infrastructure was developed with public sector resources but with a clear vision that the infrastructure and its products and services have market potential. The purpose of the questionnaire was to identify what exploitation model can capture this market potential.

The answers to this questionnaire should represent as much as possible your institution's / organisation's point-of-view. If the institutional position is not yet well-defined, please reflect this in your answers.

1. What is your organisation's vision for the sustainability of the iMarine infrastructure and its services?
2. How could your organization contribute to the sustainability of the iMarine platform?
3. Which of the 9 business opportunities (BOs) identified below[i] are most relevant for your organization? Please select the three most important.

   Business Opportunities:
   - BO1: Support implementation of FLUX related data workflow.
   - BO2: Support access to taxonomic, biodiversity, and environmental databases and related analytical and environmental enrichment services.
   - BO3: Support to generating a EA Linked Open Data network.
   - BO4: Exploit collaborative reporting tools, and content management support.

[12] The iMarine hybrid data e-infrastructure is the result of several funded initiatives started in 2003 (DILIGENT (FP6-2003-IST-2), D4Science (FP7-INFRA-2007-1.2.2), D4Science-II (FP7-INFRA-2008-1.2.2), VENUS-C (FP7-INFRA-2010-1.2.1), and EUBrazilOpenBio (FP7-ICT-2011-EU-Brazil)).

- BO5: Exploit data quality improvement services.
- BO6: Collaborative research.
- BO7: Strengthening sustainability of existing infrastructures by pooling hardware, data, software, and human expertise resources.
- BO8: Provide facilities to other relevant infrastructures, e.g. ESFRI.
- BO9: On-demand provision of facilities to scientists of the public and private sectors.

4. In your view, which iMarine services[13] or specific VREs[14] are most marketable & why? Are you aware of similar solutions for the iMarine target community/end-users? If so, please provide a link.
5. Which iMarine services or VRE directly align with your organisation's goals? Can you explain how?
6. What additional services & VREs could your organization need from iMarine?
7. Are the services identified at point 6 fundamental for your organization? Do you expect these services can generate a revenue-stream in the future?
8. Given the current services and the iMarine capabilities, has your organisation already identified end users or potential customers? If so, please give some brief information.
9. What, in your opinion, is the iMarine unique selling point and why?
10. What Business Model would you recommend iMarine to deliver?
11. Other comments.

9.2. Questionnaire Results

Overall 13 questionnaires have been compiled from 6 partner organizations (CERN, CNR, Engineering, FAO, FIN/WorldFish, UNESCO) and 6 independent consultants. Below the breakdown of interviewees per organization:

Organisations	# of persons
CERN	1
CNR	1
Engineering	1
FAO	2
FIN/WorldFish	1
UNESCO	1
Independent Consultants	6

Table 2: Respondents breakdown.

Question 1: What is your organization's vision for the sustainability of the iMarine infrastructure and its services?

[13] http://wiki.i-marine.eu/index.php/Ecosystem_Approach_Community_of_Practice:_D4Science_Business_model_proposal#Inputs_to_Market_analysis_for_Board_3_consideration

[14] http://www.i-marine.eu/VREs & https://portal.i-marine.d4science.org

General issues for sustainability

The iMarine infrastructure is the outcome of a long development process, which started in FP6. Sustainability challenges are certainly not restricted to iMarine but apply more broadly to EC programmes, e.g. the FIRE facilities and Software & Services, Cloud, where there are no clear definitions of how to best achieve sustainability. Issues include complexity with respect to the number of partners involved; maturity (closer to market but services are not yet comparable with commercial competitors); projects have no legal status with no single partner taking responsibility; sustainability is limited to "best-effort" approaches based on open access, but often over a limited period of time. Some pioneering projects are now beginning to explore federation and re-branding around core services to ensure sustainability.

The questionnaires highlighted several general issues for iMarine sustainability, including negative views that are helpful in identifying any weaknesses.

"The development phase of iMarine has been long (10 years?) and expensive. Normally the operational phase should be less expensive, but I don't think iMarine has reached that point that it fully entered the operational phase. It seems to have become a big, complicated and expensive animal to feed and to take care of. I hope I am wrong, but that is my impression".

"Hosting and maintaining an infrastructure like iMarine by, and relying on, multiple organizations is difficult to maintain. Especially if funding from the EC will stop and there is no continuous reliable source of core funding anymore. The relationship between the different organizations needs to be very strong and it will require strong commitments and agreements on the operational and business side. It will need a central operations office."

"In our opinion the iMarine experience can demonstrate that there's the opportunity to move toward the commercial phase. However, the sustainability with only one community (the marine one) is not considered sufficient. iMarine needs to be the first step for a platform that will embrace all data sources thanks to bilateral agreements and with a community as wide as possible. I would talk about the **gCUBE platform** (or any other name) rather than the iMarine platform."

"My vision on the sustainability of the infrastructure: Basic sustainability should be part of institutional or national funding. New innovations should be paid by EC projects or come from major stakeholders (ICES, OBIS, etc.)."

