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EVALUATION

of the

European Marine Observation and Data Network (EMODnet)

{SWD(2023) 282 final}

Glossary

Term or acronym	Meaning or definition
CMEMS	Copernicus Marine Environment Monitoring Service
DG ENV	Directorate-General for Environment
DG GROW	Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs
DG MARE	Directorate-General for Maritime Affairs and Fisheries
EEA	European Environment Agency
EFCA	European Fisheries Control Agency
EMFF	European Maritime and Fisheries Fund
EMODnet	The European Marine Observation and Data Network
FAIR	Findable, Accessible, Interoperable, Reusable
HELCOM	The Baltic Marine Environment Protection Commission (Helsinki Commission)
ICES	International Council for the Exploration of the Sea
INSPIRE	Infrastructure for Spatial InfoRmation in Europe
JRC	Joint Research Center
MSFD	Marine Strategy Framework Directive
MSPD	Maritime Spatial Planning Directive
OSPAR	The Convention for the Protection of the Marine Environment of the North-East Atlantic
UNCLOS	UN Convention on the Law of the Sea

1 INTRODUCTION

1.1 What is EMODnet ?

The concept of a European Marine Observation and Data Network (EMODnet) followed the publication of the 2006 Green Paper "Towards a future Maritime Policy for the Union: A European vision for the oceans and seas" [1]. This concept was endorsed in 2007 as part of the EU's new integrated maritime policy which followed a public consultation and impact assessment [2].

In the Commission's 'Marine Knowledge 2020' Communication [3], published in 2010, the European Marine Observation and Data Network (EMODnet) is described as a network of marine organisations that would provide a single entry point for accessing and retrieving marine data derived from observations, surveys or samples from the hundreds of databases maintained on behalf of agencies, public authorities, research institutions and universities throughout the EU. It would also deliver digital map layers of parameters derived from these primary data for entire sea basins around Europe.

In 2014, the European Maritime and Fisheries Fund regulation (EMFF, [4]) defined EMODnet as 'a network that integrates relevant national marine observation and data programmes into a common and accessible European resource'. A detailed timeline of EMODnet history until 2014 is provided in Annex VI.

EMODnet's objectives are to create and implement interoperability standards for marine data and to aggregate, harmonise, quality-check and consolidate data on hundreds of parameters related to the marine environment. The data are used to create and make openly available multi-resolution data products, covering all EU seas.

Today EMODnet includes a wealth of data and data products covering the European seas and beyond. The data are organised by seven thematic areas: Bathymetry, Geology, Seabed habitat, Chemistry, Biology, Physics and Human activities[1].

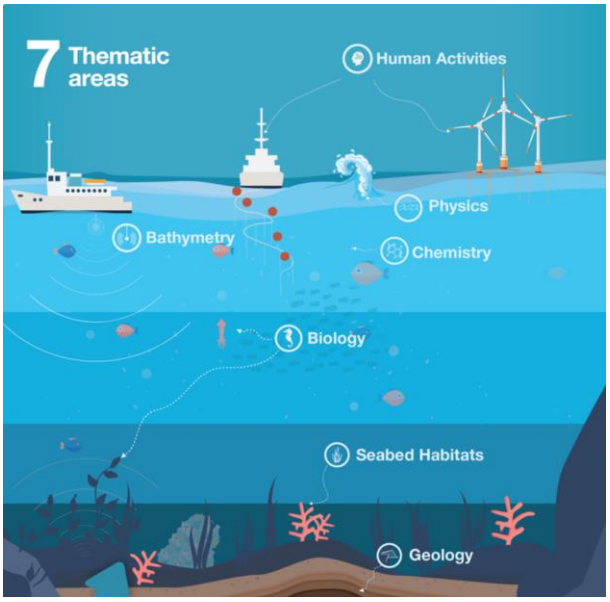

Figure 1: The seven thematic areas of EMODnet

[1] European Marine Observation and Data Network (EMODnet): https://emodnet.ec.europa.eu/en

The network comprises over 120 organisations including national hydrographic offices, geological surveys, oceanographic institutes, etc., supported by private companies with expertise in data management, processing, and dissemination.

The EMODnet portal provides access to a large number of in situ measurements, information and products, such as for example digital maps of the sea floor, water temperature, marine litter, presence of algae, nature of the seabed, type of habitats for marine life, as well as the mapping of human activities (e.g. offshore wind farms).

1.2 What is EMODnet used for and by whom?

Access to marine data is of vital importance for scientific research, decision-making bodies, marine industries and the society at large for implementing EU policies in relation to EU oceans and seas. EMODnet, as a pan-European marine data infrastructure, is utilised for a wide array of uses in these domains.

Academia and the research community are among the most important users of EMODnet (61%, see Figure 2). The open sharing, harmonising, and quality-checking of marine data across Europe is significantly optimising the time and cost of marine research, expediting results, increasing high-quality publications and reducing uncertainty. This extends to better simulation of marine systems and forecasting of their behaviour, which is valuable beyond research (management and conservation of living resources, coastal zone protection, conditions at sea etc.).

EMODnet is used by national, regional, and local government bodies to access, share and reuse marine data across European borders and to access readily available data products to support and speed up the decision-making processes. It enables the implementation of efficient legislation regarding marine environmental protection, marine spatial planning and more. Sharing and re-using of data collected via public funding is optimising investment at the national and EU scales.

EMODnet is used during the planning, development, and implementation phase of multiple activities in the blue economy, such as aquaculture, offshore energy, environmental services and more. The availability of marine data allows for more efficient and sustainable planning, reduces data collection costs and sparks innovation, especially for Small and Medium Sized enterprises (SMEs).

Civil society organisations, such as environmental NGOs, make use of the EMODnet data products to enhance their knowledge base and to transform it into information that engages the wider public on the importance of the marine environment to everyday life. EMODnet is powering the European Atlas of the Seas[2], which distributes wide and variant marine related information for students, teachers and the wider public in the easy-to-understand form of maps.

Private industry is responsible for about a quarter of the downloads. Many of these users are SMEs who incorporate the data in the services they provide to other industries or public authorities.

2 European Atlas of the Seas: https://ec.europa.eu/maritimeaffairs/atlas/maritime_atlas/

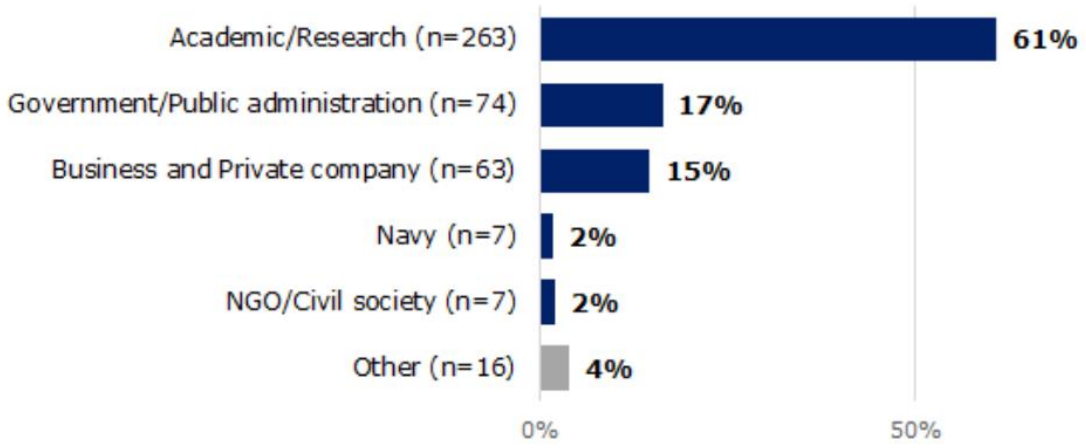

Figure 2: Type of organisations involved in the online survey carried out by an external study [13]

To better understand the full benefits of EMODnet for marine industries, decision-making bodies and scientific research, a few use case examples are given below:

1. EMODnet Seabed Habitats data was used for the mapping of physical damages to benthic habitats due to fishing in the Nord-East Atlantic as part of a wider OSPAR assessment.
2. An Italian technology-transfer company active in the environmental physics field has released a new service for its customers as part of an environmental impact assessment package which uses EMODnet physics radar data to provide a solid and validated input to oil spill models.
3. EMODnet Human Activities datasets on windfarm and hydrocarbon extraction provided crucial information to determine areas of interest for the development of wind farm projects.
4. Based on EMODnet Geology data, a university investigated the influence of the environmental conditions on the distribution of the seagrass species in the Mediterranean Sea basin.
5. EMODnet Chemistry contributed to the Commission Staff Working Document on Reducing Marine Litter: action on single use plastics and fishing gear [5], which performs an analysis of plastics distribution coming from these sources.
6. EMODnet Biology data helped prevent the introduction of non- indigenous species outside their natural range by assessing the effectiveness of current measures.
7. EMODnet Bathymetry data are used by the Swedish Agency for Marine and Water Management (SwAM) to assess the cumulative impact of human activity in Swedish waters.

Many more examples of use cases can be found on the EMODnet web site[3]

A structured view of the use of EMODnet raw data, harmonised data and data products is shown in Figure 3.

[3] https://emodnet.ec.europa.eu/en/use-cases

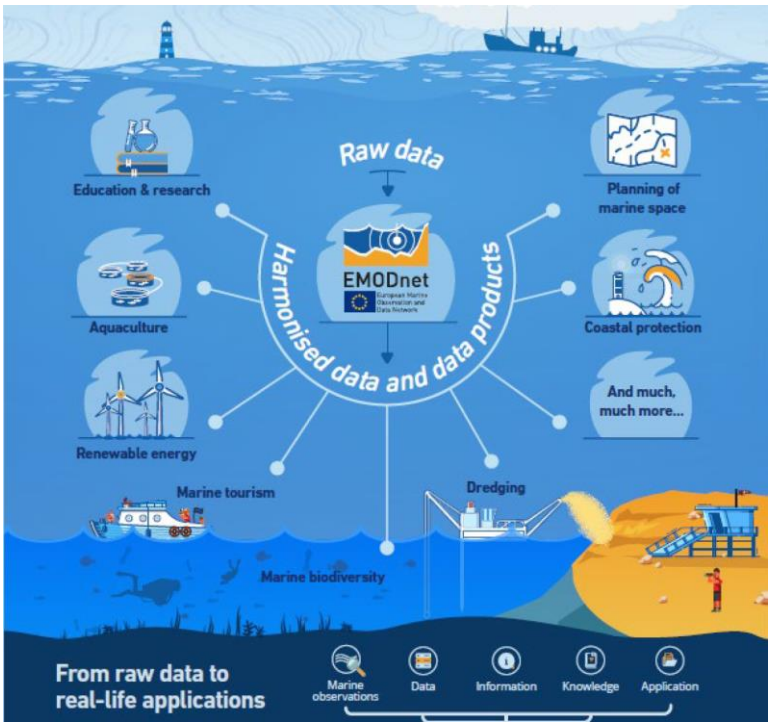

Figure 3: What is EMODnet used for.

1.3 Purpose of the evaluation and methodology

EMODnet has undergone an evaluation in the context of the Interim evaluation of the direct management component of the EMFF [6]. As the scope of the evaluation was the entire EMFF, the part dedicated to EMODnet remained limited in relation to the numerous points to be analysed.

While there is no legal requirement to perform a separate evaluation for EMODnet, the Commission announced its commitment to carry out such evaluation in its 2014 “Marine Knowledge 2020 roadmap” accompanying the Communication "Innovation in the Blue Economy realising the potential of our seas and oceans for jobs and growth" [7]. There are three main objectives to this evaluation:

1) To assess how well the original objectives have been reached, whether the original objectives are still valid, how the situation has changed during the period covered by this evaluation, how the action has reacted to these changes and if such action needs to be continued,
2) To assess the performance of EMODnet,
3) To create a reference which will allow to reflect about the future of EMODnet.

The 5 standard evaluation criteria: effectiveness, efficiency, relevance, coherence, and EU added value are analysed and are organised in the report as follows:

- To what extent was the intervention successful and why? (effectiveness, efficiency, coherence),
- How did the EU intervention make a difference? (EU added value),
- Is the intervention still relevant? (relevance).

The articulation between needs, objectives, outputs and the 5 evaluation criteria used in the context of this evaluation are shown in Figure 4.

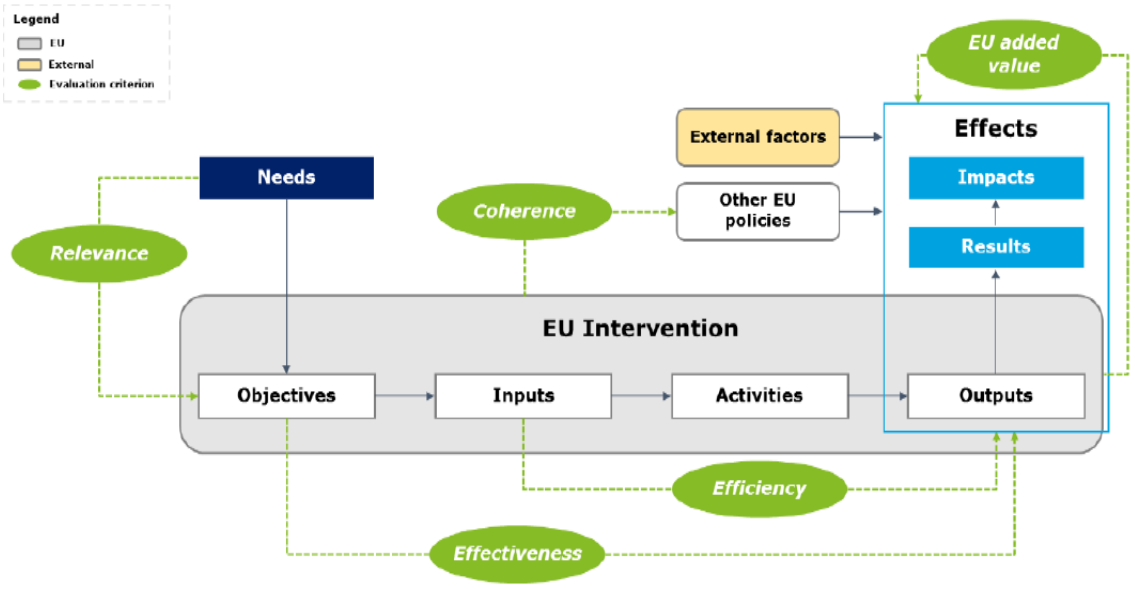

Figure 4: Simplified view of the intervention and the 5 key evaluation criteria [13]

The data gathering and analysis, legal texts, policy documents, impact assessment, studies and internal project reports that have been used in this evaluation can be found under the section 'References'.

The evaluation of the 5 standards criteria draws mainly from the following:

- A public consultation organised in the period March to May 2019 [14],
- An external evaluation study published in 2020 [12], which also includes a consultation,
- Yearly internal project review reports which include focused surveys and target assessments carried out by the EMODnet secretariat (e.g. [25, 26, 35]).

Details on the public consultation and the consultation in the evaluation study are provided in the synopsis report in Annex V.

There are of course limitations and strengths in the different material supporting this evaluation.

The external evaluation study was performed by an external contractor, which ensured an independent approach, and it included a consultation of registered EMODnet users who have expertise in the use of EMODnet.

While the consultation carried out in the external evaluation study includes 430 inputs, mostly from users, the public consultation gathered only 46 inputs and is therefore less statistically relevant. However, in the last, the inputs are mostly made by entities while in the first, there are mostly from individual users.

The methodology includes therefore three different perspectives: an external evaluation study, a public consultation and internal reports by specialists.

More details on the methodology and the reference documents can be found in Annex II.

1.4 Time period covered by the evaluation

Time Period

In 2010, an impact assessment [9] was carried out and confirmed that the benefits of such action would likely outweigh the costs.

Based on these results and confirmation that the structure of the prototype EMODnet financed by the European Parliament's preparatory actions was sound, this prototype was reinforced through a transitional fund [15]. In 2013, the Council invited the Commission "to develop a roadmap towards a sustainable structure that is driven by the needs and priorities of public authorities, industry, the research community and other stakeholders". EMODnet was then eligible for support from the 2014-2020 EMFF.

This evaluation is therefore centered on the period 2014-2020 corresponding to the years of EMFF and the corresponding Multi-Annual Framework. Elements of information were also added for the evolutions which occurred in the period 2013-2014 and 2020-2022 for a better understanding and in order to be able to draw relevant conclusions.

Geographical scope

Today EMODnet provides access to data and knowledge for all European seas and oceans including waters of all EU Member States, of neighbouring third countries and of EU Outermost Regions but also provides information on landlocked countries (Austria, Hungary, Luxembourg, Slovakia) e.g. regarding aquaculture. The scope of this evaluation covers therefore primarily the EU Member States in the period 2014-2020[4].

EMODnet covers other waters, which vary depending on the thematic group considered, the availability of data and the existence of international collaboration. Without going into the details of which quantity is available in each ocean, data can be found outside waters of EU Member States in the Atlantic, Arctic and Antarctic Oceans as well as the Caspian and the Black seas.

In terms of users, the data being free and open access, entities from all around the globe are accessing EMODnet data.

2 WHAT WAS THE EXPECTED OUTCOME OF THE INTERVENTION?

2.1 Rationale for the intervention

Needs

The needs which motivated the establishment of EMODnet described in the 2010 impact assessment [9] were to:

1) Achieve a coherent approach to marine data collections

   In 2010, most marine data collection was focused on meeting the needs of a single purpose such as for example a regulatory requirement or for further scientific understanding. However, assessing the

[4] UK withdrew from the European Union as of 01/02/2020.

state of the ocean, planning a new infrastructure or analysing its impact on the ecosystem requires to access an ensemble of data and cannot rely on such an approach.

2) Remove barriers to application of marine data

At that time stakeholders complained that it was very difficult to find the data and to obtain the rights to use it without restrictions. Different data sets were using different formats, making it difficult to combine them, data providers would charge costs, there was often no information on the quality and accuracy, and the spatial and temporal resolutions were insufficient.

3) Enable competition to deliver product and services

Organisations owning data wanted exclusivity to develop the added-value applications of the data. This not only reduced the number of bodies that were potentially able to deliver the product or service but reduced innovation because it limited the development of services based on different suppliers of data.

4) Reduce uncertainty

In order to study current and future ocean behaviours (e.g. sea-level rise), several types of data need to be combined. The lack of accuracy of source data results in an even higher level of uncertainty when they are combined. This can result in significant economic impact (e.g. cost of adaptation to sea level rise).

Objectives, activities

In the 2010 impact assessment [9], the objectives were defined as follows:

General Objectives

Underpin EU policies that preserve, protect, and improve the quality of the environment,

- Pursue the prudent and rational utilisation of natural resources, strengthen the scientific and technological bases of Community industry,
- Support the common transport policy,
- Progressively establish an area of freedom, security, and justice,
- Increase fisheries productivity,
- Support an open market with free competition.

Specific Objectives:

1) To reduce operational costs and delays for those who use marine data and therefore:
   a) Help private industry compete in the global economy and meet the challenge of sustainability,
   b) Improve the quality of public decision-making at all levels. Coastal protection, impact assessments, maritime spatial planning, maritime surveillance, licensing and fisheries management are all heavily dependent on marine knowledge. Efficient implementation of the Marine Framework Strategy Directive requires a working marine data infrastructure,
   c) Strengthen marine scientific research.

2) To increase competition amongst users of marine data by providing wider access to quality-checked, rapidly available coherent marine data and hence stimulate the development of new innovative services,
3) To reduce uncertainty in knowledge of the oceans and the seas and so provide a sounder basis for managing inevitable future changes.

Operational Objective / Activities

The specific objectives could be achieved by setting up and maintaining at EU level:

1) A catalogue of European marine data collections with common formats and nomenclature, completed with information including at least geographical location, time of measurement, ownership, precision and accuracy,
2) A set of complete interoperable layers for European sea basins, showing where data are being collected, where the gaps are and providing seamless, quality-checked data layers (gridded or polygons) for unrestricted public access,
3) A user-driven process that determines priorities for the collection and assembly of marine data and that directs support to those activities that need to be carried out at an EU level in the most appropriate way.

Impacts, what success was expected to look like

The expected impacts listed in the 2010 impact assessment [9] which are assessed in this evaluation [12] are:

- Improve Productivity. From an economic perspective, the development of EMODnet may lead to gains in terms of improved productivity and reduced redundancies,
- Increase Innovation. Innovations derive from using the data provided by EMODnet to develop new products, services, applications (both within existing and newly formed organizations) or additions upgrading existing products, services and applications,
- Reduce Uncertainty. The implementation of EMODnet is expected to reduce uncertainty, mainly as the result of better data availability allowing operators to modify their behaviour.

Success means having achieved progress in each of the three expected impacts.