Domain-specific – niche market

A number of the questionnaire respondents perceive iMarine sustainability in terms of a domain-specific infrastructure, and therefore as a niche market. It is important to note that this niche market could potentially be large if it targeted the large biology community (e.g. marine biologists, fisheries biologists) or large-scale international initiatives.

"The effort spent in the context of the project to create a solid infrastructure and a set of services that can be exploited by a significant number of stakeholders is half way to being achieved. A number of key components have been developed and are already used by member of the User communities. However, some components still have to be delivered /reach maturity. In addition, the level of engagement outside the direct members of the project has not increased as expected since the beginning of the project (iMarine products are for **niche markets**). Given this, my personal vision is towards participation in Horizon 2020 funding scheme, in order to involve new communities and stakeholders in a future project

continuation. The focus has to be given to strengthen the parts of the iMarine work that have proven to be more appetizing for the market."

"The role for the infrastructure could be:

1. Supporting local organizations with limited resources. Local indicates that also small department of big organizations or institutions can also be beneficiaries, with the aim of extending links beyond large, global organizations.
2. Supporting large organizations with data harmonization needs (typically, small organizations do not have harmonization needs).
3. Assist biologists in data management. **Biologists** indicate a wide group of scientists including marine biologists, fisheries biologists.
4. Assist statisticians in data flow management.

Each of these will contribute to the exploitation with expertise (people can bring expertise and get resources in exchange) or rent services (an idea could be to rent a VRE for a yearly fee based on a pre-defined cost) though a central group, responsible for the provision of a suitable environment. The central group is the coordinator entity necessary to manage access to the infrastructure. This entity could be one of the iMarine partner but also a company or organization acting as an independent group."

"As to relevance, commercial cloud infrastructures offer domain-agnostic technological platforms to address provisioning issues for enterprises and their markets. In contrast, iMarine is a **domain-specific**, **data-oriented**, and **interactive infrastructure**, i.e. adds domain-oriented services, datasets, and portals that are immediately relevant to the users that my organization hosts or more broadly represents. As for return on investment, much of the technical development that currently takes place in the organization can or could be conveniently addressed by or within the infrastructure. Similar reasoning can be applied to provisioning hardware resources, which is currently an in-house cost."

"The generic vision is for a cross-agency data infrastructure that is sector specific, with the D4Science Platform-as-a-Service (PAAS) offering support to existing organizations and initiatives that have data management needs (data storage, description, discovery, dissemination, processing) on issues related to the sustainable use of aquatic resources and their conservation. Various Communities of Practices (CoPs) cluster themselves in governance bodies according to areas of common interest, e.g. the current EA-CoP. << There is a high demand for data management solutions to effectively support sustainable use of aquatic resources, which no institution in isolation is able to satisfy alone. In the context of its recently launched **Global Blue Growth** (BG) initiative, FAO responds to this societal challenge by promoting through iMarine and its underlying D4Science data infrastructure the development of a Global partnership/alliance aimed at forging a Global Blue Growth data Framework (GBGF) for aquatic living resources and their use offering access to a wide array of relevant data, web-services, data processing tools, and related expertise, geared to address Blue Growth policy challenges.>> This GBGF would potentially cover: EAF through support to regional stock assessment working groups and fishery management plans, Ecosystem Approach to Aquaculture (EAA), fight against IUU by delivering data -and web-services- including through a global standard for fisheries operations data (FLUX), Contribution of the fishery sector to the state of the environment (LMEs project), contribution of the fishery sector to food security and nutrition (FSN)".

"The possibility to consolidate the existing services (i.e. StatsCube) to provide solutions at Regional and National levels for **fisheries managements**, using Tabular Data Manager to

load and publish Statistics, Semantic services to exploit information available from different sources to enrich a regional or a national Fisheries Information System (FIS), even to develop it, if the integration of these components can be achieved soon with user friendly workflows."

ICT infrastructure & capacity building – potential large market

A number of the questionnaire respondents see sustainability focusing on capacity building to capture a large market of IT consumers, including developing countries. Future directions also point to federation.

"The interest in sustaining the iMarine initiative might arise from multiple perspectives. As a matter of fact iMarine offers:

- An innovative ICT result that can be transferred to third-parties.
- A platform for supporting the work of scientists operating in marine related domains.
- An e-infrastructure that can be used to experiment innovative IT services and algorithms.
- A platform for training new scientists.
- An ICT result that can contribute to addressing relevant needs of public and private organizations.
- An instrument for promoting collaboration with other institutes and countries.
- An e-infrastructure that can support some of the ESFRI European Research Infrastructures (e.g.LifeWatch).

"My organization collects data on everything involved in the **food production chain**. The challenges on data exchange are initially tackled by multi-lateral agreements among member countries, converted into policies of multi-parties collaboration, finally the policy implementation include development of IT capacities in the field where data are collected. iMarine role (with infrastructure or services) could support the development of IT capacities, directly or by delegation. Direct support implies that resources of the iMarine consortium are involved in projects dedicated to developing and building IT capacities where requested. When a direct-support-model could not be evoked, a delegation of services, through affiliated third-party businesses (e.g. SMEs), could insure iMarine sustainability beyond its own outreach and scale of business."

"My opinion is that iMarine sustainability relies on collaborative data analysis and collection. The iMarine sustainability can increase by requesting users to 'give back' to the infrastructure their knowledge and data in return for all those services that iMarine can provide. Proposing iMarine as a platform to support and enhance capacity building in developing countries could also be a plus with respect to the sustainability of the initiative. I'm not referring to a specific service but more on the infrastructure level (nodes, etc.), from infrastructure to work spaces."

"With the iMarine platform and its underlying D4Science "cloud based" infrastructure, there is an opportunity for pooling hardware, software and data resources across-agencies; there is also an opportunity for outsourcing services to a publicly controlled cloud platform."

"I see a huge potential of this infrastructure and services when, once again, these services are better available for implementation; the potential is the different calls for tenders funded by different organizations (EU, World Bank, GIZ etc.) to set up Fisheries Information Systems at national/regional levels (the regional level is the trend now). If a customizable solution is available, with services that my technical partners in the private sector can use and reuse and tailor, then we would have a wonderful platform to develop such functionalities, providing to

iMarine a long-term sustainability through maintenance agreements (Service Agreement). But to achieve that, the platform must be opened to a community with clear rules for updates and developments of new modules. This will be only possible if an iMarine open source community is built with clear rules and software policies to use the components and more important, fix bugs, improve functionalities and add new ones to gCube."

General comments

"The public partnership that is the main vehicle proposed by the business model seems to me the only way to sustain the infrastructure. Another condition is that scientific papers are produced by the use of the infrastructure."

"No clear organisation's vision"

Question 2: How could your organization contribute to the sustainability of the iMarine platform?

The following opportunities and propositions were the most frequent in the questionnaire responses:

Marketing opportunities

- Giving the network of contacts, disseminating, promoting, engaging new user communities, therefore playing a facilitator role.
- Potential consumers.

Resources, maintenance and software

- Committing resources to support the technical team for VRE creation and the e-infrastructure maintenance and to continue the usage of the current services (i.e. Aquamaps by FIN).
- Feeding regular high quality data for research infrastructures (i.e. OBIS data provision).
- Providing computing resources, providing domain expertise, contributing to the development & evolution of the iMarine software components.

Organizational structure

- Participating to the iMarine governance

Sustainability support

- Providing dedicated funding.

Future competitive calls

- Participating to a new H2020 project.

Question 3: Which of the 9 business opportunities (BOs) identified below are most relevant for your organization? Please select the three most important.

The table below reports the business opportunities selected in order of priority. B02 was identified as the most relevant Business Opportunity. With regard to question 1, business opportunities most relevant to domain specific areas are: BO2, BO4, BO5, BO1, BO3; and to ICT infrastructure/capacity: BO8, BO9, BO7.

Business Opportunities	Additional Comments	Number of participants who selected it
BO2: Support to access to taxonomic, biodiversity, and environmental databases and related analytical and environmental enrichment services.		8
BO4: Exploit collaborative reporting tools, and content management support.	This has been identified as one of the most common need for FAO.	7
BO8: Provide facilities to other relevant infrastructures, e.g. ESFRI.	Relevant infrastructures identified are: EMODNET, Biovel, LifeWatch.	7
BO9: On-demand provision of facilities to scientists of the public and private sectors.	The issue here is to understand if scientist would pay for the service.	6
BO6: Collaborative research.	EC or Member States could provide funds.	6
BO5: Exploit data quality improvement services.		5
BO7: Strengthening sustainability of existing infrastructures by pooling hardware, data, software, and human expertise resources		5
BO1: Support to implementation of FLUX related data workflow.	Vessels monitoring has been identified as one of the main challenge: it is difficult to maintain and generate these reports; there are different fishing regulations across the EU A possible iMarine service could be to provide a VRE to "fluxify" their data, thus facilitating the submission of required data to the EC. This poses several challenges but constitutes a really good business opportunity.	4
B03 Support to generating a EA Linked Open Data network for connecting existing data resources under thematic portals (e.g. FIRMS, SmartFish).		3

Question 4: In your view, which iMarine services[15] or specific VREs[16] are most marketable & why? Are you aware of similar solutions for the iMarine target community/end-users? If so, please provide a link.