The EMODnet intervention logic is depicted in Figure 5.

Figure 5: Intervention logic of EMODnet as described in the external evaluation [12]

Wider Policy context before 2014

In 2007, the European Commission adopted for the first time "An integrated Maritime Policy for the European Unions" [2] which aimed to create a more joined-up approach to all EU policies that depended on the seas and oceans or affected them. Previously, EU maritime actions had concentrated on fisheries. This Communication therefore opened up a new dimension, containing specific tools for integrated policy-making.

This included three flagship cross-cutting priorities – (1) providing better knowledge on the sea, (2) detecting potential illegal or dangerous activities and (3) agreeing where individual economic activities should be allowed or prohibited. Responsibility for these priorities was held by different authorities so the challenge in each case was to bring these authorities together to share knowledge, facilitate communication and agree on standards.

In 2008, the Marine Strategy Framework Directive [19] was published, calling on Member States to achieve or maintain Good Environmental Status (GES) in each marine region and to draw up monitoring programmes in the interest of coherence and coordination.

In 2010, the Communication on Marine Knowledge 2020 [3] was calling to develop existing EU instruments such as the preparatory action ur-EMODnet alongside with the fisheries Data Collection Framework, Global Monitoring for Environment and Security Initiative (GMES), the Shared Environmental Information System SEIS and its marine environmental component, WISE-marine that is an extension of the Water Information System for Europe (WISE) system.

EMODnet impact assessment [7] was published in the same year, laying the foundation for a long-term perspective for EMODnet.

In 2014, the Maritime Spatial Planning Directive [16] was adopted with the goal to bring coherence in possibly competing use of maritime space at any given time such as fishing, aquaculture, shipping, renewable energy, nature conservation and other uses.

The same year, the European Maritime and Fisheries Fund (EMFF) regulation, which covers the period 2014-2020, was adopted. It included under direct management 'the progressive development of a comprehensive and publicly accessible high quality marine data and knowledge base which shall facilitate the sharing, re-use and dissemination of those data and knowledge among various user groups, thus avoiding a duplication of efforts; for that purpose, the best use shall be made of existing Union and Member States' programmes'.

2.2 Point(s) of comparison / Assessment of the achievements

As discussed in Section 2.1 "Rationale of the intervention" and further detailed in the timeline of EMODnet before 2014 in Annex VI, the period 2006-2010 was a policy preparation phase starting with the 2006 Green paper "Towards a future Maritime Policy for the Union: A European vision for the oceans and seas" [1] and resulting in the finalisation of the impact assessment in 2010 [9].

Between 2008 and 2013, a first EMODnet prototype was developed financed successively by preparatory actions from the European Parliament and the Programme to support the further development of an Integrated Maritime Policy. Separate groups of biologists, chemists, geologists and hydrographers as well as a group specialising in seabed habitats replied to the call for tender, joined later by one for physics.

In 2012, EMODnet was extended to cover the needs of environmental policy and spatial planning, included a new group to assemble data on human activity.

However, at the time of the start of the evaluation period (2014), EMODnet was not yet operational. It was still time-consuming to find data and obtain permission to use it and hard to put data from different sources and of different types together to create a complete picture because of differing standards, nomenclatures and baselines. The resolution was limited as well as sea-basins coverage. The secretariat did not exist (portals were operating independently) and there was no ingestion facility.

Usage of the prototype EMODnet was low because the amount of data available was limited and the coverage incomplete. Potential users were not going invest in services that relied on EMODnet until they could be confident that it was going to be sustained once the initial contracts ended.

3 HOW HAS THE SITUATION EVOLVED OVER THE EVALUATION PERIOD?

EMODnet funding is usually secured with contracts of 2 years duration, with an optional renewal, and this for each thematic area. The different contracts are not synchronised time wise. Below, the evolution of the situation is presented per main phases in order to facilitate the understanding of the main evolutions since 2013.

2013-2015: Stress tests - First Digital Terrain Model - Setup of the ingestion service

In 2013 EASME (today CINEA), as an executive agency of the European Commission, took on the responsibility to manage the EMODnet contracts.

Between 2013 and 2014, a set of stress tests were undertaken to determine where EMODnet should step up effort on assembling and distributing data. Sets of independent consortia were asked to tackle several practical problems such as to find a site for a wind farm, track an oil spill, determine changes in heat content or eutrophication in a sea-basin, and identify the fitness for purpose of the available data. Some of the results included the lack of access to fisheries data, unknown river inflows, poor availability of wind data, lack of knowledge of impact of alien species.

In 2015, based on the data provided by the national Hydrographic Organisations, who are in charge of the production and distribution of nautical charts in EU Member States, the bathymetry service introduced the Digital Terrain Model (DTM). This resulted in a considerably increased quantity and quality of available bathymetric data and services.

A data ingestion service was also set up to include data in EMODnet from research projects, environmental impact assessments (e.g. for an off-shore energy park) or from the private sector, harmonising and integrating them, when possible.

2016-2017: Enhancing EMODnet geology and Seabed Habitats, expanding the role of the Secretariat.

In this period, EMODnet geology layers underwent significant improvements. The classification of sediments became more uniform and detailed, providing harmonisation in European data of seabed substrates. The better accuracy and uniformity of geological and hydrographical data were then fed to the EMODnet habitats portal which, for the first time offered a complete mapping of European habitats using a uniform classification. This advancement is crucial for designing marine protected areas, for the achievement of Good Environmental Status under the MSFD and for efficient marine spatial planning, which is not possible if the classifications between Member States are not harmonised.

In 2017, the role of the Secretariat was expanded. This strengthened their coordinating function for the network, by evaluating and harmonising the services provided by the thematic areas. This included the assessment of reporting, assessment and advice on thematic portals developments (indicators to quantify the use of EMODnet) and maintaining the central website with a centralised catalogue and access to thematic services. The Secretariat also became responsible for much of the EMODnet European and international collaboration and networking, building partnerships with relevant organisations and handling a larger portfolio of communication and outreach activities. They undertook the development of the EMODnet Associated Partnership framework and started conceptualising the "EMODnet 4 business" scheme, aiming to identify and answer the needs of the private sector in terms of marine observation and data. The Secretariat also became responsible for major landmark EMODnet events (Jamboree, Open Sea Labs, ocean observation conferences), EMODnet Annual Reports and advanced communication material (videos, infographics, promotion material). At the same time, they took over from the JRC the maintenance and development of the European Atlas of the Seas that is the ocean literacy marine map tool of the European Commission.

2018-2019: Focus on user needs, applications for EU policies

In 2018, EMODnet efforts to identify user needs were stepped up, in order to refine the service. The main user requirements are higher spatial and temporal resolution of data and fewer gaps in available data. The gaps were being addressed, partly through the incorporation of new parameters, partly by engaging with more data providers and partly by harmonising data collected from different sources. At this stage, one of the services of EMODnet that became increasingly useful is the provision of indications of the available data reliability or completeness.

The lack of reliable information on flows of freshwater, sediments and nutrients from European rivers identified by the stress-tests have been partially addressed in this period.

In 2019, EMODnet Human Activities made available new, relatively high-resolution monthly maps of shipping density provided by EMSA, differentiated by type of vessel. This product has proven very popular with users. In this period, EMODnet Human Activities became the reference for the positions and characteristics of all offshore windfarms in the planning, licensing, construction or operation phase. This data contributed to the analysis of national recovery and resilience plans and to WindEurope’s analysis of space requirements for meeting 2050 deployment targets under the Green Deal.

During this period, EMODnet Chemistry and EMODnet Biology scaled up their engagement efforts to provide data for the Marine Strategy Framework Directive (MSFD, [19]), working closely with DG ENV, JRC and EEA. EMODnet Chemistry provides since 2019 the common methodology and harmonisation of Member States data that enabled the establishment of a baseline for beach litter in all EU countries.

In 2019, the signature of a Memorandum of Understanding (MoU) between DG MARE and DG GROW confirmed the complementarity of the Copernicus Marine Service and EMODnet and increased coherence, synergies, and collaboration. In 2020, this MoU was transferred to the newly established Directorate-General for Defence Industry and Space (DG DEFIS).

2020-2021: Increased use for EU policies

The European Green Deal [22] has heightened the need for reliable marine data. The EMODnet Habitats team had already delivered data on sea grass distribution and is working to provide mapping of coastal wetlands. These data can help researchers estimate carbon sequestration on national or European scales

and contribute towards the long-term aim of inclusion of sea use in Land Use, Land-Use Change and Forestry (LULUCF) reporting. The staff working document accompanying the Zero Pollution Action Plan [32] gives a significant role to EMODnet, regarding harmonising and making openly available more and better marine in situ data on marine pollution.

During this period, the high complexity of marine biodiversity was an area of focus and growth for EMODnet. Until 2020, most EMODnet interaction with environmental reporting has been through MSFD, and the Nature Directives have been comparatively less well served. Since then, EMODnet biology and EMODnet Seabed established collaboration with the Directorate-General for Environment (DG ENV), and the European Environment Agency (EEA), to work together and contribute more to the six-year reporting cycle of the Habitats [27] and Birds Directives [28].

In 2020 EMODnet Geology delivered a mapping of coastal erosion over the past 10 years on all the EU's sandy coasts, supporting climate adaptation activities. Since then, efforts have begun on other types of coast substrate.

In the context of the European Commission's Technical Expert Group on Maritime Spatial Planning (MSP) Data, EMODnet Human Activities thematic area contributed in 2021 to the development of a harmonised nomenclature for ocean uses in the EU. Since then, it has taken up the task of converting official Member State submissions of maritime spatial plans to a common format in order to facilitate cross-border spatial planning, and therefore enhance the implementation of the Maritime Spatial Planning Directive (MSPD [16]).

In 2021, a coordinated effort began in order to centralise the thematic portals under a common entry point. This activity, soon to be finalised, will satisfy the requests for simplification and user friendliness, in turn will strengthen cohesion in the EMODnet partnership.

Evolution of data, data products, citations and visitors

The progress made through EMODnet, regarding the availability of marine in-situ data during the evaluation period can be deduced through the increase of datasets and data products made available through the network.

An EMODnet data product is a composite collection of data related to a specific variable, harmonised and standardised across Europe, to reflect the state of the variable across European Seas or focusing on specific region, based on data availability. Where relevant the data is interpolated to provide approximation of information across EU seas. In a few cases, EMODnet data products are the result of modelling analysis, based on standardised methodologies developed by the EMODnet thematic experts. This is for instance the case for the Seabed Habitats EUSeaMap and for the Human Activities Vessel Density Maps. All EMODnet data products are accompanied by detailed metadata.

Between 2014 and 2020 this progress has been important as shown in Table 1, with a great variety of multidisciplinary data made available and data products being created.

The increase of the number of citations is another indicator of the growing use of EMODnet by the scientific community. The external study [12] evaluated that in the period 2014 to 2018, the number of citation grew steadily from 251 to 529 i.e. 210% increase.

In terms of visitors, the central entry portal had 89000 unique visitors in 2021 [26]

Thematic area	Indicator
Bathymetry	137% increase in data sets used for the creation of the Digital Terrain Model (DTM)
Biology	97 % increase in datasets
Chemistry	61% increase in datasets
Geology	240% increase in data products
Human Activities	100% increase in data products
Physics	164% increase in data products
Sea bed habitats	230% increase in data sets

Table 1: Increase of the number of data sets and data products in the period 2014-2020

EU funding

During the period considered under this evaluation i.e. 2014-2020, a total of € 51.3 million i.e. of the order of € 7 million per annum, having in mind that some of the previous contracts ended after 2014, some of the contracts during this period have ended after 2020.

It should be acknowledged that the Flanders Marine Institute (VLIZ) is hosting the Central Portal, office and infrastructure for the Secretariat without remuneration, based on a bilateral agreement with the European Commission. Details on the distribution of the funding are provided in Table 2.

Theme & Project	EU funding (million €)	Thematic Portals overview
Central services	**8.6**	
Secretariat	3.5	Coordination and technical support, development of the EMODnet Central Portal, monitor the various EMODnet projects and disseminate their results
Data Ingestion	5,0	Facilitates ingestion of marine datasets for external users, support for processing, publishing
Thematic Groups	**44.2**	
Bathymetry	11.4	Data on bathymetry (water depth), coastlines, and geographical location of underwater features: wrecks.
Biology	5.0	Data on temporal and spatial distribution of species abundance and biomass from several taxa.
Chemistry	6.4	Data on the concentration of nutrients, organic matter, pesticides, heavy metals, radionuclides and antifoulants in water, sediment and biota.
Geology	8.7	Data on seabed substrate, sea-floor geology, coastal behaviour, geological events, and minerals.
Human Activities	4.6	Data on the intensity and spatial extent of human activities at sea.
Physics	3.4	Data on salinity, temperature, waves, currents, sea-level, light attenuation, underwater noise and more.
Seabed Habitats	3.3	Data, maps and models on the spatial distribution and extent of seabed habitats and communities.
Total	**51.3**	

Table 2: EU funding provided in the period 2014-2020

4 EVALUATION FINDINGS (ANALYTICAL PART)

4.1 To what extent was the intervention successful and why?

Effectiveness and efficiency

This section is structured according to the impacts of the intervention as described in section 2.1:

- improve productivity,
- increase innovation,
- reduce uncertainty.

It also includes considerations on the form of funding that is currently being used.

For each of the impacts, effectiveness and efficiency are assessed together. As illustrated in Figure 5, effectiveness assesses how well the outputs relate to the objectives while efficiency relates the magnitude of the inputs to the generated outputs (costs and benefits). In this section, the percentages used to quantify the answers to the public consultation are based on the sum of respondents who expressed an opinion, see also Annex V.

Improving public & private sector productivity

90% of the respondents to the public consultation [14] reported either slight (57%) or great (33%) productivity gains. The survey conducted as part of the EMODnet external evaluation study [12, section 5 Effectiveness], explored increased productivity through questions related to operational costs, organisations' productivity, and administrative burden. 55% of the 262 surveyed users agreed or strongly agreed that EMODnet use leads to an effective reduction in operational costs within their organisations. Additionally, all the 35 specialised users interviewed as part of the same evaluation, declared an increase in productivity due to the use of EMODnet.

Some of these productivity gains referred to actual reduction of costs, as before EMODnet, the purchase of specific datasets for a given local area could cost up to €10,000 per dataset, adding a financial burden to the budget of institutions and companies. The representatives of a large civil engineering company reported performing between 500 to 1000 projects annually in different local areas, using the EMODnet Bathymetry Digital Terrain Model, providing the best-harmonised resolution in the EU, as well as EMODnet Physics data, estimating their savings due to EMODnet in between €0.5 and €1 million a year for a single company. Small and medium-sized companies active in marine modelling, and thus in need of updated datasets of several marine parameters, report that, depending on the dataset and per dataset, savings can be from €1,000 to €10,000 [12, section 5 Effectiveness: Productivity].

In order to quantify the efficiency, users were interviewed and asked to estimate the productivity gains per year associated to the use of EMODnet. For this purpose, they evaluated the saving on salaries at the level of their company resulting for the time saved thanks to a central access to data provided by EMODnet versus having to fetch data source by source. For registered EMODnet users, the estimate of savings spans between €3500 and €7000 per year. While there are 874 registered users, it was estimated that the unregistered users could range between 8300 and 16500 yielding total savings ranging between €29 million and €115 million. In 2021, the number of unique visitors of EMODnet central amounted to 90000. Of course, not all visitors are downloading data.

Increasing innovation

EMODnet aims to facilitate the development of innovation in the Blue Economy, through increased and unrestricted access to data, thus allowing other parties, besides the original data-holder, to provide added-value services. The assembled, harmonised, standardised and quality-controlled data products at EU scale, created by EMODnet through aggregation of data from different sources also stimulates the creation of new services.

88% of the respondents to the public consultation slightly (36%) or greatly (52%) agree that EMODnet was boosting innovation development for their organisation (see Annex V). According to the external evaluation study [12], 74% of the survey participants agreed that EMODnet has allowed them to provide new or additional services to their clients and/or stakeholders. Additionally, 65% of respondents agree or strongly agree, that EMODnet data are contributing to boosting innovation within their field, not only in their affiliated organisation, but also in other organisations in their sector. It is thus clear that EMODnet indeed is considered as an innovation facilitator.

Dedicated stakeholders' interviews of 28 specialised EMODnet users enabled to identify practical examples.

EMODnet developing new products and services

EMODnet is supporting the creation of technological innovation through the development of products and activities which would not be possible if the EU marine data landscape remained fragmented. The external evaluation study [12] mentions that research organisations see potential in robotics application for underwater navigation thanks to the higher resolution bathymetry data available in EMODnet. The improvement of spatial and temporal resolutions of data allows the improvement of forecasts at the coastal zone, the development of comprehensive EU marine habitat maps and more. Other EMODnet activities, such as the Open Sea Labs (EMODnet Hackathons) target specifically innovators, which use the available open data, data products and web-services to create added-value applications as solutions for aquaculture sighting, ocean literacy tools, fish-stock assessment tools, visualisation tools for marine spatial planning and more [36].

In the domain of marine biodiversity data, which is very complex due to the temporal and spatial variability across the European seas and the particularities of monitoring, EMODnet develops internal activities to promote and foster innovation. These demonstrators, related to modelling of species observations, display how to use the available data in an artificial neural network and make available the full methodology that can be used by other actors.

EMODnet boosting innovation in companies

The effect of EMODnet in boosting innovation is particularly evident regarding SMEs, allowing them to be competitive in the landscape of marine related service provisions, to cater for clients outside their usual zone of influence or to create services based on the free, harmonised and quality-checked data.

For example, a Danish engineering company has developed a business model with the support of EMODnet data. The company develops numerical, hind cast models for the Mediterranean Sea, resulting in forecasts of wind and wave. The data are stored in a database and are purchased by the company's customers under a fee. EMODnet Physics data are used to calibrate and validate the outputs of the model, meaning that EMODnet enabled the creation and guarantees the quality of the service, which generates annually €100,000 for this company [12].

A Portuguese SME, active in marine modelling, stated that the development of higher quality and innovative products is only possible through the open, unrestricted access to high-resolution in situ data

of EMODnet, attributing directly up to 10% of their funding for a period of 3 years (€45,000-€90,000). A small Greek engineering company, has developed a floating mast performing offshore wind measurements, a project with funding of about €2 million. EMODnet supports the capitalization and search for clients as it allows the identification of areas for proposed new and old wind farms in all European seas.

Larger companies in the engineering and energy sector also acknowledge the change in the competition landscape created by the unrestricted access to available marine data thanks to EMODnet.

EMODnet boosting innovation in academic labs and research centres

Research institutes, universities and other organisations are utilising EMODnet data to develop European marine knowledge. EU Research and Innovation value these outputs and document them in scientific papers. Between 2014 and 2018 more than 2000 peer-reviewed papers and assessments have been published with the acknowledged contribution of EMODnet with a doubling of the number of citations per year between 2014 and 2018 (from 251 to 529).

Additionally, EMODnet data are contributing as baseline to further marine research and innovation development, for quality assessments, for the calibration and validation of modelling forecasts, for exploration of critical raw materials from the marine environment and more [25, 26]. For these organisations, EMODnet facilitates the development of R&I projects on marine sciences, attracting funds from public and private resources and thus creating value and jobs.

Efficiency gains in relation to innovation

The 2010 EMODnet impact assessment analysed the situation in the USA where it is estimated that the greater availability of public data and their use made by industry leads to a sector that is at least 6 times larger than in the EU. Applied to the size of the sector in the EU (estimated between €10 million and €30 million in 2010), this yields between €60 million and €200 million annually.

The external evaluation study [12] attempted to provide a better quantification of the gains related to innovation relying on specific quantified examples from the interviews such as those mentioned above. This was however un-conclusive since no proper methodology was found to extrapolate these specific business benefits to the ensemble of EMODnet users.

Reducing uncertainty of data

Open, unrestricted access to harmonised standardised and quality-controlled data has a direct impact on the reduction of uncertainty in science, research and development, impact assessment, management, and decision making. The availability of data products with high temporal and spatial resolution reduces significantly uncertainties of the behaviour of marine systems, lowering risks and thus enabling economies of scale and timely action. In previous paragraphs analysing productivity and innovation, there are already multiple examples mentioned where EMODnet is contributing to reduced uncertainty, through marine forecasts, information on sea-level rise, wave height, marine biodiversity distribution, marine pollution and more.

95% percent of the respondents in the public consultation stated that EMODnet reduces uncertainty slightly (38%) or greatly (57%, see Annex V). According to the external evaluation study [12], 62% of the surveyed users agreed on the significant contribution of EMODnet for the provision of reliable data and that was not possible before the network was assembled. Furthermore, the majority of users perceived that the use of EMODnet data for their activities, reduces the uncertainty of their outputs.

Through use cases available at the EMODnet Central portal[5], notable examples of reduction of uncertainty can be found. Among others, the improved Bathymetry Digital Terrain Model enabled the improvement of the accuracy of the storm surge forecast models of meteorological services. Another example is the reduction of uncertainty of the marine environment state assessments enabled by data coming from EMODnet Chemistry, Seabed Habitats and Biology. The EMODnet services are developed in close collaboration with the Copernicus Marine Environment Monitoring Service (CMEMS), powering a part of the CMEMS In situ Thematic Centre. The EMODnet products are used in the Copernicus Marine forecasting models or products for validation purposes and are also provided to Copernicus Marine Service users for further research and downstream activities [38].

Through the consolidation of data at pan-European level, EMODnet also helps in the reduction of another form of uncertainty, by making more visible the thematic and geographical gaps existing regarding the in situ data of the marine environment. The high-level overview that EMODnet provides allows to identify which areas are observed more adequately and in which areas more public investments and efforts are necessary to achieve a robust marine knowledge background.

Other proved benefits of reduced uncertainty due to the provision of EMODnet data and services are related to prediction of the state of the sea with regards to offshore operations, where more accurate forecast can lead to taking advantage of all optimum days for work at sea or reducing risk activities under unfavourable weather. Increased availability and better quality of marine data can also create savings in the insurance sector, both for insurance companies and their clients, reducing the risks of insuring infrastructure offshore or at the coastal zone, cabling operations and more [12, section 5 Effectiveness - Uncertainty].

A study has been performed focusing on Irish waters in 2008, estimated that an investment of €70 million spent on marine mapping would lead to approximately €415 million benefits to the industries of the Blue Economy [39], as fisheries, aquaculture, renewable energy and marine conservation, providing 5 times more benefits, compared to the investment.

In the first decade of operations (until 2020), EMODnet made significant progress towards achieving a comprehensive mapping of all European seas. Efficiency gains in relation to uncertainty were estimated to an average reduction of uncertainty between 15% and 23% [12, section 5 Effectiveness - Uncertainty]. According to a study on the Assessment of Coastal Vulnerability to Climate Change [23], public authorities in charge of coastal management would benefit €100 million for a 25% reduction in sea-level rise uncertainty. Applying this gain to the percentages of reduction achieved thanks to EMODnet yields benefits between €60 million to €92 million.

Cumulated benefits

Based on the detailed benefits detailed in the above sections, the cumulated benefits per year are summarised in Table 3 yielding €149 million per year as a minimum and €407 million as a maximum (see also the 2019 external evaluation study [12, section 5 Effectiveness]).

These values are based on a number of assumptions and the difference between minimum and maximum is quite large but one can conclude that compared to the EU investment which has been of the order of €7 million per year in the period, the benefits are of the order of 20 times the cost.

[5] https://emodnet.ec.europa.eu/en

	Min MEur	Max MEur
Productivity	29	115
Innovation	60	200
Uncertainty	60	92
Sum	149	407

Table 3: Cumulated benefits per year according to [12, Table 6-9]

Implementation and development costs: could it be done with less resources?

To better assess the costs associated with EMODnet, the EMODnet external evaluation study [12] proposed to define 4 possible levels of functioning.

1. *Minimum functioning*, only maintaining what has been developed, with an annual cost of €0.4 million across the whole network. This would result in an outdated EMODnet with minimum added value and loss of value created through the investment.
2. *Medium functioning*, aggregating, harmonising, and giving access to data as well as full continuation of building data products. Maintaining the IT, managing and reporting, communicating with users as well as keeping the Secretariat active, with an annual cost of €8.5 million.
3. *Full functioning*, creating new data products, developing new IT and more outreach, management, and reporting as well as a full-fledged functioning of the Secretariat. This level requires extra efforts in aggregating, harmonising, and giving access to data, with an annual cost of €11 million.
4. *Expanded functioning*, which would mean additional effort on creating data products and aggregating, harmonising, and giving access to data (by improving spatial & temporal resolution, including more surveys, etc.) as well as increasing interaction and communication with users. This will require more resources allocated to developing and maintaining IT, an expanded secretariat and increased managing and reporting, with an annual budget of €14.6 million.

The aforementioned functioning levels do not include the Ingestion facility in their calculations.

During the period 2014 -2020, EMODnet operated with an average annual cost of €7 million, which corresponds to a functionality just slightly lower than medium functioning. It should also be noted that some stakeholders are providing efforts on a voluntary basis (e.g. VLIZ and EMODnet infrastructure hosting). A decrease in resources below the current €7 million would directly significantly impact the functions of the network.

Potential efficiency increases

The external evaluation study identified few areas where the same benefits could have been achieved for less costs [12, Table 6-10]:

- Enforcing data standards on data providers would avoid data processing costs,
- Improved coordination among portals and the secretariat, who are operating with a high level of independence could reduce the cost of contractual reporting,
- One could look at possibilities to streamlining the number of partners (more than 100 overall) which would also lower the coordination costs,

- The data assembly process before making the data available in the portal could be more automated,
- The use of a cloud-based infrastructure (instead of access through different servers) would enhance the speed and reliability of the service.

The study also identified areas where more benefits could have been achieved for the same cost:

- There exists local, regional and national legal obligations to report about marine environment data (e.g. MSFD); a more systemic use and treatment of this existing data would widen the amount of data available on, EMODnet,
- Further efforts on the user friendliness and focus on user needs,
- Further dissemination and outreach to broaden the data and user basis.

Form of funding

EMODnet is now an operational and continuous EU level service, which has achieved a high level of coherence and is perceived from the outside as a single entity.

Since 2014, the funding is provided by the European Maritime and Fisheries Fund (EMFF) and for the period between 2014 and 2020 amounted to € 51.3 million [25] and then by EMFAF. At the beginning of the intervention and for the 3 development phases that EMODnet underwent between 2009 and 2020, independent call for tenders and contracts have been launched, starting at different times since the different thematic areas started progressively.

This was adequate as it allowed the different thematic communities to come together, create trust to open and share data, develop and implement common standards per thematic community, identify needs and work on priorities. Over the years, the thematic groups have brought progressively together the top organisations at European level, forming a unique network. In many instances, the withdrawal of one member would result in a loss of access to data without another alternative. For example, an aggregated Bathymetry service at EU level can exists only thanks to the involvement of most national hydrographic offices.

As a result, today, EMODnet is implemented through 9 independent procurements (one for each of the 7 thematic community, one for the ingestion service and one for the secretariat) of 2 years duration with optional renewals, with different start dates as the different services started at different times, supplemented by 1 EC level administrative agreement. This creates artificial boundaries, extra costs in internal coordination. It is difficult to develop proper long-term planning, coordination, overall and synchronised management of the network. This creates a sense of lack of stability and ownership for the participants to the network. There is scope for improvement here also.

Coherence

Gaining coherence of the various elements of EMODnet

EMODnet was originally built through 7 thematic web portals operating in relative independence resulting in some initial discrepancies in the coherency of the overall network.

The EMODnet Secretariat, created in 2013, has developed a series of activities to ensure that the different thematic areas are working together in a coherent manner. The Secretariat also contributed to the monitoring of EMODnet, disseminating results, and analysing user feedback and statistics (see for example EMODnet periodic report [35]).

In parallel, the EMODnet Steering Committee ensures that coherency is maintained all the time, that EMODnet is well connected to the external stakeholders and that synergies between the thematic areas

are maximised [25]. These synergies are expressed through collaborations, common data products, scientific publications and more.

In 2016, a Central Portal was developed to provide a unique landing and entering page, guiding users to the full array of data, products, and services that EMODnet has to offer. Through appropriate reporting methodologies and through monitoring of the web-services, the whole network implemented the same standards (INSPIRE compatible) and the same methods to remotely access data and data products. Through a revamp operation of the thematic portals in 2017, all EMODnet components implemented the same visual identity and a common "look and feel" of the thematic portals.

The Ingestion facility was created in 2017 to facilitate the submission of data from actors external to the network. This approach permitted the thematic communities to come together, organise their priorities, develop common methodologies and standards, as well as to implement appropriate web-services for sharing data and data products.

From 2020 onwards, the network undertakes a major centralisation effort which will consolidate all EMODnet portals under a single point of access, with a common map-viewer and ability to combine data and data products from different thematic areas fully. This effort will be completed in 2023.

Coherence with other initiatives

The Copernicus Marine Environment Monitoring Service[6] (CMEMS) is the marine component of the Copernicus Programme of the European Union. Through a centralised structure, it provides free, regular and systematic authoritative information on the state of the physical and biogeochemical ocean on a global and regional scale by providing satellite observation and state-of-the-art forecasting services [38].

The two services have a long-standing collaboration at both coordination and operational levels, as they are the two key, long-term marine data initiatives of the European Union. As a focal point for in situ marine environmental and human activities data, EMODnet provides in situ marine data to CMEMS that are used to validate satellite-derived data and models and as input to forecast modelling. Additionally, some CMEMS model outputs are used by EMODnet, as for instance the bottom-water current model outputs to help define EMODnet Seabed Habitats. Close collaboration with the Copernicus Marine Service has led to greater interoperability across services and cross-validation of satellite and in situ data sets, user-driven data products and complimentary developments to further add value to the user-experience [26]. The coherence and collaboration between EMODnet and CMEMS is greatly enhancing the marine knowledge base in Europe.

Coherence with EU policies

The INSPIRE Directive [17] aims to create a European Union spatial data infrastructure for the purposes of EU policies or activities which have an impact on the environment. To ensure that the spatial data infrastructures of the Member States are compatible and usable in a community and transboundary context, the INSPIRE Directive requires that common Implementing Rules are adopted in a number of specific areas, such as metadata, data specifications, network services and more[7]. Doing this should allow data from different sources to be assembled.

[6] https://marine.copernicus.eu/

[7] https://inspire.ec.europa.eu/quick-overview-implementers/57528

From the start, EMODnet pursues an INSPIRE compatible approach in all aspects of its implementation and compatibility with INSPIRE is embedded in the Terms of Reference of the network. One of the greatest challenges in the cross-border implementation of INSPIRE results from the different ways Member States describe the same data, making it difficult to achieve pan-European coverage for specific themes. In the INSPIRE evaluation [40], EMODnet is identified as a good practice regarding the additional efforts to specify, agree and implement precise common standards for distributing marine geospatial data according to INSPIRE-based Findable, Accessible, Interoperable, Reusable (FAIR) principles [18]. EMODnet, when necessary, has enriched further the INSPIRE standards to cater to the special needs of the marine community, due to the fact that most geospatial data follow 2D models, when often marine data require 3D models. The aforementioned not only demonstrates the case of EMODnet's coherence with INSPIRE, but go further to showcase that EMODnet's approach can be a community practice which other sectors can follow to achieve efficient data sharing and interoperability.

The Marine Strategy Framework Directive (MSFD, [19]) aims to protect the marine ecosystem and biodiversity upon which our health and marine-related economic and social activities depend on[8]. To support the Member States to achieve a Good Environmental Status (GES), the directive sets out 11 illustrative qualitative Descriptors: 1) Biodiversity; 2) Non-indigenous species; 3) Commercial fish species; 4) Food-web structure; 5) Eutrophication; 6) Sea-floor integrity; 7) Alterations of hydrographical conditions; 8) Contaminants; 9) Sea-food contaminants; 10) Marine litter and 11) Energy and noise. Achieving the specific objectives of the MSFD require data that could be available through EMODnet to support their evaluation and assessment. EMODnet covers many of the mentioned areas of intervention of MSFD.

Figure 6: MSFD Good Environmental Status descriptors[9]

Member States can use both the primary data and the wealth of standardised and harmonised EMODnet data products, to produce the assessments they are required to report under the MSFD. To demonstrate the value of these kind of products for MSFD reporting, EMODnet and the Copernicus Marine Service

[8] https://ec.europa.eu/info/research-and-innovation/research-area/environment/oceans-and-seas/eu-marine-strategy-framework-directive_en

[9] https://www.msfd.eu/rages

published a common portfolio of products for the implementation of the MSFD in the Baltic Sea [41], covering descriptors 1,2,3,5,6,7,8,9,10 and 11.

Additionally, EMODnet, through the Chemistry thematic group, has supported the Commission Technical Group on Marine Litter, led by the JRC, with the Common Implementation Strategy of the MSFD, regarding Descriptor 10. EMODnet Chemistry provided valuable contributions to the completion of the joint list of macro-litter categories [42], which includes the litter types occurring in the coastal and marine environment. The list can be used to enable comparable monitoring across the European Seas and beyond, as well as across different compartments of the marine environment. By doing this, EMODnet Chemistry underpinned the link between monitoring programmes and data management [43], as well as the importance of common criteria and methodological standards for environmental monitoring, which are fundamental for developing high quality datasets and data products. Through this work, the first authoritative pan-European database for marine beach litter and sea-floor litter has been developed and is now openly available. DG MARE, DG ENV, JRC and EMODnet are discussing about extending this work to other descriptors as well (contaminants, eutrophication, noise).

Regarding Descriptor 4 on Food-web structure, only baseline information is available and there is no information for Descriptor 9 on Sea-Food contaminants.

The EU Data Collection Framework regulation (DCF, [20]) organises the collection of EU Member States data in the fields of fisheries, biology, ecosystem impacts and socioeconomics to provide the scientific basis for the Common Fisheries Policy (CFP). The DCF makes this data available to end-users under specific procedures. The data are stored, managed and disseminated through different dedicated data bases. Data are Member States proprietary and some are not available publicly, mostly due to their confidential nature. In turn, many DCF data products are publicly available. DCF data provide the main basis for assessments under Descriptor 3 on Commercial Species and have also made important contributions to MSFD Descriptor 1 on Biodiversity and Descriptor 6 on Sea-floor integrity. EMODnet gives access to some of the data made openly available in the context of the DCF, e.g. aggregations of fisheries data that are anonymised and provides important information and integrated data products that can support the provision of scientific advice to the CFP. Both DCF and EMOdnet therefore contribute to MSFD Descriptor 3 on Commercial species.

The Maritime Spatial Planning Directive (MSPD, [16]) aims to sustainably organise sea uses and create transparent planning-at-sea systems, now and in the future. The data and data products made available by EMODnet are coherent with the objectives of MSPD, in terms of implementing an ecosystems approach for the better management of the marine environment and contribute to the sustainable development of the Blue Economy sectors [12, section 7 Coherence]. All the different EMODnet thematic groups contain data that are crucial for the environmental and socio-ecological component of MSPD. In addition, the Human Activities and Biology portals provide data that is essential to the economic and social aspects specified in the objectives. The use of EMODnet data for MSPD has been assessed in detail by other projects, supporting the conclusion that EMODnet is indeed coherent with MSPD.

In December 2020, EMODnet Human Activities, in collaboration with the Commission's Technical Expert Group on data for maritime spatial planning has developed a harmonised nomenclature model, to ensure harmonisation and usability of MSPD data by all potential marine users: policymakers, scientists, private companies and the public. This work built on previous initiatives and research projects such as

the HELCOM-VASAB[10], the maritime spatial planning INSPIRE Data Model [45] and the SIM project [44]. The specific attributes of the maritime spatial plans across EU countries were also taken into account for representation on the EMODnet geoportal. The work of harmonising the Member States maritime spatial plans is currently on-going, but once finalised will allow of consolidated, overall view of the MSPD implementation in Europe.

The EMODnet external evaluation study pointed out that at Member State level, there are differences between governance and organisation in the macro-level and the sub-regional level. Some Member States have developed tools to support their MSPs, but do not directly use EMODnet data, as they are situated at too high a level (macro-scale). This results in some cases in Member States having their own independent and unique small-scale data aggregators [12, section 7 Coherence]. A solution to the need for increased harmonisation may involve EMODnet organising and facilitating interactions with Member States from the same Sea Basin to bring in and harmonise more data from the local scale. The neighbouring Regional Sea Conventions and ICES operate data systems that are already involved in the EMODnet activities.

The objective of the Habitats Directive [27] is to ensure the conservation of a wide range of rare, threatened, or endemic animal and plant species. The data aggregated by EMODnet for Human Activity, Biology and Seabed Habitats is coherent with the implementation needs of these objectives, incorporating even data products on cultural heritage, which is part of the Habitats' Directive [35]. Particularly, EMODnet Seabed Habitats provides a single access point to European seabed habitat data and products by assembling individual point datasets, maps and models from various sources and publishing them as interoperable data products for assessing the environmental state of ecosystems and sea basins. Furthermore, it continues to update the EMODnet broad-scale seabed habitat map for Europe, known as EUSeaMap[11], and makes available the environmental data and models used as inputs to EUSeaMap.

The overarching aim of the European Green Deal [22] published in 2019 is for the European Union to become the world's first "climate-neutral" economy by 2050. It has goals extending to different sectors, including infrastructure, biodiversity, energy, transport, and food[12]. EMODnet is coherent and in support to the objectives of the Green Deal, by providing access to marine data and observations and thus contributing to the knowledge base that can lead to the necessary transitions to achieve them. Marine data in EMODnet: a) contribute to the monitoring of evolution of pollution in EU marine waters (including marine litter); b) provide harmonised data on marine biodiversity and seabed habitats, c) provide the baseline information for the selection of appropriate sites for sustainable, low-trophic level aquaculture and for off-shore renewable energy, d) provide the primary data for the development of climate-related models which can forecast coastal change and access adaptation alternatives, etc. In this regard, EMODnet complies with the green oath to "do no-significant harm" and helps towards responding better to the possibility of actions, activities or investments doing significant harm.

Coherence with international initiatives

EMODnet focuses on the European Seas but is also aggregating and harmonising data coming from neighbouring countries, especially those with which the EU is sharing sea basins. According to the International Ocean Governance Communication in 2016 [46], 'Sound scientific knowledge of the oceans

[10] https://vasab.org/theme-posts/maritimespatial-planning/helcom-vasab-msp-wg/

[11] https://emodnet.ec.europa.eu/en/euseamap-2021-emodnet-broad-scale-seabed-habitat-map-europe

[12] https://ec.europa.eu/commission/presscorner/detail/en/ip_20_17

is crucial to tackling most […] actions successfully and ensuring that resources are used sustainably. It requires considerable investment in assets and equipment. It provides maximum benefit to society if the knowledge and data are shared'. EMODnet is coherent with International Ocean Governance in that it is an example of successful international collaboration (EU Member States achieving interoperability and sharing of marine data), which can be used as a good practice in the wider international landscape of marine in situ data.

Additionally, regarding the United Nation Sustainability Agenda, EMODnet is coherent with the Sustainable Development Goal 14 "Life Below Waters" [13], as it provides data that can contribute to the estimation of the progress of the EU in sub-indicators such as the quality of bathing waters, the marine waters affected by eutrophication and surface seawater acidity. EMODnet also provides data that can be used in the context of the UN Convention for Biological Diversity assessment, as well as the assessments produced from the Intergovernmental Panel for Climate Change (IPCC) and the Intergovernmental Panel for Biodiversity and Ecosystem Services, especially regarding the regional European assessment chapters.

Potential areas where to improve coherence

The external evaluation study identified mainly two areas where the coherence could potentially be improved [12, section 7 Coherence]:

- While the reporting under e.g. MSFD, Habitat's Directive is mandatory, the reporting under EMODnet is on a voluntary basis,
- There is scope for improvement in the coherence between the approaches between the different portals.

4.2 How did the EU intervention make a difference?

Providing harmonized data services EU wide

In the period 2014-2020, EMODnet has assembled fragmented local, regional, and national data in one place and made it accessible through the EMODnet portals. Today, EMODnet provides free and open data in harmonised format of the 27 Member States and other regions in the fields of bathymetry, biology, chemistry, coastal mapping, geology, human activities, physics, and seabed habitats. The justification for acting on EU level is the transnational nature of the challenge, where collaboration across borders and disciplines is required for assembling sea-basin and European seas data. Without EU intervention this data would not be readily available.

Not only EMODnet data are INSPIRE compliant but EMODnet brings further added value to INSPIRE as stated in the their own evaluation report [40]: 'This has been done, for instance, by the marine community whereby over 120 organisations have agreed common standards for distributing geospatial data according to INSPIRE-based FAIR (Findable, Accessible, Interoperable, Reusable) principles through the EMODnet initiative'.

In the public consultation, two thirds of respondents agree that EMODnet allows for consistent standard formats, baselines, and nomenclature.

[13] Goal 14: Conserve and sustainably use the oceans, seas and marine resources (https://www.un.org/sustainabledevelopment/oceans/)

Savings efforts and costs by mutualising data at EU level

If EMODnet would not exist today, an entity who needs to access data such as bathymetry in European sea beds would need to contact each national oceanographic institute (22 EU Member States have access to the ocean / seas), collect the data Member State by Member State, aggregate it having in mind that probably different formats and grids are being used. If another entity would have the same need, it would have to undertake a similar work. In addition, when new data are produced, all this work should be carried out again if the user wants to benefit from the most recent knowledge.