Table below shows the services that have been highlighted by the participants to the survey:

iMarine services	Reasons	# answers
StatsCube	The capacity to harmonize various information systems is one of the most frequently mentioned requirements. In this context, the management of observational data includes statistics	4
ConnectCube and semantic services	Semantic Annotation web-services & associated generic web-components	4
Time Series and the new Tabular Data Manager for statistical time series	Nothing similar on the market – unique positioning. It has been already exploited in the context of other EU projects (EUBrazilOpenBio and ENVRI) and it offers the possibility to be further integrated with new technology and data providers	4
Collaboration environments / workspace	Despite their recognized importance none of the existing research / e- infrastructures provide them as a service to their community of practice.	3
None of them	I don't see any VRE as marketable in the meaning of gaining money through its use. If marketable means that they will attract users, and public funds, the fisheries VRE should be promoted because solving a number of issues for the fisheries community.	1
gCube platform as a whole		1
Services that enable controlled data exchange, collaborative data processing, and governed by custom workflows.		1
BiOnym		1
The VRE concept	The notion of VRE which enables scientific collaboration, i.e. a sort of Wiki for science, has considerable potential in FAO's position. We can acknowledge a lot of situations where demand exists for this kind of facility, even though there is still a need to convince by demonstrating practical implementation and easy usability (such as friendly user interface, cultural issues, etc).	1
GeosCube		1
Scalable Data Mining	Nothing similar on the market	1
Reporting/Content Management		1
Computational resources		1
Hosting		1
BiolCube facilities	The services are highly appreciated by the biodiversity scientific community especially when they are able to	1

[15] iMarine services can be structured into three main areas: **e-Infrastructure Capacity services** (Access to a broad range of computational, storage and international data resources http://www.i-marine.eu/e-InfrastructureCapacity); **Application Bundles** (Applications which can be clustered in four main thematic domains and dynamically combined to build Virtual Research Environments (VREs) http://www.i-marine.eu/ApplicationBundles & https://portal.i-marine.d4science.org); **Data heterogeneity management services** (http://www.i-marine.eu/DataManagement).

[16] http://www.i-marine.eu/VREs & https://portal.i-marine.d4science.org.

	overcome computational limitations.	
data management and dissemination	They fulfil goals which are shared by many public organizations and private companies. Dissemination: centralised repository with data that has been evaluated by scientists so people have access to relevant data without re-inventing the wheel. For the components, we need to consider possible licences – opportunity to make source codes reusable.	1

Table below reports the solutions that have been quoted as similar to the ones provided by iMarine:

Solutions similar to iMarine
FAO / CountrySTAT
UNICEF / DevInfo
Prognoz (Selected by the African Bank of Development to publish all the Global Strategy indicators in Africa)
The VRE on discovering species data are quite similar to the BioVeL Taxonomic Refinement workflow (http://beta.biovel.eu/). The VRE on aquamaps share some resembles with the BioVeL STIFT tool. **BioVeL is an EGI community.project (https://www.egi.eu/community/projects/biovel.html).**

Question 5: Which iMarine services or VRE directly align with your organisation's goals? Can you explain how?

iMarine services	**# answers**
Statistical manager & StatsCube in particular R capacities.	5
Species distribution modelling	1
EM (Ecological Modelling)	2
Kernel occurrence density	1
Trendylyzer	1
Scalable Data Mining	1
BiodiversityLab	4
Taxonomic data matching	1
Time Series, ICIS & Tabular Data Managers, Tabular Data Management/ Tabular Data Processing	3
Code List Management / Code List discovery	1
Documents Workflow	1
Fact sheet management	1
FishFinderVRE	1
VME-DB	2
FCPPS	1
Services that enable controlled data exchange, collaborative data processing, and governed by custom workflows.	1
Shared Workspace	2
Support the work of researchers	1
Chimaera	1

Geospatial Data Discovery / Geospatial Data Processing	1

Question 6: What additional services & VREs could your organization need from iMarine?

Answers are in order of priority

- **Geo-Visualization service** (services that allow us to build GIS map that FAO statisticians can use)
- **Advanced Tabular Data manager** with map visualization capacity (connection to Geo-Visualization service), access to data processings
- **A catalogue of services with related costs indicated** (e.g. for validation services; names, locations).
- **Unique public data catalogue** that clusters multiple scattered data sources that can be made available to other scientists
- **Code lists and fishing vessel data management and dissemination**
- **Better integration with existing projects / frameworks** (EMODNET)
- Beyond the social features of the portal, iMarine should prepare a solid ground **to analyze the relationships, explicit or rising as identified pattern, among the final users of its services**. The communities involved are sometimes complementary, or orthogonal in their daily business. If iMarine could support discovery of potential partnership based on the activities carried out on the infrastructure, this would be a secondary effect of great benefit, and additional motivation to rely on it. This aspect will be really interesting to facilitate the e-infrastructure uptake.
- **A Legacy applications deployment tool to make easier & faster the integration of legacy applications**
- The infrastructure is still lacking services for **master data management**.
- Distributed management of **Linked Open Data**
- **Dynamic fact sheets management**
- **Integrate socio-economic data and tools.**

Question 7: Are the services identified at point 6 fundamental for your organization? Do you expect these services can generate a revenue-stream in the future?

Most of the respondents think that the services are relevant for their organisations but some of them are not able to identify the revenue streams.

Question 8: Given the current services and the iMarine capabilities, has your organization already identified end users or potential customers? If so, please give some brief information.

Potential End Users	Services that they can use
ABNJ Deep Seas project partners	GeoCube & BiolCube

ABNJ Tuna project partners	StatsCube
Data managers/Statisticians, TBTI	data curation of timeseries, & apply processing algorithms
DG-MARE, Eurostat, ICES	Code Lists management services
FAO/FIPS, RFBs involved in CWP, Eurostat	ICIS
FAO/FIR in partnership with South American institutions	FishFinderVRE, Global Tuna Atlas
FIN is indeed interested in the Biodiversity research VRE primarily, but also R.	
LifeWatch	D4Science & gCube
Marine biologists	BiOnym
NEAFC and ICES, RFMOs	VTI and secured/confidential access to and processing of VMS data
RFMOs & FAO/FI data managers	VME-DB
SmartFish and IOC Indian Ocean Commission (IOC), SWIOFC and KMFRI	Chimaere
WorldFish	interested by the Climate Change studies

Question9: What, in your opinion, is the iMarine unique selling point and why?

- A key differentiator of iMarine is that it is domain specific (thematically focused) rather than a generic approach, Strong focus on the marine environment. Participation of major (marine) stakeholders within this field.
- A key benefit of iMarine is that there is no need to invest in hardware and software as they are already part of the infrastructure. iMarine has computational power, it has already a strong infrastructure in place, so it does not need to start from scratch.
- An efficient platform to support a task force of scientists collaborating on disposable research environment. The iMarine VRE concept and social facilities have proven to be a good selling point. Other initiatives have followed the same approach (http://www.marinexplore.org/) and they are becoming popular. The 2 key success aspects are that they are online available and social.
- Adequacy between the solution proposed and the users' needs, and its costs.
- The variety of basic services it offers that largely facilitate exploitation of data and computing resources.
- The variety of data type supported: documents and geospatial, statistical, semantic and biodiversity data.
- The hybrid nature that enables to exploit several technologies, infrastructure and services provided also by third-party providers.
- The openness of the supported frameworks which facilitates their dynamic enrichment also by users.
- Exploiting strong partners, it could federate the fisheries regional and national bodies.
- The ability to give access to heterogeneous and distributed data sources and seamlessly allow the development (and execution) of process using those data.
- For national organizations iMarine can provide tools at institution level to generate statistics; tools to exploit statistics or information coming from different organizations.

Question 10: What Business Model would you recommend iMarine to deliver?

"Public partnership." "a business model focused on the public partnership model, which would allow free exchange of service usage with additional data and knowledge or some 'pay per use' billing system for non-public users (e.g. private companies) that can't - or won't - give back such assets to the initiative in return for the services used"

"A public partnership sustaining a Global Data Framework on a "scope to be agreed upon" (e.g. such scope could be Ecosystem Approach, or Blue Growth, etc…)

Aspiring to be a 'customer driven' framework, the Global Data Framework is to offer support to existing organizations and initiatives with data management needs, including data-driven scientific collaborations. The focus is on Open Data, complete solutions, improvement of quality, and a long-term vision includes data-preservation.

The solution cannot be a monolithic, one-size-fits-all product, but rather proposes to integrate and/or network existing products from different providers as part of a consistent suite of approaches, methods and tools across the data value-adding chain. In order to leverage approaches, expertise and related technology solutions, the framework includes a governance and management model for networked solutions, with data access and sharing policies constituting a cornerstone explicitly describing the role of data custodian, and best practices stressing the central role of Open Data standards and exchange protocols.

The advantages of bringing existing tools to an infrastructure governed under a Global Partnership are manifold: reduced operational and development costs, standards based data storage, powerful processing facilities, and a dedicated expertise for support. The business model includes a robust community led governance model, and partnership with the private sector.

The Community Governing Board is driven by a core set of institutional partners who form a unique alliance representing together global, authoritative and trustable data management components of the "scope to be agreed upon", and includes institutions in the ICT field promoting innovation. This community might organize itself in various clusters, depending on areas of common interest. Thanks to active outreach and coordination of the core members, the Board is extended by a broader range of institutions and stakeholders who are flexibly associated to the work and orientations provided by the Board for delivery of services and development of data and software policies aimed at serving the global partnership.

Core Members expertise in coordinating, collaborating and operating people-platforms in various regions will be key to realizing the technology potential. This effort will naturally be part of existing strategic plans which concerned organizations conduct in their respective field of action to support the various components of the "scope to be agreed upon".

Through institutional processes (technical consultations, workshops, resource mobilization) supporting development of these strategic plans or their implementation, these organizations identify win-win situation (e.g. to support regional working groups or collection efforts), funding sources, and proceed incrementally aligning with other efforts. Communities' workshops can discuss priorities, resource mobilization, and implementation steps. Their output is key to any physical implementation as part of GBGF, and the Board's role will be to assess recurrence of needs and most pressing generic technological capacities or data policies, and technical and financial feasibility and viability of specific applications requested by the Community.