With the EMODnet Bathymetry portal, all this information can be accessed from one web site and once the work is done once, any entity can benefit from what has been done. This is valid for Bathymetry but also for the 6 other Portals: biology, chemistry, coastal mapping, geology, human activities, physics, and seabed habitats. In the case of Biology, for example, in 2019, 88 entities were supplying information.

This constitutes important potential savings of time and resources valued between €29 million and €115 million per year in 2019 (see under section 4.1, Efficiency and effectiveness).

Contribution to EU policies

As demonstrated under section 4.1 'Coherence with other EU policies' EMODnet, in addition of being coherent, contributes to a number of European policies such as the INSPIRE directive [17], the Marine Strategy Framework directive, the Marine Spatial Planning directive [16], the Habitats directive, the Horizon Europe Research and Innovation programme, including the Mission 'Restore our Oceans and Waters by 2030' [20], the EU Digital strategy and the Copernicus marine component of the EU space programme. The network also supports multiple objectives of the European Green Deal [22] and it is supporting the Twin (Digital and Green) transitions.

This is further substantiated under section 4.3 'How EMODnet adapted to the evolutions' which analyses how EMODnet has been able to answer to new needs from successive legislative proposals.

To whom did the intervention make a difference?

The prime entities to whom EMODnet makes a difference are those who are performing the measurements: national hydrographic offices, national or other research centres and academic labs who are performing expensive in situ measurements and survey on water temperature, on pollution on the nature of the sea floor, on habitats, on human activities, etc. While making available their data, they get access to the data of their peers at EU level and can agree on standards.

EMODnet also makes a difference to Member States for some of their reporting obligations. In the context of the Marine Strategy Framework Directive and Descriptor 10 on 'Properties and quantities of marine litter do not cause harm to coastal and marine environment', JRC uses the Chemistry portal to display graphically marine litter data. The Human Activities portal also offers the possibility for Member States to display graphically the type of allocation of their maritime domains in the context of Maritime Spatial Planning.

In the introduction, a few examples of uses cases have been provided to illustrate who uses EMODnet for what. Among users are regional conventions, such as OSPAR, SMEs developing services for their customers, consultancy companies performing studies, entities involved in the development of offshore wind plants, universities and research centers who are not data providers but use the available data for their research and developments and the European Commission itself for some of its policies.

Subsidiarity

In the 2010 impact assessment [12], the subsidiarity argument was substantiated by the transnational nature of assembling data and knowledge across sea basins or at European level. This argument is still valid today.

From the above findings, it is clear that without EMODnet, such a data network would not exist at EU level and stopping the activities would impact readily and directly the benefits listed above.

In the public consultation, 86% of the respondents estimate that EMODnet could not have been setup without EU intervention. This confirms that EMODnet is creating clear additional value compared to a national, regional, or local solution by bringing together a previously fragmented set of data providers.

Another particularity of this action it that Member States do not lose any competence, it is not replacing their actions at national level, nor their capacity to decide on the way they manage data at national level and they do not loose ownership of the data.

4.3 Is the intervention still relevant?

How EMODnet adapted to the evolutions

Since the 2007 communication on Integrated Maritime Policy for the European Union, a number of new legislative initiatives have been introduced and EMODnet evolved to address them, to the extent possible:

- 2008 - Marine Strategy Framework Directive [19]: establishes 11 qualitative Descriptors to assess the Good Environmental Status. The 2017 Commission Decision on good environmental status further defines the criteria elements and the methodological standards on good environmental status, as well as the specifications and standardised methods for monitoring and assessment of state under the MSFD. EMODnet Chemistry has created the methodological protocol for the monitoring of Descriptor 10 on marine litter and is making available the EU harmonised collections. Additionally EMODnet is openly providing harmonised data that the Member States can utilise for their MSFD reporting and that the Commission can use to cross-reference the state of European marine waters. Although the level of use of EMODnet data products for such purposes cannot be fully monitored, the intervention remains relevant, as authoritative, harmonised, quality-controlled data directly related to MSFD are being openly available with no restrictions, for all interested users;
- 2010 - Marine knowledge 2020 – marine data and observation for smart and sustainable growth [3]: EMODnet is acknowledged as one of the EU instruments needed to improve marine knowledge,
- 2014 - Maritime Spatial Planning Directive [16]: EMODnet Human activities, has created a harmonised nomenclature for the MS to use in their maritime spatial plans and is hosting this plans in support of the implementation of the Directive (for the moment of the MS that have submitted plans, aiming to include all, when available),
- 2014 - Innovation in the Blue Economy: realising the potential of our seas and oceans for jobs and growth [7] pursues the goal of ‘marine data is easily accessible, interoperable and free of restrictions on use, with the specific target of developing a multi-resolution map of the entire seabed and overlying water column of European waters by 2020’; the objective is met,

- 2015 - The 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development were adopted by world leaders in September 2015 at an historic UN Summit (Sustainable Development Summit held from 25-27 September at UN Headquarters in New York); they officially came into force on 1 January 2016. EMODnet is and remains relevant to mainly 3 of the UN SDGs. EMODnet Seabed habitats, Chemistry (which include litter) and Biology are providing data and products relevant to SDG 14 Life below water and SGD 13 Climate action. With their mapping of wind offshore plants and power cables and the use of marine space, the EMODnet Human activities is relevant to SGD 7 on affordable and clean energy,
- 2016 - International ocean governance: an agenda for the future of our oceans [46] refers to EMODnet under action 12: A coherent EU strategy on ocean observation, data and marine: Aligning the EU's work with that of its international partners would considerably strengthen the knowledge underpinning ocean governance,
- 2019 - The European Green Deal [22]: a sustainable blue economy will have to play a central role. This will include ways to manage maritime space more sustainably, notably to help tap into the growing potential of offshore renewable energy. Data on offshore wind farm, cables and broader uses of the seas is made available under EMODnet Human activities,
- 2019 - Single Use Plastic Directive [24]: Data on marine plastics are harmonised and made available under EMODnet Chemistry,
- 2020 - The Commission launched under Horizon Europe the EU Missions [21], including "Restore our Oceans and Waters by 2030", in the course of which the Commission will pool its resources together with Member States, regional and local authorities, research institutes, private and financial sector to create real and lasting impact. One of the five objectives of this Mission is the creation of a Digital Ocean and Water Knowledge System – the EU Digital Twin Ocean. It will be key to better understanding the ocean system: integrating existing fields of knowledge, pushing frontiers in biology, and bridging social economy, linking knowledge across disciplines for multiple purposes and uses. EMODnet is one of the key parts of this core digital infrastructure,
- 2021 - A new approach for a sustainable blue economy in the EU transforming the EU's Blue Economy for a Sustainable Future [47] refers to "work to boost the capacity for Copernicus and EMODnet observation, modelling and forecasting to better anticipate the effects of extreme weather events (e.g. floods, storm surges) and regional sea-level rise".

The public consultation also confirmed the relevance of EMODnet with respect to EU policies. A vast majority estimated that it is between very useful to essential:

- 82% for the Marine Strategy Framework Directive,
- 91% for Maritime Spatial Planning,
- 69% to environmental impact assessments,
- 47% to companies offering consultancy for offshore or coastal engineering,
- 74% to the bioeconomy (aquaculture, fisheries etc.),
- 60% to the renewable energy industry.

Are the original objectives and the intervention still relevant?

Recalling the objectives set out in section 2.1 and taking into the evolutions as described in the previous section, the following general objectives are found still very relevant today:

- Underpin EU policies that preserve, protect and improve the quality of the environment: the environment continues to be the subject of changes and threats – many new policy initiatives and legislations have been established in the period 2013-2020 (e.g. MSPD, Green Deal, Single use plastics Directive, etc.) and new initiatives are under preparation (e.g. Revision of MSFD, Climate law, Nature Restoration law, etc.),
- Strengthen the scientific and technological bases of community industry: today, only 20% of the oceans have been mapped – we know more about the surface of the Moon and Mars than our seabed's; needless to say that the remaining knowledge gap is huge,
- Support an open market with free competition: EMODnet has definitely changed the situation and gives access freely and without restrictions to a wide range of data and this should continue,
- Pursue the prudent and rational utilisation of natural resources: the availability of harmonised transdisciplinary marine data, including for geological substances, biodiversity, habitats, is the basis for the developments of adequate management of resources.

The following objectives are relevant per se but EMODnet has made a modest impact on them:

- Support the common transport policy: the amount of data and the use of this data are relatively modest, the vessel density maps are however often consulted,
- Progressively establish an area of freedom, security and justice,
- Increase fisheries productivity,

Regarding the three specific objectives, EMODnet remains very relevant today to all of them. In the context of digitalisation and initiatives such as Destination Earth and the Digital Twin of the Ocean, there is an increasing need for in situ data, reduced operational costs and less delays for those who use marine data. The European Digital Twin of the Ocean will comprise of data, models and tools that will describe every facet of the marine physical, geochemical, biological and social-ecological system and will require a wide range of data as input forces, calibration and validation needs, but also to build and assess what-if scenarios. EMODnet is considered one of the two main pillars upon which the EU DTO data lake will be build, so the coherence with the initiative is obvious. EMODnet is intended to be part of the EU DTO core public infrastructure, which means that many EMODnet data products would be embedded in the core infrastructure, ready to use for any EU DTO related application.

The current energy crisis (REPower EU, [48]) and the global competition of economies do call for action to help private industry compete in the global economy while meeting the challenge of sustainability.

With all the environmental policies which are in place and the upcoming ones, it is more than ever needed to improve the quality of public decision-making at all levels. Coastal protection is an increasing concern owing to the increasing pressure put on their ecosystems by increasing population and activities. The efficient implementation of MSFD still requires an efficient and transparent marine data infrastructure, which will allow at least a level of traceability on the origin and quality of the data used for the assessment of the good environmental state (GES).

The strengthening of marine scientific research remains the foundation on which environmental policies can build while research and innovation is capable of bringing forward solutions to some issues, as for example the ones addressed though the Horizon Europe Mission on Ocean.

If EMODnet was to stop, costs and delay of accessing to data would immediately increase and reduce the competitive advantage of companies who need this data. We have also seen that EMODnet is being increasingly used by public bodies for environmental assessment and this enhances the quality of the decision making.

This is supported by the results from the online survey conducted within the external evaluation study, which suggests that most stakeholders use EMODnet for reasons that correspond to the identified problems and/or needs, e.g.: (1) 90% of the respondents agreed that EMODnet provided them with data they could not otherwise access; (2) 83% agreed that more data are available than before EMODnet existed; (3) 39% think that EMODnet is crucial to their work, another 39% agree that it contributes to their work but is not crucial.

This evaluation study also concludes that the needs and objectives which EMODnet set out to meet remained relevant.

Lastly, relevance assesses whether EMODnet has contributed to meeting overall Commission priorities. The study concludes that EMODnet is relevant, having a special impact on four out of the ten overall Commission priorities: (1) Digital Single Market, (2) Jobs, Growth and Investment, (3) A stronger Global Actor, and (4) Energy Union and Climate.

5 WHAT ARE THE CONCLUSIONS AND LESSONS LEARNED?

5.1 Conclusions

Did the intervention achieve its objectives?

A summary of the strength of the estimated impacts made for the different objectives is provided in Table 4 with an evaluation of the impact made using + for low impact, ++ for medium impact and +++ for high impact. The detailed discussion substantiating this summary follows Table 4.

General objectives	
Underpin EU policies that preserve, protect and improve the quality of the environment	+++
Strengthen the scientific and technological basis	+++
Prudent and rational utilisation of resources	++
Support common transport policy	+
Progressively establish an area of freedom, justice and security	+
Increase fisheries productivity	+
Support an open market with free competition	++

Specific objectives	
1. Reduce operational costs and delays	+++
a) Help private industry compete in the global economy	++
b) Improve the quality of public decision-making at all levels	++
c) Strengthen marine scientific research	+++
2. Increase competition amongst users of marine data	++
3. Reduce uncertainty in knowledge of the oceans and the seas	+++
4. Enhance marine knowledge for maritime surveillance, licensing and fisheries management	+

Operational objectives: Setting up and maintaing at EU level	
1. A catalogue of European marine data collections with common formats and nomenclature	+++
2. A set of complete interoperable layers for European sea basins	+++
3. A user-driven process that determines priorities for the collection and assembly of data	++

Table 4: Summary of the strength of the estimated impacts made for the different objectives

General Objectives

Recalling the objectives set out in section 2.1 and as evidenced under section 4.1 and 4.3, the intervention has made many contributions in the field of EU policies that preserve, protect and improve the quality of the environment such as e.g. MSFD and MSPD. This is logical since most of the data are relevant to the environment [+++].

Compared to 2014, the quantity, accuracy and coherence of the data made available has improved considerably and therefore a strong contribution to the scientific and technology community was made. These are two strong points of the intervention [+++].

Regarding the prudent and rational utilisation of natural resources, as mentioned in Section 3, the data and availability on the seabed has improved greatly. There are now complete seamless digital maps of geological strata, sediments and physical habitats for all European waters using European standards. More data on marine life on the seafloor and water column are now available but the technical challenges in merging such heterogeneous data into a common system means that much remains outside EMODnet, while also EMODnet cannot guarantee uptake of the available data. [++].

Compared to the start of the intervention, EMODnet has considerably improved the situation in terms of free access to data and waived many existing restrictions. This supports an open market with free competition, but one should acknowledge that the focus remains scientific data mostly used by university and research centre laboratories, many of which are publicly funded [++].

Regarding the support to the common transport policy, EMODnet is contributing to stakeholder's awareness under Human activities with for example maps of the traffic on maritime routes. This contribution, while acknowledged as very useful, remains modest [+].

Regarding fisheries productivity, the vast majority of data collection in the EU is taking place under the framework of the Common Fisheries Policy and the Data Collection Framework. As mentioned previously, data are Member States proprietary and some are not available publicly, mostly due to their confidential nature. EMODnet Human Activities and Biology thematic areas mostly provide access to some of the aggregated data that is made publicly available in the context of the DCF, so the contribution to this objective is modest. [+].

EMODnet contributes indirectly to establish an area of freedom and justice by providing free and open access marine observation, data and products to all interested users. Information on the state of the EU marine environment, including information on the Human Activities of the Blue Economy, allow users to be better informed, to be engaged and take action towards the protection, conservation and management of the marine environment and its resources [+].

Specific Objectives

EMODnet is reducing considerably operational costs and delays for those who use marine data and the benefits of the actions exceeds by one order of magnitude its costs (see Section 4.1, “Enhancement of marine innovation”). It has strengthened considerably marine scientific research, and this is attested by the growing number of publications referring to EMODnet [+++].

EMODnet is also serving public decision-making and has continuously adapted to an evolving policy context and needs (see section 4.2, “How EMODnet adapted to the evolution”). The Human Activities thematic area and a specific section for Maritime Spatial Planning is definitely a good achievement and EMODnet data contribute to some of the MSFD Descriptors. As mentioned in section 4.1, “Coherence with other EU policies”, EMODnet provides data that is of interest for 10 of the 11 Descriptors on Good Environmental Status for the Marine Strategy Framework Directive, with a particular strong contribution to Descriptor 10 on Marine Litter covered under the Chemistry thematic area. This supports Member States for their assessment before they upload in the dedicated portal their aggregated information and in some cases their data (WISE-Marine). More data, with a more exhaustive coverage, in full synergy with existing data repository existing in the context of other legislation is needed [++].

EMODnet also helps private industry to access marine data in the EU, provides them with a better position to compete in the global economy and meets the challenge of sustainability. EMODnet is de facto making competition fairer amongst users of marine data by providing wider access to quality-checked, readily available coherent marine data and hence stimulate the development of new innovative services. Numerous examples have been provided under section 4.1, “Enhancement of marine innovation”. This innovation is however difficult to quantify [++].

The reduction of uncertainty in knowledge of the oceans and the seas has been assessed in the external evaluation study to range between 15 and 21% and so provides a sounder basis for managing inevitable future changes. Efforts should be pursued however to improve the geographical coverage [+++].

Regarding maritime surveillance, licensing and fisheries management, the contribution of EMODnet remains modest. EMODnet includes data on traffic but has a limited impact on maritime surveillance. Regarding fisheries management, similarly and for the same reasons explained above regarding the general objective on fisheries productivity, EMODnet also provides a modest contribution [+].

Operational Objective

EMODnet has fully matched its objective of setting up and maintaining a catalogue of European marine data collections with common formats and nomenclature complete with information including geographical location, time of measurement, ownership, precision and accuracy. In addition, this has been achieved in a coherent way across the thematic areas (see the sub sections dealing with coherence under section 4.1) [+++].

EMODnet has been also very successful in providing a set of complete interoperable layers for European sea basins, showing where data are being collected, where the gaps are and providing seamless quality checked data layers (gridded or polygons) for unrestricted public access, see Introduction "What is EMODnet", "What is EMODnet used for") [+++].

EMODnet depends nevertheless on data that is being acquired and has little influence on the quantities which are measured and their coverage. This dimension of a user-driven process that determines priorities for the collection and assembly of marine data and that directs support to those activities that need to be carried out at an EU level in the most appropriate way requires more attention [++].

What has been specific about the role of the EU?

EMODnet like many other EU funded initiatives (e.g. Copernicus) is responding to a market limitation. This document has provided many examples of the contribution of EMODnet to science and research, to environment and climate, to EU policies and also in some case to businesses. However, in many cases, there is today no market which would enable users to bear the costs of the action through for example fees. Nevertheless, it has been shown that the benefits to the EU stakeholders and to the society are valued multiple times the EU funding.

As evidenced in section 4.2, "Subsidiarity", there is no entity better placed than the EU that can steer and finance the gathering at EU level, the access to data and data products and services of interest to EU seas and oceans. It is also of EU interest to make this data available to many communities to assess the state of the seas and the progress made thanks to a number of EU policies. In addition, this action does not interfere with Member States competence and capacities.

5.2 Lessons learned

Are the objectives still valid, is the continuation of the intervention needed?

EMODnet has fulfilled most of its original objectives (Section 5, "Did the intervention achieve its objectives?"), in many instances making a strong impact. At the same time, EMODnet has adapted to evolving needs (section 4.3 "How EMODnet adapted to the evolutions").

With an ever-increasing amount of data and knowledge, ever evolving policy and challenges, it is clear that the need to collect and make accessible fragmented data in a harmonized way across Europe is and will remain relevant (see section 4.3 “Is the intervention still relevant?”).

As shown in Table 3, some of the original objectives have been reached very successfully while the contribution to some other objectives has been very modest. Based on what was learned for the period 2014-2020 and in the context of a follow-up phase these could be revisited based on the following considerations.

1) Giving stronger importance and visibility to those objectives which are still valid, of growing importance and to which EMODnet made a strong impact such as scientific and technological basis, support policies that preserve protect and improve the quality of the environment, reduce operational costs and delays, reduce uncertainty and improve the resolution, expand accessibility to more datasets, both geographically and thematically,
2) Review the areas where little impact was made (e.g. transport, freedom, justice and security) and other initiatives are more efficient and align the objectives with what EMODnet actually contributes to,
3) Reinforcing the effort on areas where the impact was average but where needs remain and should be pursued more efficiently such as in relation to innovation for businesses, fisheries and user driven process to determine priorities, user friendliness of the portal,
4) Answering new areas and new needs which have emerged such as support and develop synergies for the technical reporting for EU policies such as MSPD (in particular off-shore energy) and MSFD, develop blue economy aspects, enhance user friendliness.
5) De facto, EMODnet transnational nature has also establish long-term collaborations across borders and disciplines between lead organisations in the EU, which are required for assembling sea-basin and European Seas data and products and has reinforced the international position of the EU as a strong global actor; these could be made as explicit objectives.

Evaluation of EMODnet benefits

As shown in section 4.1 Efficiency and Effectiveness, EMODnet yields benefits in terms of productivity innovation and reduction of uncertainty. These benefits are of a different nature and quantifying these ex-post without having established a methodology and process to achieve this proved to be difficult. Also, some of the extrapolation results in a very wide range between minimum and maximum benefits.

In all cases benefits exceed investments by far but a more sound and systematic methodology should be put in place ex-ante an evaluation is done and assessed during the functioning and not only ex-post.

Form of funding

As discussed at the end of the section on Effectiveness and efficiency under section 4.1. the progressive evolution and growth of the network resulted in multiple contracts which are not synchronised and operating independently on a contractual point of view.

Other ways of contracting could be investigated. These should potentially keep a competitive dimension for some of the needs but formalises the fact that some specific entities are necessary and cannot be selected on a competitive basis.

The Financial Regulation allows a negotiated procedure where there is a monopoly situation but only for individual entities, rather than groups.

Another alternative could be the creation of a single EMODnet entity with a single long-term contractor that would contract the other services through indirect management. In the case of Copernicus for example, there is a contractual arrangement between the Commission and an entrusted entity, the duration of which corresponds to the Multi-annual Financial Framework. The entrusted entity must of course comply with public procurement rules and issue calls for tender for the services.

Considerations for possible future evolutions

Beyond the benefits already obtained (see table 3), continuing to aggregate coherently more data sources and achieve better spatial and temporal resolution will logically generate new advances and make further impacts on two objectives of the current action: foster innovation and reduce uncertainty.

As identified under "Potential efficiency increases" in section 4.1, IT developments targeting easier accessibility and better user friendliness would improve the overall efficiency, consistency among the thematic areas and coherency with other portals and instruments. Further actions for outreach and engagement would also enable a larger base both to provide and use the data.

The new developments, the associated additional benefits and the broadness of the stakeholders community who will benefit from it will be of course dependent on the budgetary resources that can be allocated. The external evaluation study provides estimates of what can be achieved for different levels of resources see section 4.1 “Implementation and development costs: could it be done with fewer resources ?”

EMODnet origins are in the mutualisation of scientific data relying on a bottom-up approach, structured along thematic areas. Today, more than half of the users are from academic laboratories and research centres. As shown in the subsection "Coherence with EU policies" under section 4.1, we observe an increasing pressure to have data which can be used for policy making such as Descriptors for MSFD or MSPD. In practice, it remains however very difficult to have and to access the data needed for policy making, which often requires Sea basins coverage. In addition of the bottom approach, a top-down approach could also be developed to better answer policy needs.

For example, under the MSFD requirements, Member States often collect data that fall under categories served by EMODnet’s data (e.g. on nutrients, chemicals, habitats) but for the purpose of policy implementation. They submit the results of their assessments in the WISE-marine portal14 as well as some of their primary data collected. Nevertheless, today there is no systematic data exchange process between EMODnet and WISE-marine. A stronger and more systematically organised collaboration between EMODnet and WISE-marine (and thus DG MARE and EEA) would improve the coherence of EMODnet with the MSFD. A better linkage between EMODnet and CMEMS would also mutually reinforce the relevance and pertinence of the two services, EMODnet providing data for validation and calibration and CMEMS delivering information with a coverage that cannot be achieved with in situ measurements.

While EMODnet and DCF have different objectives, they are complementary and developing further synergies can provide mutual benefits and opportunities.

As this has been the case in the period covered by this evaluation, new policy needs will emerge. Today, it can already be anticipated that the development of the Digital Twin Ocean in the context of the Mission on Oceans and its interoperability with Destination Earth in the context of the twin Green and Digital

[14] https://water.europa.eu/marine

transitions, calls for new and more efficient access to data for calibration and validation purposes. The new nature restoration targets under the current proposal for a Nature Restoration Law[15] will also call for data to monitor state of play and progress. Maintaining the capacity of EMODnet to adapt to an ever evolving context is therefore very important for its relevance.

Overall, a reflection should be undertaken on a strategy which defines the future objectives and needs of a continued EMODnet and an assessment of the required resources.

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7 ANNEX I: PROCEDURAL INFORMATION

- *Lead DG, Decide reference:* Directorate-General for Maritime Affairs and Fisheries - PLAN/2017/1441
- *Derogations granted and justification: Not applicable*
- *Organisation and timing:*
  - *17/09/2017: First interservice group meeting (Ares(2017)4470490)*
  - *18/012/2018: Finalisation of the evaluation and fitness check roadmap (Ares(2018)316404)*
  - *06/03/2019 - 29/05/2019: Consultation period [*14*],*
  - *05/05/2020: Publication of the external evaluation study [*12, 13*]*
  - *22/02/2023: Interservice group meeting to present the first draft of the evaluation attended by DG MOVE, ENV, RTD, EEA, JRC, written comments by SG, ENV, MOVE.*
  - *2023- first quarter finalisation of the evaluation*
- *Consultation of the Regulatory Scrutiny Board: Not applicable*
- *Use of external expertise: Public consultation [*14*], external evaluation study [*12*]*

8 ANNEX II. METHODOLOGY AND ANALYTICAL MODELS USED

The methodology used to perform this evaluation is based on the following steps: (1) structuring, (2) data gathering, (3) analysing, (4) judging, and (5) reporting, similar to what was done for the external evaluation study [12]. The structuring of the document follows the standard template provided by the Better Regulation guidelines [8] i.e. (1) the purpose of the evaluation is first described, then (2) the outcome of the intervention at the time of its inception is reminded and (3) the evolution of the situation over the evaluation period described. Then (4) the evaluation findings are presented and (5) the conclusions drawn.

Regarding data gathering, for section (2) (3) and (4), legal texts, policy documents, annual reports, users surveys, impact assessment, public consultation, and evaluations from the inception in 2007 until 2020 have been analysed. These can be found in the section "References".

Sections (3) analysing (4) judging were more specifically based on:

1) an external study on the Evaluation of the European Marine Observation and Data Network (EMODnet) [12]

Between January 2018 and August 2018 was carried out the evaluation of the EMODnet with the purpose to evaluate its performance and functioning. The evaluation was performed according to the evaluation criteria laid out in the Better Regulation Guidelines of the European Commission: Relevance, EU added value, Effectiveness, Efficiency and Coherence. The findings of the evaluation were used to guide activities undertaken in support of marine knowledge of the European Maritime and Fisheries Fund.

2) a public consultation organised by the Commission

The detailed results of the public consultation are provided in Annex V

3) Other documents supporting the evaluation

Annual evaluation reports (e.g. [14],[25],[26])

In addition, the EMODnet secretariat has carried out:

- User surveys have been carried out to capture and analyse the views and experiences of those building EMODnet about difficulties in obtaining data, actual and potential users of EMODnet about user friendliness, impact on productivity, innovation, comparison with other providers, contributors of data to EMODnet about due recognition of contribution, effort involved, users of added-value services based on EMODnet products about impact on productivity, quality of service.
- Quantified statistics on usage (downloads, views etc.) as well as feedback from users,
- Targeted consultations by an external contractor within the above mentioned supporting evaluation study. The answers to the evaluation questions are informed by literature review, desk research, interviews with EMODnet users, EMODnet Secretariat and Thematic Portals' representatives and EU policy experts, as well as a user and supplier survey with 430 responses.

Evaluation of the 5 criteria

In order to determine the relevance, the objectives of EMODnet are compared against the needs/problems that were defined ex-ante and while EMODnet was in effect. The EU added value was determined by assessing the effect of an EU-wide regulation instead of having regulations on Member State (MS) or regional levels. The effectiveness of the data network was determined by assessing the outcomes of EMODnet relative to its objectives focusing on productivity, innovation and uncertainty. Efficiency was determined by an assessment of the costs and benefits related to achieving the desired outcomes. The coherence of EMODnet in relation to other marine observation data networks and among its own portal was determined by assessing the synergies and possible inconsistencies between EMODnet and these networks, and among EMODnet's portals. The sustainability of EMODnet was determined by comparing scenarios for the financing and governance after the financing ends in 2020.

In order to determine the Relevance of EMODnet, the objectives of EMODnet were compared against the needs/problems that were defined ex-ante and while EMODnet was in effect. The EU added value is determined by assessing the effect of an EU-wide regulation as opposed to having regulations on Member State (MS) or regional levels. The Effectiveness of the data network is determined by assessing the outcomes of EMODnet relative to its objectives. Efficiency is determined through an assessment of the costs and benefits related to achieving the desired outcomes. The Coherence of EMODnet in relation to other marine observation data networks is determined by assessing the synergies and possible inconsistencies with these networks. The Sustainability of EMODnet is determined by comparing scenarios for the financing and governance after 2020.

In terms of limitations, one should recognise that the methodology to quantify the benefits has been designed by the external evaluation study i.e. a posteriori. The quantitative values (see Table 3: Cumulated benefits per year according to [12, Table 6-9] are based on interviews and existing literature and yields to a wide range between minimum and maximum values. It would have been better to have defined this at the beginning of the action and collect data more systematically as the project was progressing.

9 ANNEX III. EVALUATION MATRIX AND DETAILS ON ANSWERS TO THE EVALUATION QUESTIONS (BY CRITERION)

Relevance	
EQ1 - To what extent are the problems that EMODnet aims to solve still relevant? EQ2 - Is EMODnet contributing to solving the problems?	
Operationalised EQ	The problems that EMODnet aimed to solve are called the objectives of EMODnet: **1) General objectives:** The general objective is to underpin EU policies that preserve, protect and improve the quality of the environment, pursue the prudent and rational utilisation of natural resources, strengthen the scientific and technological bases of Community industry, support the common transport policy, progressively establish an area of freedom, security and justice, increase fisheries productivity and support an open market with free competition **2) Specific objectives:** **Reduce operational costs and delays** for those who use marine data and therefore; Help private industry compete in the global economy; Improve the quality of public decision- making at all levels and; Strengthen marine scientific research **Increase competitiveness and innovation** amongst users and re-users of marine data by providing wider access to quality-checked, rapidly available, coherent marine data **Reduce uncertainty in knowledge** of the oceans and the seas and so provide a sounder basis for managing inevitable future changes[2]
Indicators/Descriptors	1) Determine how often EMODnet is used on a yearly basis per data portal (8 in total) 2) Determine the advantages from a qualitative point of view of EMODnet data (currently and in the past, to make a comparison possible) 3) Try to extract quantitative indicators related to the 3 objectives of EMODnet 4) Provide insights in the reasons for non-use

Data sources	**1) Desk research** • EMODnet database (number of yearly clicks) 2) **Survey,** ask the following questions to all EMODnet users (only target the EMODnet users): • Can you indicate which databases you used before to gather the data now available by EMODnet? • Can you indicate how much time and costs were involved in gathering the data before EMODnet was active? • Can you indicate how much time and costs there are now associated with data gathering via EMODnet? • Can you indicate which of the below is relevant for the data gathered via EMODnet: i. Higher quality than before ii. More data available than before iii. Data better linked to other data iv. Lowers uncertainty related to the data used before v. Steering innovation within your type of business • What is the main reason you started to use EMODnet in the first place? *i. Suggest to use closed answers: reduce costs, increase innovation, better quality of data, reduce uncertainty in knowledge of Seas and Oceans* • What is the main reason you are still using EMODnet? *i. Suggest to use closed answers: reduce costs, increase innovation, reduce uncertainty in knowledge of Seas and Oceans* • To what extent is EMODnet crucial for your daily work i. Without EMODnet I am not able to perform my work ii. EMODnet is a vital part of my work iii. EMODnet contributes to my work but not crucial iv. EMODnet is a nice asset to have, but without EMODnet I can still do the work without problems v. Without EMODnet no changes in my work are foreseen 3) **Literature review** on previous EMODnet evaluations (PART-2018-32007VI): • Interim Evaluation of the European Marine Observation and Data Network Accompanying the document Green Paper Marine Knowledge 2020: from seabed mapping to ocean forecasting • Ex post evaluation of the transitional financial programme of the Integrated Maritime Policy (IMP) and of two preparatory actions on maritime spatial planning • Interim evaluation of the implementation of the direct management component of the Regulation (EU) No 508/2014 of the European Parliament and of the Council (European Maritime and Fisheries Fund (EMFF) Regulation (Articles 15 and 125)).

	• The new interim evaluation of the direct management component of the European Maritime and Fisheries Fund will run concurrently to this evaluation. (EMODnet is only a small part of that evaluation) • A set of stress tests on marine data were run for the Arctic, Atlantic, Baltic, Black Sea, Mediterranean and North Sea in order to assess the fitness of purpose of Europe's marine data infrastructure. The scope was wider than only EMODnet but the "data adequacy reports" offer useful information on what has been achieved and what needs to be done. • A set of projects are evaluating the adequacy of data for cross-border spatial planning. 4) **Stakeholder interviews** with possible non-users (find these via the EMODnet secretariat, based on the type of users we have identified). Interviews should be targeted at reasons for non-use (unknown/ not useful/ not relevant).
Method	1) Desk research • EMODnet data analysis: Examine the allocation of clicks 2) Survey • Among EMODnet users (only) 3) Literature review 4) Stakeholder interviews with non-users
Stakeholders	1) EMODnet organisation for usage data 2) EMODnet users 3) Possible EMODnet users (but currently non-users)

Expected outcome	• Yearly number of users of EMODnet per data portal (and how this evolves over time) • Indication of time and costs involved in data gathering before EMODnet (extrapolated) • Indication of time and costs involved in data gathering with EMODnet (extrapolated) • Reasons why EMODnet was used in the past • Reasons why EMODnet is still used (and compare this with past reasons) • Added value of EMODnet to the work of stakeholders involved in EMODnet • Insight in (groups of) non users and reasons for current non-use.

European added value	
EQ3. What is the additional value resulting from EMODnet compared to what could be achieved by Member States at national and/or regional levels? EQ4. To what extent do the issues addressed by EMODnet continue to require action at EU level?	
Operationalised EQ	EMODnet is aimed at multiple types of users namely: • private industry compete in the global economy • public decision-making • marine scientific research • civil society • Navy For each of these users the goals are to: • Reduce operational costs and delays • Increase competitiveness and innovation • Reduce uncertainty in knowledge In addition the relevant core objectives of EMODnet stated in the interim evaluation report are: • Collate existing data from public and private organisation relating to the state of maritime basins • Develop, test, operate and maintain a portal allowing public access • Monitor and report on the effectiveness of the system • Improve accuracy, precision, coverage and ease of use of the data • These goals could be achieved on a national level or via alternative databases. However, databased at national level will be aimed at solving national issues or catering to national users (assumption) Therefore we must ask the questions: • Do member states have diverging objectives from EMODnet? • To what extent would the objectives of EMODnet be achieved by Member States (at national and/or regional levels)? • To what extent would the output have been realised without the EMODnet activities?
	• To what extent are other parties willing and capable to offer comparable services like EMODnet? • Is a European action still required to achieve the objectives of EMODnet?
Indicators/Descriptors	1) # of portals/initiatives on a national level NOT included as EMODnet suppliers 2) # of portals/initiatives on an international level (both European and Global) NOT included as EMODnet suppliers 3) Member state objective overview towards marine data gathering 4) Stakeholder interview input on comparability of other portals to EMODnet 5) Review documents of existing alternative portals 6) Alternative approaches to achieving EMODnet addressed issues

Data sources	**1) Desk research** • EMODnet supplier analysis from EMODnet supplier database: list of suppliers, list of possible future suppliers 2) **Survey,** ask the following questions to all EMODnet users (only target the EMODnet users): • Are you aware of any alternative platforms? If yes, which? • Does EMODnet provide you with the required level of detail or do you require additional databases? • Does national data suffice or do you require a larger geographical scope? 3) **Case studies** with all identified user archetypes • In depth discussion on the alternatives of EMODnet • Overview of segments of data used (national, international, cross themes) 4) **Stakeholder interviews:** Ask the following questions to all EMODnet national suppliers • Are you aware of national platforms which offer an alternative for EMODnet? • How do these international platforms compare based on: i. Geographical spread ii. Level of detail iii. Integration with other databases iv. User base 5) **Literature review** • Interim Evaluation of the European Marine Observation and Data Network Accompanying the document Green Paper Marine Knowledge 2020: from seabed mapping to ocean forecasting • Interim evaluation of the implementation of the direct management component of the Regulation (EU) No 508/2014 of the European Parliament and of the Council (European Maritime and Fisheries Fund (EMFF) Regulation • A set of stress tests on marine data were run for the Arctic, Atlantic, Baltic, Black Sea, Mediterranean and North Sea in order to assess the fitness of purpose of Europe's marine data infrastructure. The scope was wider than only EMODnet but the "data adequacy reports" offer useful information on what has been achieved and what needs to be done. • A set of projects are evaluating the adequacy of data for cross-border spatial planning. The one on the Celtic Seas has been completed • National mission statements for improvement of marine data quality • Websites from and documents on existing and planned national portals/initiatives
Method	1) Stakeholder survey among EMODnet users (only) 2) Case studies 3) Survey OR stakeholder interviews with national EMODnet data suppliers 4) Literature review
Stakeholders	1) EMODnet data providers (on national level) 2) EMODnet users
Expected outcome	1) Overview of alternative platforms on national and international level 2) High level benchmark of alternative platforms to EMODnet with regards to available data, geographical spread, and user base (if possible given GDPR) 3) Usefulness of EU involvement in platform 4) National capabilities for platform development

European added value	
EQ5.	Has EMODnet contributed to meeting overall Commission priorities?
Operationalised EQ	The European Commission has several targets (see EU priorities below) to which the EMODnet platform can either directly or indirectly contribute. • To what extent are overall Commission priorities applicable to EMODnet? • To what extent contribute the outcome and results of EMODnet to meeting Commission priorities? • Is there potential to contribute to other priorities in a more active manner?
Indicators/Descriptors	Based on the overall question: To what extent contribute the outcome and results of EMODnet to meeting Commission priorities? The effect of EMODnet on each of the 10 EU priorities will be checked: • Jobs, growth and investment: indication of# of employment generated, indication of effect on investment • Digital single market: indication if EMODnet improves: better access of consumer to online tools, the development of digital solutions, the market as a whole through digital • Energy Union and Climate: indication if EMODnet improves: climate, energy efficiency, safety and innovation • A stronger Global Actor: indication if EMODnet has any impact of the visibility of the EU as global actor on for e.g. nature preservation Priorities not considered: • Internal Market: indication if EMODnet improves the internal market • A deeper and fairer Economic and Monetary Union: indication if EMODnet improves the fairness of the Economic and Monetary Union • A balanced and progressive trade policy to harness globalisation • Justice and Fundamental Rights: indication if EMODnet improves Justice and Fundamental Rights • Migration: indication if EMODnet has an effect on migration policy or management • Democratic Change: indication if EMODnet has any impact of the Democratic values of the EU This results in indicators: 1) Impact on internal market improvement (none - low to high) 2) Impact on job growth (none - low to high) 3) Impact on investment growth in the blue economy (none - low to high) 4) Impact on digital single market (none - low to high) 5) Impact on energy efficiency and climate (none - low to high) 6) Impact on EU as strong global actor in nature conservation (none - low to high)
Data sources	**1)** **Survey,** ask the following questions to all EMODnet users (only target the EMODnet users, using a Likert scale for quantification): • Does EMODnet contribute to any of the following EU priorities: +List of all the priorities with checkbox • Does EMODnet increase the willingness to invest in the Blue Economy cluster • Does EMODnet increase employment in the Blue Economy cluster • Does EMODnet allow/facilitate you to create digital tools • Does EMODnet facilitate you in finding greener, safer solutions 2) **Case studies** with all identified user archetypes • Focussed on perception of EMODnet with regards to relevant indicators • Where possible quantification of indicators (jobs, investments) for basis of extrapolation 3) **Stakeholder interview** with DG Mare • Does EMODnet contribute to the 10 EU priorities?
Method	1) Survey amongst EMODnet users 2) Case interviews with EMODnet users 3) Stakeholder Interviews • DG mare/EC
Stakeholders	1) EMODnet users 2) DG Mare/ European commission
Expected outcome	Qualitative measure of contribution of EMODnet to relevant Commission priorities, where possible supplemented with quantitative Likert scale output

Effectiveness	
EQ 6: What have been the effects in terms of productivity, innovation and reduced uncertainty to industry, researchers, public authorities and civil society? To what extent do these results fulfil EMODnet's original objectives?	
Operationalised EQ	The expected effects (specific objectives) of EMODnet are as follows: 1) Improving productivity in the blue economy: users do not need to make additional measurements or surveys where they had already been made but were previously hidden or inaccessible; it costs less to assemble data from different sources that use similar standards, formats, baselines, and nomenclature. 2) Increasing innovation in the blue economy: the increased access to data allows those other than the holders of data to provide added-value services; new services based on data from different sources become feasible. 3) Reducing uncertainty in the blue economy: data products of higher quality reduce uncertainly in the behaviour of the sea and hence investment risk. In order to ascertain the effects of EMODnet in terms of productivity, innovation and reduced uncertainty to industry, researchers, public authorities and civil society, we will first focus on ascertaining the degree of awareness of EMODnet among its target group, whether public or private bodies, and the actual uptake (i.e. use) of EMODnet among these same stakeholders. Further to this, we will look into the extent to which EMODnet has had an impact by answering the following questions: • To what extent and how has EMODnet had an impact on the work of public and private bodies? Is it useful to their (daily) work? In what way? • To what extent have users (industry, researchers, public authorities and civil society) relied solely on EMODnet for their data requirements? • To what extent are stakeholders other than the holders of data providing added-value services as a result of the data provided by EMODnet? • To what extent have new services been provided as a result of the data provided by EMODnet? • To what extent has EMODnet resulted in a greater ability to forecast marine events and put in place appropriate measures to protect life and property on the coast and offshore? By doing so, we will be able to assess the extent to which EMODnet has achieved its original objectives of reducing operational costs and delays, increasing competitiveness and innovation, and reducing uncertainty in knowledge.
Indicators/Descriptors	The indicators that we will employ to answer the questions listed above are linked to the logic of intervention of EMODnet and are situated at the output, outcome, result and impact levels, as listed below. <u>Output level</u>: 1) Number of thematic portals providing access to marine data. 2) Number of data products created. 3) Number of sea-basin checkpoints 4) Number of EMODnet features/services/initiatives (e.g. data ingestion, data wanted, etc.) <u>Outcome level</u>: 1) Stakeholders' views on the degree to which the sea-basin checkpoints adequately assess the availability and fitness for purpose of marine data in different regions. 2) Stakeholders' views on the degree to which the Central Portal provides access to data from all the thematic portals. 3) Stakeholders' views on the degree to which it is possible to retrieve data layers from multiple portals at the same time. 4) Stakeholders' views on the degree to which the Ingestion Portal facilitates the submission of new datasets. 5) Stakeholders' views on the degree to which the EMODnet Secretariat ensures coherence between the different strands; disseminates results, and analyses user feedback and statistics. <u>Result level:</u>