The business model caters for partnership with the private sector, through MoUs defining rights and obligations. The private sector:

- brings the required flexibility to respond to the demand and to offer the broad range of functions and expertise required;

- develops its own business building on available software solutions and data products – these data products might be commercialized under certain conditions including a certain level of value-addition
- pays fees to the D4Science/iMarine consortium on the basis on the income generated by exploiting the services and data

The components of such business model and the related business plan must be very carefully assessed, and would deserve a full-fledged project supported by EUH2020"

"It needs to link with current European research infrastructure projects like LifeWatch and get government support. LifeWatch represents a really important client as it is funded by the member states but lacks an e-infrastructure on which to rely on, as explained above. I do not believe in a pure commercial market business model for iMarine. The services it offers will never reach a big market. The target audience is scientists. I doubt iMarine will get enough revenue from scientists to sustain it. There need to be an institutional commitment to host and maintain the infrastructure. They need to be convinced that they will be benefiting from the capacities that it turns out to be profitable for them, so they want to invest in its future."

"iMarine should go towards a funding support in the context of the Horizon 2020 framework trying to include in the consortium members of others infra (e.g. ESFRI)"

"There are different products behind it. The business model can be different for each of them. Do we mean the D4Science infrastructure able to support different CoPs? Do we mean gCube or its bundles that can be exploited to build different infrastructures or to support specific application needs? Do we mean the e-infrastructure supporting the current iMarine CoP?"

"It is D4Science, so aim at 4; 4 months to delivery, 4 key users, 4 key services in a VRE, 4 organization collaborating. If < 4, a local solution is probably better, if > 4, choose another business model (i.e. not based on exploitation, but on development). The envisaged model is oriented towards a consultancy model: it foresees the capability to react to the user needs in a quite short timeframe like it has been done for VME-DB: nothing there at the start, assets in infrastructure, use case support, repository of software and adjust it to the use case. Small team of 4-5 developers can put it together. (business model is one thing, the infrastructure is another). "

"iMarine as a service provider animating a community contributing to the development of the framework, which in return gets funds from the project using the framework (either by being part of the consortium developing the needed FIS or by a line in the proposal budget to support iMarine infrastructure, kind of license paid once). Then once the framework is well established, it can be expanded to other domains such as agriculture."

Question 11: Other comments

These have been collated under question 1.

10. Final release references: iMarine data platform for collaborations workshop Questionnaire

Results of the Workshop questionnaire[17]:

On 7th March 2014 over 50 managers, policy-makers and scientists from the fisheries and biodiversity domains and from 17 countries gathered in Rome to explore potential roles in the iMarine partnership model to sustain collaborative e-Science in the field of fisheries. On this occasion a questionnaire was distributed in order to collect feedback from the participants.

10.1. Questionnaire Template

Name:
Surname:

1. How does your work and/or your services relate to iMarine?

   I am:
   - Resource Provider
   - Technology/Software Provider
   - Data Provider
   - Current or potential End-User
   - Policy or Scientific Advisor
   - Other

2. According to your knowledge and on the basis of what you have learnt today, what are the main assets of iMarine that you consider critical to sustain?
   - Advanced computational capacity
   - Supporting flows of quality controlled data
   - Capability to rapidly implement customer-specific requirements (under supply)
   - Infrastructure under central governance of public organizations

3. What in your opinion could be the barriers for the uptake of an e-infrastructure like iMarine?
   - Cultural/economical barriers
   - Lack of partnership leaders and/or champions
   - Emergence of other market leaders and/or champions
   - Lack of revenue streams for some services, e.g. Open Data/Data sharing
   - Lack of IT skills

4. What in your opinion could be the main drivers for the uptake of the iMarine e-Infrastructure?

[17] Annex 1 includes the questionnaire and the list of interviewed people.

- Big data management needs
- Model and Processors hosting for compute intensive tasks
- Data transformation services that deliver standard format outputs
- Data Processing Services

5. How could your organization contribute to the sustainability of the iMarine platform?
   - Providing data
   - Providing resources
   - Providing consultancy/domain expertise
   - Providing funds
   - Adopting existing iMarine solutions
   - If yes which one are you referring to?
   - Adopting iMarine solutions customized to the need of my organization.
   - If yes which one are you referring to?

10.2. Questionnaire Results

The questionnaire was completed by 19 participants, mostly data providers and potential users, as shown in the figure below. Figure 9 reports the answers given by interviewees when asked how their work can relate to iMarine. From the responses the multiple roles that data providers can play in the iMarine clearly emerge.