	1} Degree to which public/private bodies are making use of the data. 2) Degree to which there are variations in the levels of use of the data across the eight thematic portals. 3} Degree to which users and other stakeholders provide (innovative} examples of how the data is being used. 4) Degree to which there are variations in how the data is being used across the eight thematic portals. 5) Degree to which users assess that EMODnet has had impact on their (daily} work and provide examples of this. 6} Public/private users' views on the degree to which they relied solely on EMODnet for their data requirements, i.e. they have not had to undertake additional measurements or surveys? 7} Public/private users' views on the extent to which stakeholders other than the holders of data are providing added-value services as a result of the data provided by EMODnet. Degree to which concrete examples are provided of such added-value services. 8} Users and other stakeholders' views on the extent to which new services been provided as a result of the data provided by EMODnet. Degree to which concrete examples are provided of such new services. 9} Users and other stakeholders' views on the extent to which EMODnet has resulted in a greater ability to forecast marine events and put in place appropriate measures to protect life and property on the coast and offshore. Degree to which concrete examples are provided. <u>Impact level:</u> 1} Degree to which evidence of the uptake of EMODnet by public and private demonstrates its contribution to its specific objectives of reduced operational costs and increased productivity; greater competition and/or innovation in the blue economy; and/or to reduced uncertainty and investment risk in the blue economy.
Data sources	1} **Desk research and data analysis** • Monitoring data on outputs: o Number of thematic portals providing access to marine data o Number of data products created o Number of sea-basin checkpoints o Number of features/services/initiatives offered • Monitoring data on usage: o Number and type of registered users (overall and per thematic portal} o Number of non-users among the stakeholder audience o Number of views and downloads on website o Results of completed pop-up forms/questionnaires on planned usage of downloaded data o Results of website user survey • Monitoring data on fitness for purpose of data: o Stress tests and data availability reports of the six sea basin checkpoints • Monitoring data on feedback: o Users of thematic groups, MS Expert Group, UK House of Lords EU Committee, Agriculture, Fisheries, ENV and Energy sub-committee, EU Regional Marine Cooperation o Data on use cases from EMODnet website/"Study to support impact assessment for marine knowledge" 2} **Survey/Stakeholder interviews with registered users (public/private} of EMODnet data (primarily), but also from the EMODnet organisation and data suppliers:** • To what extent do the sea-basin checkpoints adequately assess the availability and fitness for purpose of marine data in different regions? How could this be improved? (Interviews - EMODnet organisation, data suppliers) • To what extent does the Central Portal provide access to data from all the thematic portals? How could it be improved? (Interviews - EMODnet organisation, data suppliers} • To what extent is it possible to retrieve data layers from multiple portals at the same time? How could this be improved? (Interviews - EMODnet organisation, data suppliers} • To what extent does the Ingestion Portal facilitate the submission of new datasets? How could it be improved? (Interviews - EMODnet organisation, data suppliers} • To what extent does the EMODnet Secretariat ensure coherence between the different strands; disseminate results, and analyse user feedback and statistics? How could it be improved? (Interviews - EMODnet organisation, data suppliers}

- Have you ever made use of EMODnet data? If so, what type of data do you use, i.e. from which thematic portal? (Survey/Interviews - users)
- For what reason(s) do you make use of EMODnet data? (Survey - users, multiple options possible)
    - Reliable data
    - Complete data
    - Interlinked data
- How frequently do you use EMODnet data? (Survey users, Closed question)
- How do you use EMODnet data? In what situations has it been most/least useful and why? (Interviews-users)
- To what extent is EMODnet crucial for your daily work? (Survey-users, Closed question)
    - Without EMODnet I am not able to perform my work
    - EMODnet is a vital part of my work
    - EMODnet contributes to my work but not crucial
    - EMODnet is a nice asset to have, but without EMODnet I can still do the work without problems
    - Without EMODnet no changes in my work are foreseen
- Has EMODnet had an impact on your (daily) work? If so, how? If not, why not? (Interviews - users)
- To what extent has EMODnet reduced the costs for your company/organisation to assemble data from different sources that use similar standards, formats, baselines, and nomenclature? (Survey - users, closed)
- Can you indicate how much time and costs were involved in gathering the data before EMODnet was active? (Interviews - users)
- Can you indicate how much time and costs there are now associated with data gathering via EMODnet? (Interviews - users)
- To what extent have you relied solely on EMODnet for your data requirements, i.e. you have not had to undertake additional measurements or surveys to complement its data? (Survey-users, closed)
- To what extent has EMODnet allowed you access to data that you would otherwise not have had access to or have had difficulty accessing? (Survey-users, closed)
- To what extent have you used EMODnet data to provide new services to your own customers? To what extent has EMODnet data allowed you to provide services that you would otherwise not have been able to provide to your own customers? ((Survey-users, closed/interviews-user) Please provide examples. (Interviews-users)
- To what extent has EMODnet made it more feasible than in the past to develop new services based on data from different sources? (Survey, interviews - users) Please provide concrete examples. (Interviews-users)
- To what extent has EMODnet resulted in a greater ability to (1) forecast marine events, (2) put in place appropriate measures to protect life and property on the coast, (3) put in place appropriate measures to protect life and property offshore. (Survey/interviews- users) Please provide concrete examples. (Interview-users)
- To what extent has EMODnet (1) reduced your operational costs, (2) increased your productivity, (3) created greater competition, (4) steered innovation in your organisation/company, (5) reduced uncertainty in the behaviour of the sea, (6) reduced investment risk in the blue economy? (Survey, closed/Interviews -users) Please provide concrete examples of how it has done so. (Interviews-users)

3) **Case studies of 12 archetypes** of EMODnet users to gather more in-depth data on:

- Differences in degree and types of use across different stakeholder types, thematic portals and reasons for this
- Time and costs involved in gathering the data before EMODnet was active/via EMODnet, including:
    - Estimated cost of additional measurements or surveys undertaken prior to EMODnet when they had already been made but were previously hidden or inaccessible, and which are now available via EMODnet
    - Estimated cost savings related to increased facility to assemble data from different sources that use similar standards, formats, baselines, and nomenclature.
    - Number and value of added-value services provided by those other than the holders of data
    - Number and value of new services developed thanks to EMODnet data

Method	l} Desk research and data analysis 2) Surveys 3} Stakeholder interviews 4) Case studies of EMODnet user archetypes 5) Drawing on the survey, interviews and case studies seek to provide a quantitative estimate of the impact of EMODnet for each archetype of use, including quantification in euro of the benefits where data is available 6} Through extrapolation, provide a consolidated figure of the impact of EMODnet on the EU as a whole. Extrapolation will be done based on estimates of the population of actual and potential users. Such estimates will be derived from a combination of available data on the use of EMODnet (user statistics and web analytics} and stakeholder opinions on the level of awareness and penetration of EMODnet. The latter will be gathered through the survey, as well as additional interviews with EMODnet participants and other stakeholder organisations as necessary.
Stakeholders	l} Users of EMODnet in particular, whether • public or • representatives of industry, researchers, • public authorities • civil society. 2) DG Mare; 3} EMODnet organisation
Expected outcome	Understanding of *how* EMODnet is being used by the European marine community and *what* the impact is on productivity, innovation and reduced uncertainty through: • Yearly number of users of EMODnet per data portal (and how this evolves over time} • Trends in the differences in use by user type, across different portals • Indication of time and costs involved in data gathering before/ with EMODnet (extrapolated} • Where possible, quantification/monetisation of the effects on EMODnet in terms of the provision of value of added-value services by those other than the holders of data and new services developed thanks to EMODnet data • Estimate of the effect of EMODnet at EU level for each type of use-case, and then as a whole through extrapolation

Effectiveness	
EQ 7: What are the factors influencing the achievements of the objectives set by EMODnet?	
Operationalised EQ	In order to assess the factors influencing the achievements of these objectives, we will seek to identify the factors internal to EMODnet and external to it that have had an impact on the degree to which it meets its objectives. We will use the following questions as a basis to do so: • What internal factors have negatively/positively influenced EMODnet's ability to meet its objectives of reducing operational costs and delays, increasing competitiveness and innovation, and reducing uncertainty in knowledge? o To what extent is the data on EMODnet accessible? o To what extent is the data clear? Are sources clear? Are gaps clearly identified? o To what extent is the data contained on EMODnet of high quality (i.e. complete, standardised/comparable/interoperable}? o To what extent has the quality assurance process employed by EMODnet led to high quality content (i.e. complete, standardised/comparable/interoperable}? How could it be improved? o To what extent has EMODnet resulted in data products of a higher quality than what was available in the past? • What external factors, if any, have negatively/positively influenced EMODnet's ability to meet its objectives of reducing operational costs and delays, increasing competitiveness and innovation, and reducing uncertainty in knowledge? o To what extent is EMODnet a user-driven process in terms of priority setting for the gathering and assembly of marine data? o To what extent are public/private bodies able/willing to provide data? o To what extent is the data provided fit for purpose?
Indicators/Descriptors	**Result level - internal factors:** • Public/private users' and other stakeholders' assessment of the degree to which the data is clear (i.e. identification of sources and gaps} and extent to which there has been an evolution in this over time.

	• Public/private users' and other stakeholders' assessment of the degree to which the data is complete (i.e. transboundary and multi-disciplinary; includes data from the public and private sectors (e.g. data generated through EU research grants, non-confidential private data arising from licensing requirements and environmental impact assessments); and offers full coverage of the necessary themes through its 8 portals) and extent to which there has been an evolution in this over time. • Public/private users' and other stakeholders' assessment of the degree to which the data is standardised/ comparable/ interoperable across European sea basins (i.e. use of consistent standards, formats, baselines, nomenclatura) and extent to which there has been an evolution in this over time. • Assessment of the quality assurance process and degree to which it contributes to data quality. • Public/private users' and other stakeholders' assessment of the degree to which there are variations in data quality across the eight thematic portals, depending on the indicators concerned and/or depending on the data products concerned. **Output/result level - external factors:** • Users' views on the extent to which they are involved in priority setting for the collection and assembly of marine data on EMODnet. • Data providers and potential data providers' views on their ability and willingness to provide data that is fit for purpose (i.e. complete, comparable). • Degree to which checkpoints positively assess the availability of data and degree to which it is fit for purpose in the six sea basins. • Stakeholders' views on data providers and potential data providers' ability and willingness to provide data that is fit for purpose (i.e. complete, comparable).
Data sources	**1) Literature review:** • Review of quality assurance processes. • Review of user-friendliness of EMODnet. 2) **Desk research and data analysis** • Monitoring data on fitness for purpose of data - Stress tests and data availability reports of the six sea basin checkpoints • Monitoring data on feedback- users of thematic groups, MS Expert Group, UK House of Lords EU Committee, Agriculture, Fisheries, ENV and Energy sub-committee, EU Regional Marine Cooperation 3) **Survey/Stakeholder interviews** with registered users (public/private) of EMODnet data: • To what extent is the data on EMODnet clear? Are data sources clearly identified? Are data gaps clearly identified? (Survey/Interviews) Has there been an evolution in the clarity of data over time? How could it be improved? (Interviews) • To what extent is the data on EMODnet complete? Is the data transboundary and **multi-**disciplinary? To what extent does it include data from all relevant sources (e.g. private, public, data generated through EU research grants, non-confidential private data arising from licensing requirements and environmental impact assessments)? (Survey/Interviews) Are there any gaps in the data sources? If so, why? (Interviews) • To what extent does the data on EMODnet offer full coverage of the necessary themes through its 8 portals? (Survey/Interviews) What other themes, if any, should it cover? To what extent has there been an evolution in the completeness of the data over time? (Interviews) • To what extent is the data on EMODnet standardised/ comparable/ interoperable across European sea basins? Are consistent standards formats, baselines, and nomenclatura being used? (Survey/Interviews) To what extent has this changed over time? (Interviews) • Are there differences in the quality (i.e. completeness, standardisation, interoperability) of the data available on the eight thematic portals? If so, why is this the case? (Interviews) Note: Only ask if aware of more than one thematic portal. • Have you ever used EMODnet services to locate data you needed but was not available on the platform? If so, did they manage to find the data you were looking for? (Survey) • Have you been involved in priority setting for the collection and assembly of marine data on EMODnet? If so, in what way? Have you ever used EMODnet services to locate data you needed bur was not available on the platform? If so, did they manage to find the data you were looking for? (Interviews) • What key internal/external factors affect the completeness and comparability of data available on EMODnet? Prompts: Ability and willingness of data providers to share data, issues linked to standardisation etc. (Interviews)

4) **Survey/Stakeholder interviews** with data suppliers

- To what extent is the data you supply to EMODnet standardised/ comparable/ interoperable across European sea basins? (Survey/Interviews} Do you use standard formats, baselines, and nomenclatura? If so, which? (Interviews}
- What do you see as the main barriers, if any, to supplying data to EMODnet for data holders like yourself? How can these be overcome? (Interviews}
- To what extent is the data available on EMODnet standardised/ comparable/ interoperable across European sea basins? Are consistent standards formats, baselines, and nomenclatura being used? (Survey/Interviews} How could this be improved? (Interviews}

5) **Stakeholder Interviews** with representatives of checkpoints on data availability and fitness for purpose:

- To what extent is the data on EMODnet complete? Is the data transboundary and multi-disciplinary? To what extent does it include data from all relevant sources (e.g. private, public, data generated through EU research grants, non-confidential private data arising from licensing requirements and environmental impact assessments}? Are there any gaps in the data sources? If so, why?
- To what extent is the data on EMODnet standardised/ comparable/ interoperable across European sea basins? Are consistent standards formats, baselines, and nomenclatura being used? To what extent has this changed over time?
- Are there differences in the quality (i.e. completeness, standardisation, interoperability} of the data available on the eight thematic portals? If so, why is this the case?
- What key internal/external factors affect the completeness and comparability of data available on EMODnet? Prompts: Ability and willingness of data providers to share data, issues linked to standardisation etc.

6} **Stakeholder interviews** with EMODnet secretariat on data gathering process and quality assurance processes

- Please describe the process used to gather data. What would you say are its main strengths and weaknesses?
- What means, if any, do you employ to ensure the quality of the data provided by data suppliers? How well does this work? What more could be done?
- What means, if any, do you employ to ensure the quality of the data available on EMODnet? What more could be done?
- To what extent is the data on EMODnet complete? Is the data transboundary and multi-disciplinary? To what extent does it include data from all relevant sources (e.g. private, public, data generated through EU research grants, non-confidential private data arising from licensing requirements and environmental impact assessments}? Are there any gaps in the data sources? If so, why?
- To what extent is the data on EMODnet standardised/ comparable/ interoperable across European sea basins? Are consistent standards formats, baselines, and nomenclatura being used? To what extent has this changed over time?
- Are there differences in the quality (i.e. completeness, standardisation, interoperability} of the data available on the eight thematic portals? If so, why is this the case?
- What key internal/external factors affect the completeness and comparability of data available on EMODnet? Prompts: Ability and willingness of data providers to share data, issues linked to standardisation etc.?

7) **Stakeholder Interviews** with stakeholder platforms or industry organisations to assess awareness of EMODnet

- To what extent are you/your members aware of EMODnet? If so, where did you first hear about it?
- Have you ever visited the EMODnet platform? If so, to what end?
- Have you ever recommended EMODnet to one of your members?
- Have you ever made use of EMODnet data? If so:
    - To what extent is the data on EMODnet complete? Is the data transboundary and multi-disciplinary? To what extent does it include data from all relevant sources (e.g. private, public, data generated through EU research grants, non-confidential private data arising from licensing requirements and environmental impact assessments}? Are there any gaps in the data sources?
    - To what extent does the data on EMODnet offer full coverage of the necessary themes through its 8 portals? (Survey/Interviews} What other themes, if any, should it cover? To what extent has there been an evolution in the completeness of the data over time? (Interviews}

	○ To what extent is the data on EMODnet standardised/ comparable/ interoperable across European sea basins? Are consistent standards formats, baselines, and nomenclatura being used? (Survey/Interviews) To what extent has this changed over time? {Interviews) ○ Are there differences in the quality (i.e. completeness, standardisation, interoperability) of the data available on the eight thematic portals? If so, why is this the case? (Interviews)
Method	1) Focus on why impacts are achieved (or not) 2) Assess the internal and external factors influencing the achievements of EMODnet, in relation to • Supply of data (user-driven process) • Quality of data • Accessibility of data • Uptake (awareness and use) - (covered under EQ6) 3) Literature review 4) Desk research on monitoring data 5) Expert review of quality assurance processes; review of user-friendliness 6) Survey of users and data suppliers 7) Stakeholder interviews with users, data providers and stakeholder platforms or industry organisations
Stakeholders	1) Registered users (public/private) of EMODnet data 2) Data suppliers 3) Representatives of checkpoints on data availability and fitness for purpose 4) EMODnet secretariat on data gathering and quality assurance processes
Expected outcome	Understanding of why impacts on productivity, innovation and reduced uncertainty are being achieved (or not) through: • An overview the various measures and actions taken in 2014-2018, their degree of achievement according to plans, and their contribution towards the operational objectives of EMODnet. As suggested in the ToR, it will be based on a sample of measures / actions. • An assessment of EMODnet performance in terms of data supply, data quality/accessibility, and use. • Identification of internal and external factors affecting the data supply, data quality/accessibility, and use

Efficiency	
EQ8: What are the costs associated with the functioning of EMODnet?	
Operationalised EQ	• What are the in-cash contributions (if any) and in-kind contributions (e.g. related to the standardisation of the data received) related to the operation of EMODnet? • What are the investment and operational costs associated with EMODnet? ○ How have these costs evolved over time? ○ How are these costs distributed (e.g. per type of task undertaken, per thematic portal, per product type)?
Indicators/Descriptors	<u>In-cash and in-kind contributions</u> 1) Amount of in-cash contributions (annual, over time, in% of total) 2) Amount of in-kind contributions (annual, over time, in% of total) • Goods, like computers, software per supplier • Services, like administrative/financial support, data optimization • Expertise, like legal, tax, or business advice; marketing and website development; and strategic planning <u>Investment and operational costs</u> 3) Amount of monetary investment costs (annual, over time, in% of total) 4) Amount of monetary operational costs (annual, over time, in% of total) Amount of other costs (annual, over time, in% of total)
Data sources	1) **Literature review:** • EMODnet Annual Reports (e.g. for 2017 http://www.emodnet.eu/sites/emodnet.eu/files/public/Annual_report_2017/booklet_emodnet_Annual_report_15May2018_web%20(1).pdf) for budget overview of funding/costs and an initial breakdown of the costs