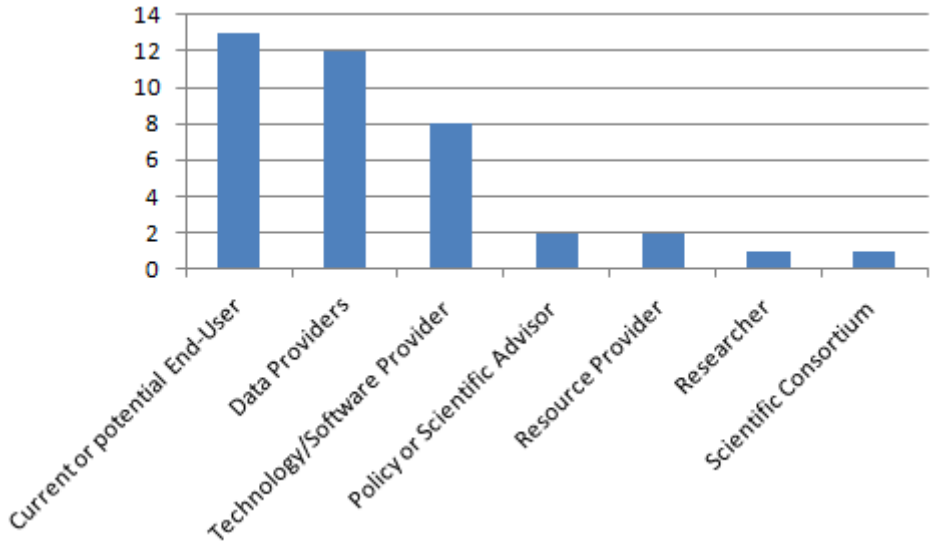


Figure 11: Annex 2 Question 1 - How does your work / services relate to iMarine?

The high number of **data providers** who have shown interest in the event is important, confirming their central role for the future sustainability of iMarine, as well as their recognition also as Potential End Users.

In response to the question 2:"According to your knowledge and on the basis of what you have learnt today, what are the main assets of iMarine that you consider critical to sustain?" The answers reflect a quite distributed perception of the added value of iMarine with a focus on one of the main expectations raised by the audience: the capability of iMarine to satisfy customer-specific requirements on a short-term horizon, mainly in relation to iMarine as domain specific.

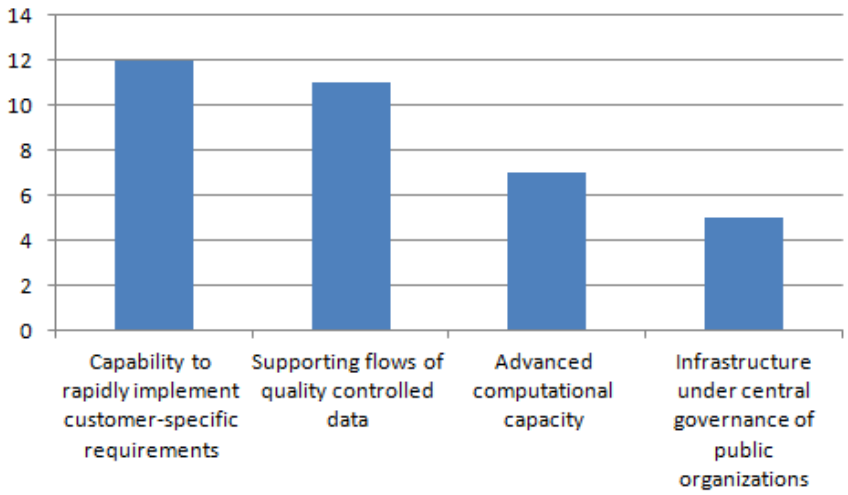


Figure 12: Annex 2 Question 2: According to your knowledge and what you have learnt today, what are the main assets of iMarine that you consider critical to sustain?

With regard to Question 3: What in your opinion could be the barriers for the uptake of an e-Infrastructure like iMarine?, It emerges that interviewees (11 people selected this option) have difficulty in understanding where the revenue streams for the services linked to open data and open access would come from and therefore perceive this as a barrier to uptake. This may also be due to the relatively new concept of services creation based on open data, including commercially viable services.

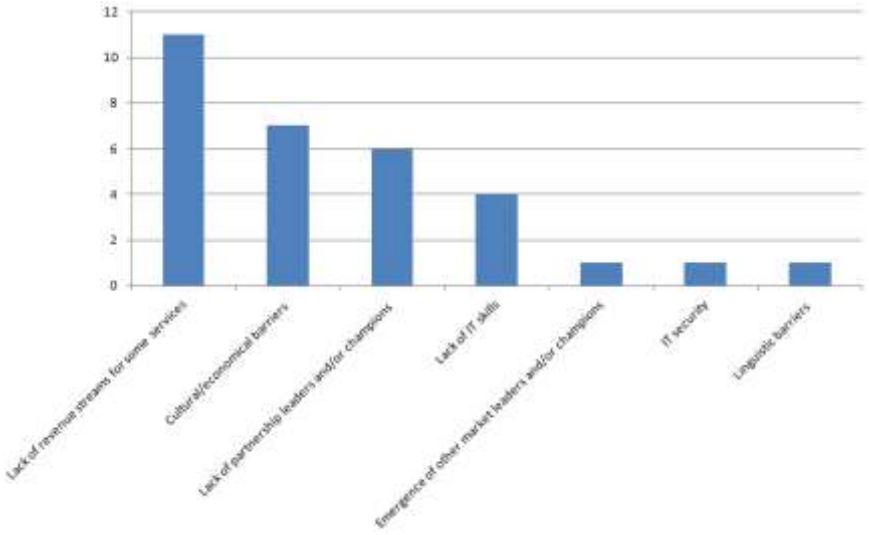


Figure 13: Annex 2 Question 3: What in your opinion could be the barriers for the uptake of an e-Infrastructure like iMarine?

The strong presence of data providers is also noticeable in the answers received in relation to question 4: What could be the main drivers for the uptake of the iMarine e-Infrastructure?. 12 people highlighted **big data management** needs as a top driver.

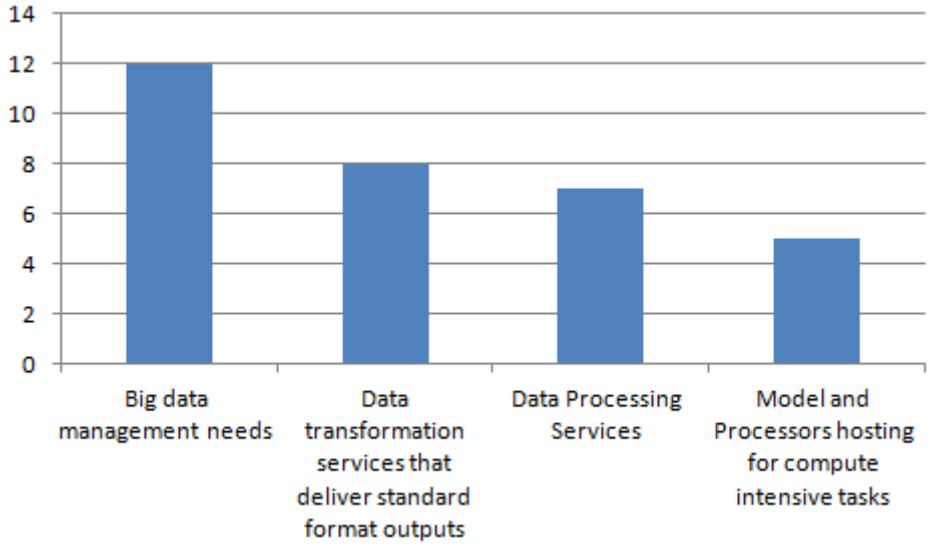


Figure 14: Annex 2 Question 4: What could be the main drivers for the uptake of the iMarine e-Infrastructure?

Finally the interviewees were asked how their organization can contribute to the sustainability of the iMarine platform. Below the results

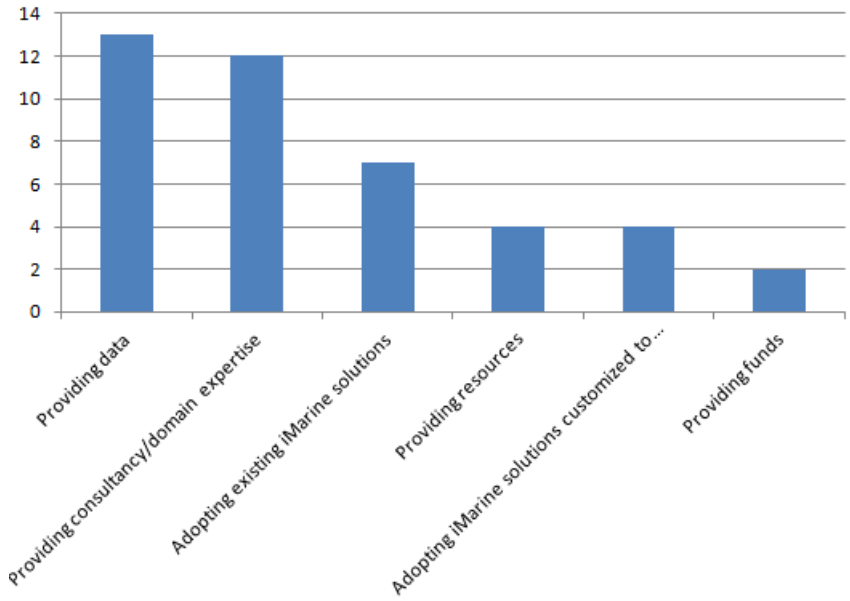


Figure 15: Annex 2 Question 5: How could your organization contribute to the sustainability of the iMarine platform?

The graph reflects the composition of the workshop audience.
7 people identified some existing services that their organizations could already adopt. Among the identified services: 3 VME DB, 1 FAO VREs, 1 Tuna Atlas, 1 BiONym, 1 Ecological Modelling. The workshop offered an opportunity to collect requirements for **new services** like tools for Marine Mammal conservation and Tabular Manager. The workshop and survey demonstrate demand from participants that are completely new to iMarine and identified several services meeting their requirements. This is a very positive outcome.