	• Meeting minutes for EMODnet Steering Committee meeting concerning budget/tinancials • Meeting minutes for budget/financial meetings between the Head of EMODnet Secretariat, EMODnet controlling, EU Purchasing/Funding and EMODnet Policy Officer • EU Procurement Documents/ Open calls for tender documents • Maritime Policy Fund documents • EMFF documents 2) **Stakeholder interviews:** • Responses of EMODnet Secretariat/Controlling to the following interview questions: o Do you receive in-cash or in-kind contributions? If yes: What are they? How high are they? How have they evolved over time? o Are all costs displayed in the budget of the Annual Reports? o Which costs are in investment and which operational costs? o Which costs are summarized in the bucket secretariat? What are the sub-categories? And how high are the costs per sub-category? o How have the costs evolved over time? Are there any anomalies and if yes, why so? 3) **Desk research and data analysis** • Investment and Operational cost per subcategory and evolution over time • Proportionality of users per portal to investment and operational costs per portal and its evolution over time • Validation and enrichment of quantitative analysis with stakeholder interview responses • Analysis of multiplyer of costs based on usage of platform (or e.g. cost increase per 100 users extra) and trend forecast till 2025 • EMODnet users and providers statistics per portal • Preparational spreadsheets and controlling data for the EMODnet Annual Report Budgets detailing out costs
Method	<u>In-cash and in-kind contributions</u> • High level quantification of in kind contributions • Analysis of quantitative in-cash contribution data since inception of EMODnet and validation of quantitative data in stakeholder interviews <u>Investment and operational costs</u> • Define investment cost categories o Hardware (servers) o Software (website, standardization tools, etc.) o Configuration (IT contractor fees) o Setup (Hardware and IT contractor fees) • Define operational cost categories o FTEs, o Maintenance o Standardization o Quality control o Data storage • Define further separation of cost categories: o Thematic portal o Product type o Type of task undertaken (e.g. central services, checkpoints, observations, studies, thematic lot) • Identify relevant documents to obtain investment and operational costs per cost category and/or subcategories • Conduct additional interviews with EMODnet Secretariat/Controller if needed to validate findings • Analyse quantitative and qualitative data • Identify findings around evolution of costs
Stakeholders	1) EMODnet Secretariat 2) EMODnet Controlling
Expected outcome	<u>In-cash and in-kind contributions</u> • List of in-cash and in-kind contributions (if any) <u>Investment and operational costs</u> • Distribution of Annual Report Grand Total in investment costs and operational costs and its cost categories (also% of total)

	• Assessment of (Un-)Proportionality of costs versus increase in data users/providers per thematic portal/product type/task undertaken

Efficiency	
EQ9: What factors influence the efficiency of EMODnet's operation?	
Operationalised EQ	• What internal and external factors influence the efficiency of EMODnet's operation?
Indicators/Descriptors	List of possible factors Internal factors: 1) IT o Software 2) Hardware o Bugs/Errors/System breakdowns o Maintenance o Support 3) Number of FTE involved 4) Processes o Coordination with data providers o Coordination with data users o Coordination with national data centres o Internal coordination o Support processes o Data structuring o Data cleaning o Data storing List of possible external factors: 1) Data providers: o Data quality o Standards/Formats o Number of providers 2) Users: o Amount of users o Frequency of usage o Benefits of usage o Different types of users (typology of users) 3) Other: o International, national legislation and organizational policies o Privacy/Security
Data sources	1) **Stakeholder interviews:** • EMODnet organisation (Head of EMODnet Secretariat, EMODnet central portal, EMODnet IT Support, EMODnet Data Ingestion Portal, EMODnet Checkpoint Leads) o What are the main factors influencing the efficiency of EMODnet's operation? o How do they influence the efficiency of EMODnet's operation? • EMODnet National Data Centres and related organizations o What are the main factors influencing the efficiency of EMODnet's operation from the perspective and work of the national data centres? o How do they influence the efficiency of EMODnet's operation? 2) **Literature review:** • EMODnet Annual Reports • EMODnet meetings minutes • EMODnet Thematic group meeting minutes • EU policy documents in relation to privacy and data security legislation (international, national) • Maintenance/service provider bills from purchasing office 3) **Desk research on EMODnet database:** • Database statistics on access time, memory utilization, shutdowns, errors, data ingestion errors, failures, download speed
Method	1) Stakeholder interviews with EMODnet organisation (incl. data centres) 2) Desk research for identified factors from interviews 3) Review of EMODnet database statistics for identified factors from stakeholder interviews

Stakeholders	3) EMODnet organisation • Head of EMODnet Secretariat • EMODnet central portal • EMODnet IT Support • EMODnet Data Ingestion Portal • EMODnet Checkpoint Leads 4) EMODnet national data centres
Expected outcome	• List of internal and external factors influencing the efficiency of EMODnet's operation

Criterion: Efficiency	
EQ10: To what extent are the costs and effects proportionate? Is there any potential for simplification?	
Operationalised EQ	• Which of EMODnet's activities are particularly contributing to the costs of EMODnet? Are such costs justified by relative to the benefits? • Which factors determine costly or complex activities? Why? • Which stakeholders' perspective around simplifications are suggested?
Indicators/Descriptors	1) Costs (or percentage of total) per identified factor influencing the efficiency of EMODnet's operation 2) EMODnet's activities are particularly contributing to the costs of EMODnet 3) Benefits per cost item/activity of EMODnet in terms of • Output • Outcomes • Results • Impact 4) Relative impact of costs to effects • Assessment per activity (based on a list of activities): o Could same benefits be achieved for less costs? o Could more benefits be achieved for same costs? • Comparison amongst same activities for different portals/activities (accumulated, over time) • Comparison per portal over time • Comparison with best practices from other EU portals (EQ 12) • Comparison with best practices from other non-EU portals (EQ 11) 5) Proportionality of benefits to the costs (efficiency) per identified activity/factor by mutual comparison 6) Reasons (stakeholders' views) for costly or complex activities and potentials for simplification
Data sources	1) **Literature review:** • Results from previous evaluation questions: o Costs and cost breakdown (Output EQ8) o Factors influencing efficiency of EMODnet's operations (Output EQ9) o Benefits per cost item/activity/factor (Output EQ6+7) on different levels (defined in data sources part from EQ6+7): ▪ Output (narrow sense of efficiency: input vs. output) ▪ Outcomes (wider sense of efficiency: input vs. outcomes) ▪ Results (wider sense of efficiency: input vs. results) ▪ Impacts (widest sense of efficiency: input vs. impacts) 2) **Desk research** • Analysis of costs per identified activity to determine which of EMODnet's activities are particularly contributing to the costs of EMODnet (ranking by costs) • EMODnet database statistics/KPIs for functionality: o Access time o Memory utilization o Shutdowns/bugs/errors and time to resolve o Data ingestion errors/failures o Download speed availability 3) **Stakeholder interviews:**

	• EMODnet organisation: Head of Secretariat, EMODnet Controlling, EMODnet Central Portal/IT, EMODnet Portals, EMODnet Checkpoints, EMODnet Data Ingestion Portals, EMODnet Thematic Groups: o Which activities are the most costly or complex for you? o What are in your opinion the largest benefits? Can these be quantified? ▪ Could the same benefits be achieved for less costs? ▪ Could more benefits be achieved for the same costs? o Do you see other inefficiencies for EMODnet? o Can you explain the inefficiencies and do you have suggestion how to resolve these? o What are the lessons learned over time to improve efficiency? o Have you received any feedback from end-users regarding features that they find particularly facilitates the use of EMODnet? ▪ Ease of use ▪ Layout ▪ Metadata standards • Registered users (public/private) of EMODnet data: o Are there features that particularly facilitate the use of EMODnet? ▪ Ease of use ▪ Layout ▪ Metadata standards ▪ Data standards o Is there the possibility for simplification? If yes, where and how? o Are there features which you do not use or hamper your use of EMODnet? o Are there features which could be offered or replacing/upgrading existing functionality which would increase your use of EMODnet?
Method	1) Literature review including results from previous EQ 6+7 on benefits and EQ8 on costs 2) Desk research being quantitative data from EMODnet database for user statistics 3) Stakeholder interviews
Stakeholders	1) EMODnet organisation: • Head of EMODnet Secretariat (high-level) • EMODnet Controlling/Finance • Central Portal Manager/IT • Thematic groups • Data Centres • Checkppoints • Portals • Data Ingestion Portal 2) Registered users for survey/stakeholder interviews
Expected outcome	1) Cost-benefit overview for EMODnet activities 2) List of identified (non-)proportionalities of cost and benefits for EMODnet activities in terms of: • Could same benefits be achieved for less costs? • Could more benefits be achieved for same costs? • Comparison (also over time) for portals and initiatives 3) List of suggested simplifications and registered user desires to improve efficiency

Efficiency	
EQ 11: Could approaches used in other EU instruments (Copernicus, the Data Collection Framework for Fisheries, GEO, INSPIRE, etc) improve efficiency?	
Operationalised EQ	• Are there any good practices/ approaches used in other instruments (e.g. Copernicus, the Data Collection Framework for Fisheries, GEO, INSPIRE, etc) which contribute positively to their efficiency? • Could these approaches be used in EMODnet to improve efficiency? • Are there practices/ approaches used in other instruments that have been identified as inefficient? If so, what means have been employed to resolve this issue?
Indicators/Descripto rs	1) Evidence of good practices and approaches which contribute positively to the efficiency of other instruments. 2) Examples provided by stakeholders of good practices and approaches which contribute positively to the efficiency of other instruments.

	3} Examples of solutions employed to address inefficient practices in other instruments. 4) Assessment by stakeholders of the degree of applicability of the good practices and approaches identified to EMODnet.
Data sources	**1) Literature review** • European Environment Agency (2014} Mid-term evaluation report on INSPIRE implementation: Joint EEA-JRC report. [Online]. Luxembourg, Publications Office. Available at: http://bookshop.europa.eu/uri?target=EUB:NOTICE:THAK14017:EN:HTML. • European Commission {2017} Interim evaluation of Copernicus final report. [Online]. Available at: https://publications.europa.eu/ en/publication-detail/-/publication/86fe47d6-c501-1le 7-9b01-0laa 75ed71a 1/language-en. • European Commission {2018} *Scientific, Technical and Economic Committee for Fisheries (STECF) - Evaluation of DCF 2017 Annual Reports (STECF-18-10}.* [Online]. Available at: https:// stecf.j rc.ec.euro pa.eu/ documents/ 43805/2086501/STECF-18-l0+Evaluation+of+DCF+2017+Annual+Re ports.pdf. • European Commission (2015} Fisheries Data Collection Framework: The DCF Reporting and Implementation Cycles and the Data End-user [Online]. Available at: http://publications.jrc.ec.europa.eu/repository/bitstrea m/JRC97782/def_enduse_feedbac k.pdf. • European Commission (2018} Study to support the review of Directive 2003/98/EC on the re-use of public sector information [Online]. Available at: https://publications.euro pa.eu/ en/publication-detai1/-/publication/ 45328d2e-4834-1le8-beld-0laa75ed71a 1/language-e n. 2} **Stakeholder interviews** with other platforms • Can you briefly explain how data is ingested, processed, and distributed on this platform? • What do you see as the main strength and the main weakness of [the portal in question]? • Has [the portal in question] undergone any changes in its working practices that has made their data ingestion process more efficient? If so, please expand. • Can you identify any working practices in [the portal in question] that are currently inefficient (e.g. duplication}? If so, has any measures been put in place to address this issue? • Can you give examples of best practices in the data ingestion process? o Methods of data delivery from provider to platform (e.g. metadata model, aggregation chain} o Operation of, and communication via, a help-service for providers o Identification and marketing to engage new data providers (as well as incentivising them to do so} o Distribution of data to end-users o Quality assurance process o Automation in the data delivery process • Have you received any feedback from end-users regarding features of your portal that [e.g. Copernicus] they find particularly facilitates their access to the portal's data? o Ease of use o Layout o Metadata standards o Data standards
Method	1) **Desk research** • In line with EQ14, map out the scope of similar instruments: o Long list of instruments and frameworks of potential relevance to learn lessons applicable to EMODnet is first developed. This will ensure that a sufficient breadth of instruments are considered o Screening of instruments for relevance via information accessible on the instrument's websites. o Shortlist of 4-6 instruments developed that will be reviewed somewhat more in depth. Specifically, the working processes of other instruments will be mapped in such a review, covering the data ingestion and distribution processes. o Mapped table of not more than 1 page per instrument. In context of EQll, such a review will underpin the judgement of the extent to which approaches in other EU instruments are applicable to EMODnet. • To further investigate sources of efficiency gains in other instruments, we would seek documents that provide judgement, or collects opinions on, the efficiency of work processes in other instruments. As such, types of documents that will be relevant to

	review are: evaluations and impact assessments of other EU Instruments, quarterly and annual reports, websites, and stakeholder consultation outcomes. • The following instruments and frameworks may be of interest to investigate in relation to EQ11: o Copernicus (Copernicus Data and Information Access Services) o Data Collection Framework for Fisheries o GEO o INSPIRE o EuroGEOSS o ESA TE o European Environment Information and Observation Network (EIONET) o European Geological Data Infrastructure (EGDI) o EUMETNET o ECMWF o (European Ocean Observing System) o Biodiversity Information System Europe o Water Informatin System Europe o Climate-ADAPT o DG ESTAT o Eurostat o JRC o European research infrastructures and projects contributing to the European Strategy Forum on Research Infrastructures (ESFRI) 2) **Stakeholder interviews** • We foresee that the information on efficiency of working processes in other instruments may primarily come from evaluation reports. As such reports may only exist for a handful of the other instruments, particularly EU instruments, and since evaluations are carried out relatively infrequently, it may be difficult to find relevant information on efficiency for some of the shortlisted instruments. • To fill this information gap, we propose to interview relevant stakeholders. To this end, we will interview up to 2 stakeholders related to a maximum of 6 platforms, where contact details are provided by the European Commission. 1)
Stakeholders	1) Policy officers of the EC 2) Data providers 3) EMODnet users
Expected outcome	• A table listing the long list of other relevant instruments, with a short summary of potential sources of efficiency gains for each respective instrument, as well as the literature on which the summary is based. • A table containing the short list of 4-6 most relevant EU instruments. • Description of the work flows of instruments among those shortlisted that have been found to be efficient • Recommendations they have been given for similar problems faced by EMODnet (e.g. difficulty to use data, to harmonise data collection and structure) and degree of applicability to EMODnet.

COHERENCE	
EQ12: To what extent is the information provided by EMODnet coherent with the objectives and implementation needs of the broader EU policy and legal framework? (including maritime spatial planning, the Marine Strategy Framework Directive, Nature Directives, the Water Framework Directive)	
Operationalised EQ	• What are the objectives and implementation needs of the broader EU policy and legal framework on maritime spatial planning, the Marine Strategy Framework Directive, Nature Directives and the Water Framework Directive relate specifically to information provided by EMODnet? • What types of information are provided by EMODnet? • To what extent is the information provided by EMODnet coherent with (i.e. is in line with and does not run counter to) these objectives and implementation needs? • Were any means or processes put in place to ensure coherence with the objectives and implementation needs of the broader EU policy and legal framework

Indicators/Descriptors	1) List the objectives and implementation needs of the broader EU policy and legal framework on maritime spatial planning, the Marine Strategy Framework Directive, Nature Directives and the Water Framework Directive relating to information provided by EMODnet (in order to work with a manageable number of EU policy objectives we focus on the four areas mentioned in the Terms of Reference) 2) List the types of information provided by EMODnet 3) Overview of synergies and inconsistencies between the data provided by EMODnet and the broader EU policy and legal framework 4) Stakeholders' views on coherence of objectives and implementation needs of the broader EU policy and legal framework and information provided by EMODnet 5) List of means or processes put in place to ensure coherence with the objectives and implementation needs of the broader EU policy and legal framework
Data sources	1) **Literature review:** • Maritime Spatial Planning Directive • Marine Strategy Framework Directive • Birds Directive • Habitats Directive • Water Framework Directive • Marine Strategy Framework Directive • Communication on Marine Knowledge 2020 • Common Fisheries Policy Regulation • Data Collection Regulation for Fisheries 2) **Desk research, data analysis:** • Extract the objectives of the broader policy framework • List types of data provided by EMODnet • Triangulate own assessment of EMODnet's contribution to these objectives with assessment by interviewees 3) **Survey/stakeholder interviews** with DG MARE staff involved in the set-up of EMODnet, EU policy officers involved in maritime/biodiversity/water policy (primarily) but also registered users (public/private) of EMODnet data • Were any means or processes put in place to ensure coherence with the objectives and implementation needs related to maritime spatial planning, the Marine Strategy Framework Directive, Nature Directives and the Water Framework Directive (Interview -DG MARE staff involved in the set-up of EMODnet) o If yes, can you describe these? • Do you consider the data provided by EMODnet to contribute to the objectives and implementation needs one of the following policy initiatives? o Maritime spatial planning, o The Marine Strategy Framework Directive o The Nature Directives o The Water Framework Directive? (Interview -EU policy officers involved in maritime/biodiversity/water policy & survey, providing the option "do not know") • Do you consider the data provided by EMODnet to run counter the objectives and implementation needs of one of the following policy initiatives? o Maritime spatial planning, o The Marine Strategy Framework Directive o The Nature Directives o The Water Framework Directive? (EU policy officers involved in maritime/biodiversity/water policy & survey providing the option "do not know")
Method	1) Desk research of the relevant policy documents related to maritime spatial planning, the Marine Strategy Framework Directive, Nature Directives and the Water Framework Directive to extract the objectives and implementation needs of the broader EU policy and legal framework 2) List the types of data provided by EMODnet 3) Assessment of whether the information provided by EMODnet is contributing to or running counter these objectives and implementation needs 4) Triangulation of own assessment with that of interviewees (EU policy officers with knowledge of these Directives) 5) Assessment of whether this consistency was taken into account when developing EMODnet

	6) Survey with EMODnet users: questions on EMODnet's contribution or inconsistency with these objectives (including the option "do not know"as we cannot assume that the average EMODnet user is familiar with these Directives)
Stakeholders	1) EMODnet users 2) EU policy makers 3) DG MARE policy officers
Expected outcome	• List of objectives and implementation needs of the broader EU policy and legal framework on maritime spatial planning, the Marine Strategy Framework Directive, Nature Directives and the Water Framework Directive • Stakeholders' views on the coherence of objectives and implementation needs of the broader EU policy and legal framework on maritime spatial planning, the Marine Strategy Framework Directive, Nature Directives and the Water Framework Directive and and information provided by EMODne • Concrete contribution of EMODnet to EU policy objectives and implementation in the fields of marine policy, water policy and biodiversity policy

COHERENCE	
EQ13: Are the data provided by the separate EMODnet thematic groups – bathymetry, geology, habitats, physics, chemistry, biology, human activity consistent with each other?	
Operationalised EQ	1) To what extent is the data provided by the separate EMODnet thematic groups complementary to each other? To what extent does it overlap? 2) To what extent is the data across the thematic groups consistent, i.e. follows common standards and nomenclature? • Does EMODnet's approach towards data holders that are not used to practices and standards as used by the international marine data management community improve consistency among the data provided by the separate EMODnet thematic groups relating to each other? • Does the workflow process of EMODnet's data ingestion portal from data submission to publication support consistency? • Does EMODnet's further elaboration of the dataset package and integration in national, European and EMODnet thematic portals improve consistency of the data across portals? • Are there any other measures taken to improve the consistency among the data provided by the separate EMODnet thematic groups relating to each other? 3) To what extent can the data across thematic portals be merged to create common datasets/maps?
Indicators/Descriptors	1) Stakeholders' views on the relatability of separate EMODnet thematic groups 2) Stakeholders' views on consistency of relatable data provided by separate EMODnet thematic groups 3) Stakeholders' views on the overlap between the data provided by the different thematic groups 4) Stakeholders' views on the EMODnet's approach towards data holders that are not used to practices and standards as used by the international marine data management community on improved consistency of relatable data provided by separate EMODnet thematic groups 5) Stakeholders' views on the workflow process of EMODnet's data ingestion portal from data submission to publication on improved consistency of relatable data provided by separate EMODnet thematic groups 6) Stakeholders' views on EMODnet's further elaboration of the dataset package and integration in national, European and EMODnet thematic portals improved consistency of relatable data provided by separate EMODnet thematic groups 7) Measures taken to improve the consistency among the data provided by the separate EMODnet thematic groups relating to each other 8) Potential to merge data across thematic portals to create common datasets/maps
Data sources	1) **Survey/Stakeholder interviews** with registered users (public/private) of EMODnet data, EMODnet data suppliers/partners and EMODnet organisation • Do you consider that the EMODnet Data Ingestion Portal provides sufficient guidance for data holders that are not familiar with the international practices and standards on marine data management to ensure consistency of the uploaded data? (interviews - EMODnet data suppliers/partners and EMODnet organisation)

	• Do you consider theprocessing of the data by the data centres and integration in national, European and EMODnet thematic portals to improve consistency of the uploaded data? (interviews - EMODnet data suppliers/partners and EMODnet organisation) • What measures are taken to improve the consistency among the data provided by the separate EMODnet thematic groups relating to each other? (Interviews - EMODnet organisation) • Do you use data from more than one thematic portal? o If so, is the data you use in the different data portals complementary? o If so, does this data overlap? *(survey - EMODnet users)* • Do you consider the data provided by the separate EMODnet thematic groups relating to each other to be consistent? (survey - EMODnet users)
Method	1) Survey • EMODnet users 2) Stakeholder interviews • EMODnet organisation • EMODnet data suppliers/partners
Stakeholders	1) EMODnet users 2) EMODnet data suppliers/partners 3) EMODnet organisation
Expected outcome	• List of overlaps between data provision of different thematic groups • List of complementarities between the data provided by the separate EMODnet thematic groups • Assessment of the processing of the data by the data centres and its impact on consistency of the uploaded data • Assessment of EMODnet's approach towards data holders that are not familiar with the practices and standards used by the international marine data management community • List of measures taken to improve consistency among data provided by the separate EMODnet thematic groups relating to each otherConcrete contribution of EMODnet to EU policy objectives and implementation in the fields of marine policy, water policy and biodiversity policy

Coherence	
EQ14: Is the set up and scope of EMODnet coherent with other EU instruments (Copernicus, the Data Collection Framework for Fisheries, GEO, INSPIRE, etc)	
Operationalised EQ	Regarding the wording of the question, we will use the following definitions: • We understand "set up" to mean the modus operandi of other instruments; • and "scope" to refer to the target stakeholders and services provided by other instruments. • To what extent is the set up and scope of EMODnet coherent with other EU instruments? o What complementarities are there between EMODnet and other EU instruments? o What overlaps are there between the set up and scope of EMODnet and other EU instruments? o What synergies are there between EMODnet and other EU instruments?
Indicators/Descriptors	1) Stakeholders' view on set up and scope coherence of EMODnet in context of other EU instruments. 2) Stakeholders' view on overlaps between EMODnet and similar platforms 3) Stakeholders' view on complementarities between EMODnet and similar platforms 4) Stakeholders' view on synergies between EMODnet and similar platforms
Data sources	1) **Literature review** related to EU instruments similar to EMODnet that are relevant to review for this question include: websites ("about us" section), technical guidelines, and directives. Below is a list of preliminary sources that may be used to map the working practices and scope of similar EU instruments, depending on whether they are included in the shortlist of 4-6 instruments for review or not: • Biodiversity Information System for Europe (n.d.) About BISE - Biodiversity Information system for Europe. • European Centre for Medium-Range Weather Forecasts (2013) What we do. • European Commission (n.d.) About EuroGEOSS. EuroGEOSS. • European Commission (n.d.) About INSPIRE. • European Commission (2014) Copernicus in brief.

	• European Commission (n.d.) DataCollection. • European Commission (n.d.) European Strategy Forum on Research Infrastructures {ESFRI). • European Commission {2016) Fisheries sector: data collection • European Environment Agency (n.d.) About Eionet. • European Meteorological Services Network (n.d.) • European Multidisciplinary Seafloor and water column Observatory (n.d.) What is EMSO. • European Ocean Observing System (n.d.) What is EOOS • European Plate Observing System (n.d.) What is EPOS. • Group on Earth Observations (n.d.) GEO at a glance. • Marine Information System for Europe (n.d.) About WISE Marine - Marine. • SeaDataNet (n.d.) About us. [Online]. SeaDataNet 2) **Stakeholder interviews** with • EMODnet end-users: o Can any of the data you retrieve from EMODnet be retrieved from other portals? If so, is it presented in a different way on EMODnet? Or would you say it is a duplication of effort? • EMODnet data providers: o Of the data you provide to EMODnet: is any of it provided to another portal(s)? If so, do these portals use it in the same way as EMODnet? • Ask EMODnet organisation and other platform managers: o Does EMODnet carry out any activities in their workflow that duplicates the work of any other platform? o Does EMODnet complement the work/output of other platforms (if so, how)? o How can synergies between EMODnet and other platform be increased? o How can overlaps between EMODnet and other platforms be decreased?
Method	1) **Desk research** • This question is similar to EQll, which relates to the efficiency between EMODnet and other, similar EU information systems and instruments. Before these two questions can be addressed, it is crucial that the scope of similar instruments is mapped out. Thus, the desk research will give an understanding of: o the work processes of other instruments o the areas in which EMODnet duplicates work of other services o the areas in which EMODnet enhances or complements other services. • In context of EQ14, this will underpin the judgement of the extent to which EMODnet overlaps or complements other EU instruments. This literature will be coded qualitatively with help of the qualitative data analysis software NVivo. • We suggest to review the same list of 4-6 other EU instruments as listed in EQll 2) **Stakeholder Interviews** • As the functioning of information collection and distribution systems have high complexity, information accessible on websites may provide too little information, and technical guidelines may be too detailed to provide a good overview of activities and services that may be overlapping or synergetic between instruments. • Interviews will therefore be a source of information where information can be gathered at the appropriate level (not too much or too little detail). • We suggest to interview up to two persons from the 4-6 shortlisted platforms (and that these are the same as those interviewed for EQll). • Interview notes will be coded with the qualitative data analysis software NVivo.
Stakeholders	1) Policy officer & platform manager from platforms similar to EMODnet. 2) EMODnet end-users 3) EMODnet data providers 4) EMODnet portal managers
Expected outcome	• Long list of other relevant instruments (incl. short summary of target users, end-service, thematic focus, and data ingestion and processing work flow), judgement criteria to build short list, and 4-6 EU instruments short list A coded set of interview notes that will contain end-users, data providers, and portal managers of EMODnet and other instruments views on: • Potential complementarities between EMODnet and other portals • Potential overlaps between EMODnet and other portals • Potential synergies between EMODnet and other portals

Sustainability	
EQ15. Are the effects likely to last after the EU funding ends? EQ17. Will costs increase or decrease?	
Operationalised EQ	Given the cost structure of EMODnet and the impact that the funding of the EC has on the effectiveness of EMODnet we can determine the impact of stopping the cash flow towards the platform. To determine this we need to understand: • To what extent depends EMODnet on the EU funding? • Does the funding impact the effects/effectiveness of EMODnet? • Which costs are affected by the EU involvement?
Indicators/Descriptors	1) Quantified link between funding and effectiveness 2) Cost allocations per service provided, per activity 3) Cost forecast for the following years based on indicators of EQ8 and EQlO
Data sources	1) **Desk research** • Using the financial statements EMODnet we will determine: o Cost evolution of various cost centres (fixed, variable, employment, IT, ...) o Based on EQ8 determine which cost categories are highly impacted by EU funding • Funding agreement and structure of EMODnet • Analysis of expected cost evolution o Based on the interview insights and findings of the financial statements we will estimate the impact of the EU funding on the cost structure • Based on our findings in EQ8 we will estimate the evolution of costs based on a variety of parameters like expected user evolution, cost structure evolution, expected development costs, etc. in order to estimate if costs will increase or decrease in the short and medium term 2) **Stakeholder interviews** with EMODnet organisation in order to gather more insights into the cost structure, input for most of the analysis can be gathered by interview questions posed in EQ8 and EQ9 • Which activities within EMODnet are fully subsidized by the EC • Which activities require no external input from the EC • Do you expect there to be an increase in required development costs towards the future 3) **Literature review** • Legacy documents of comparable EU initiatives in the past (mentioned in EQ14)
Method	1) Desk research, Financial analysis • Based on the cost structure determined in EQ8 we will determine the relative impact of EU funding on each of the cost elements of EMODnet and assess the impact it has on the underlying effectiveness • This effectiveness will be cross checked with the results of the literature review of the legacy documents of comparable EU initiatives of which funding has already been stopped or altered 2) Stakeholder interviews with EMODnet organization • We propose that the interviews will be held at the same time as the interviews of EQ8
Stakeholders	1) EMODnet organisation
Expected outcome	• Expected cost evolution of EMODnet over the coming years • Impact of EU funding on costs and performance of the platform

Sustainability	
Operationalised EQ	To what extent are other parties capable and willing to maintain and develop EMODnet? Which options are available and what would be the impact? • Self-financing • Stop activity, sale to other platform • Integration in other national or international platform o Downscaling of geographical scale o Upscaling to global scale

	What is the willingness to pay by the different stakeholders within EMODnet, being users, suppliers (member states)?
Indicators/Descriptors	1) Total cost of running EMODnet 2) Willingness to pay per user archetype
Data sources	1) **Survey** within userbase of EMODnet based on interview insights • Are you willing to pay for additional services/products provided by EMODnet like data analysis, customised reports, etc • Are you willing to pay for faster/larger data access 2) **Stakeholder interviews** with national suppliers • Do you think there is a willingness to take over part of the EMODnet activities within your national setting • Are there certain thematic focus areas of EMODnet which are particularly valuable? • Do you this EMODnet would be more or less profitable if it would scale its activity up or down 3) **Stakeholder interviews** with EMODnet organisation' • Do you think there is a willingness to pay by the users • Do you think products could be developed based on the platform from which revenue can be generated • Which funding would be required in order to make EMODnet self financing 4) **Stakeholder interview** with European Commission • Is there a possibility/added value to internalize the EMODnet operations 5) **Literature review** • Agreements with dataproviders on data-use • Assessment of legacy documents of comparable EU data platforms
Method	In order to determine the possible futures of the platform we aim to identify the willingness and capabilities of other parties to run the platform. The answer of this question will build on insights gathered in during previous questions including EQ3, EQ4 and EQS In addition insights will be gathered through: • Interviews with o National suppliers, o EMODnet organisation, o European Commission • Survey amongst the userbase
Stakeholders	1) EMODnet organisation 2) European Commission/ DG Mare 3) EMODnet Users 4) EMODnet Suppliers
Expected outcome	• Overview of the possible scenarios of legacy management of the EMODnet platform. • Scenarios linked to the outcome of the interviews and the expected possibilities of revenue generation of EMODnet. o Base case scenario will be keeping EMODnet going under its current structure and assess the required revenue generation to offset the European funding. o Other scenarios include the sale of EMODnet to another public organisation (for e.g. UN), to a private company (for e.g. data providers), or getting the required funding from national member states {data providing member states)

10 ANNEX IV. OVERVIEW OF BENEFITS AND COSTS - TABLE ON SIMPLIFICATION AND BURDEN REDUCTION

How was the intervention designed

EMODnet is not resulting from one single specific legislation setting obligations for Member States, public bodies or private entities, with a dedicated budget line. Instead, the EMODnet action was setup progressively with references in several documents such as Communication or Regulations. The funding has not been earmarked in a specific legal text. Parallel and successive contracts have been established with more than 120 beneficiaries and the action has not incurred costs to Member States. Nevertheless, it achieved saving for the community, including for Member States public bodies, by making available for free, openly and readily data at European level data which users should have searched, obtained the agreement and downloaded by itself otherwise.

The approach selected in the external evaluation study [12] to estimate cost benefit was therefore based on the Expected Impacts listed under Section 2.1 i.e. the gains in Productivity, Innovation and Reduced uncertainty. As most of the input, including quantitative, come from users but of course this quantification varies depending on the users, the benefits were assessed in a low scenario and and high scenario where users relate moderate and large benefit respectively.

While details of this quantitative assessment are provided in section 4.1 under 'Efficiency and effectiveness', the summary of these is provided in the same section in Table 3. As mentioned in the introduction, the share of business is estimated to 25%. In the tables below, we have therefore assigned this share of benefits to business and 75% under administration, having in mind that these 75% also include NGOs. Cumulated benefits related to 'Innovation' and 'Reduced uncertainty' are reported in table 1. The 'Productivity' gains translate into savings and are presented in table 2 on simplification and burden reduction.

Table 1. Overview of costs and benefits identified in the evaluation[16]									
		Citizens/Consumers		Businesses		Administrations		EU	
		Quantitative	Comment	Quantitative MEur	Comment	Quantitative MEur	Comment	Quantitative MEur	Comment
Cost or Benefit description:									
Mark the type of cost/benefit, each on a separate line: **Costs:** **Direct compliance costs** (adjustment costs, administrative costs, regulatory charges) **Enforcement costs:** (costs associated with activities linked to the implementation of an initiative such as monitoring, inspections and adjudication/litigation) **Indirect costs** (indirect compliance costs or other indirect costs such as transaction costs) **Benefits:** **Direct benefits** (such as improved well being: changes in pollution levels, safety, health, employment; market efficiency) **Indirect benefits** (such as wider economic benefits, macroeconomic benefits, social impacts, environmental impacts)	**Type: Recurrent**	Not Applicable (NA)	NA	30-73	Direct economic benefit, per year, based on Table 2, assigning 25% of benefits to businesses	90-219	Direct economic benefit, per year based on Table 2, assigning 75% of benefits to administrations	7	per year, from EMFF Direct: contribute to reporting for MSPD and MSFD Indirect: availability of data used by EEA and JRC for their work

[16] Where there is a prior impact assessment, the table should contain as a minimum the costs/benefits identified in the IA with the information gathered on the actual cost/benefit. As available, the table should include the monetisation (€) of the costs/benefits based on any quantitative translation of the data (time taken, person days, number of records/equipment/staff etc. affected or involved represented in monetary value – see Standard cost model, for example). For all information presented, it should be included in the comments section whether it relates to all Member States or is drawn from a subset. An indication of the robustness of the data should be provided in Annex II on Methodology and analytical models used.

TABLE 2: Simplification and burden reduction (savings already achieved) *Report any simplification, burden reduction and cost savings **achieved already** by the intervention evaluated, including the points of comparison/ where available (e.g. REFIT savings predicted in the IA or other sources).*								
	Citizens/Consumers/Workers		Businesses		Public bodies /Administrations		[Other…] _ specify	
	Quantitative	Comment	Quantitative MEur	Comment	Quantitative MEur	Comment	Quantitative	Comment
Title[17] *Cost savings for businesses, public bodies and administration having access centrally to data instead of having to request it to individual data owners*								
Type: recurrent	NA	NA	7-29	per year, see [12, Table 5-4]	22-86	per year, see [12, Table 5-4]		
PART II: II Potential simplification and burden reduction (savings) *Identify further potential simplification and savings **that could be achieved** with a view to make the initiative more effective and efficient without prejudice to its policy objectives*[18]*.*								
	Citizens/Consumers/Workers		Businesses		Public bodies/ Administrations		[Other…] _ specify	
	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment	Quantitative	Comment
Description: Further cost savings could occur if data was systematically made available with data coverage, accuracy improved and support more reporting obligations								
Type: recurrent				Extra savings and more innovation would be enabled by better coverage, better resolution, better accuracy		Extra savings possible by facilitating more reporting obligations under MSP, MSFD or other		

[17] Each simplification/saving should be included on a separate line.

[18] This assessment is without prejudice to a possible future Impact Assessment.

11 ANNEX V. STAKEHOLDERS CONSULTATION- SYNOPSES REPORT

Two consultations have been carried out, both online:

1) a consultation organised in the context of the external evaluation study [12] (the detailed report can be found in the Annex to the report on the external study [13] with a data collection period between 09/11/2018 and 09/12/2018 in the section Annex 5- Survey results).

2) a public consultation organised by the European Commission services [14] between 06 March 2019 - 29 May 2019. The factual summary report of the public consultation is available at: https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1538-Evaluation-of-EMODnet/public-consultation_en). The contributions received cannot be regarded as the official position of the Commission and its services and thus does not bind the Commission nor that the contributions can be considered as a representative sample of the EU population.

While the first consultation collected 430 responses and was strongly and pro-actively targeting EMODnet users (including registered users), the second consultation was open to the public and obtained only 46 respondents i.e. is less statically representative.

The processing of data is standard: in both cases i.e. percentages of respondents are calculated for the different possible answers. The percentages below all report percentages based on the number of respondents who have expressed an opinion.

The questionnaire of the second consultation was strongly focussed on collecting information for the purpose of the evaluation, was organised along the evaluation criteria: effectiveness, relevance, coherency, efficiency and EU-added value, had a strong focus on EU related initiatives and policies and was very coherent with the objectives set out in the 2010 Impact Assessment i.e. improve productivity, increase innovation, reduce uncertainty. The questionnaire of the first consultation also included questions on the evaluation criteria, questions were in most cases more detailed, covered a broader scope and were more targeting the operational aspects of EMODnet and less the aspects of how EMODnet serves EU policies. For example, there were questions on the functioning of EMODnet, on which other platforms users are also working and on strengths and weaknesses of EMODnet. The two consultations provide therefore slightly different angles.

Regarding who are the contributors, in both cases, the largest share of the respondents is from academia (61% and 39% respectively) followed by public authorities and the private sector. The civil society has much larger shares in the second consultation (20%) than in the first (2%). The first consultation provides further insights and more details regarding the sector of activity and use od the data made by the respondents, see Figure i). A large majority of

respondents (65%) work in the field of environment, followed by maritime spatial planning (27%) fisheries (24%), aquaculture (17%), and energy (16%). As expected, the use of the data accessed through EMODnet is marine research was the most often-cited purpose (53% of the responses), followed by marine mapping (43%), modelling (36%) and environmental monitoring (30%). This is overall coherent with the sector of activities.

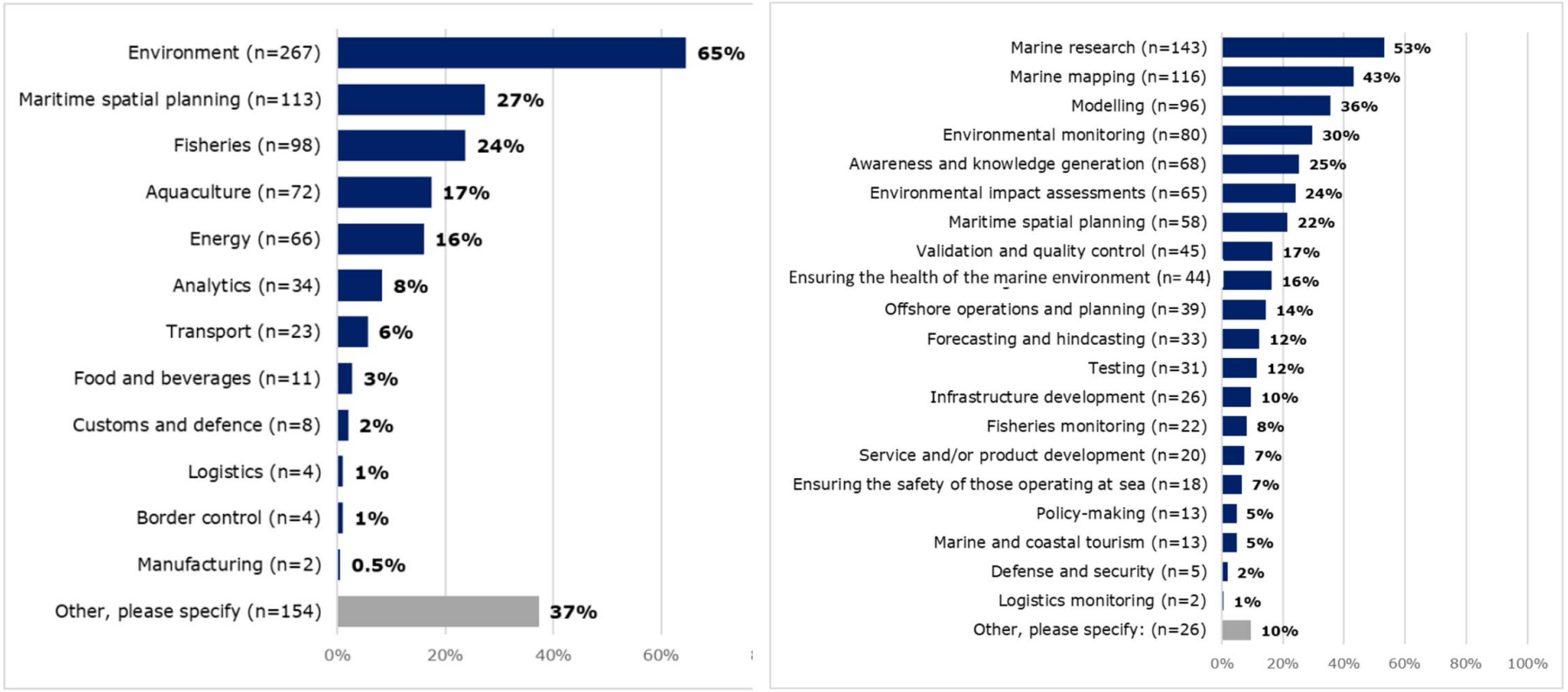

Figure i) Sector of activity of respondents (left, several sectors could be selected) – what respondents use EMODnet for (right)

Regarding the relevance, the second consultation shows that 91% of respondents assess the contribution of EMODnet to MSPD between essential and very useful, 82% for MSFD. The percentage falls to 60% when it comes to renewable energy industry. The first consultation had a more user-oriented approach and found out that 34% of the respondents are not able to perform their work without EMODnet and 39% acknowledge that it contributes to their work but is not crucial. The external evaluation study has also assessed the impact on the availability of marine data, see Figure ii). The stakeholders community

clearly agrees or strongly agrees that thnaks to EMODnet, more data is available compared to before (83%), that this data is better linked to other data (72%), that this contributes to more innovation (65 %) and higher quality (65 %).

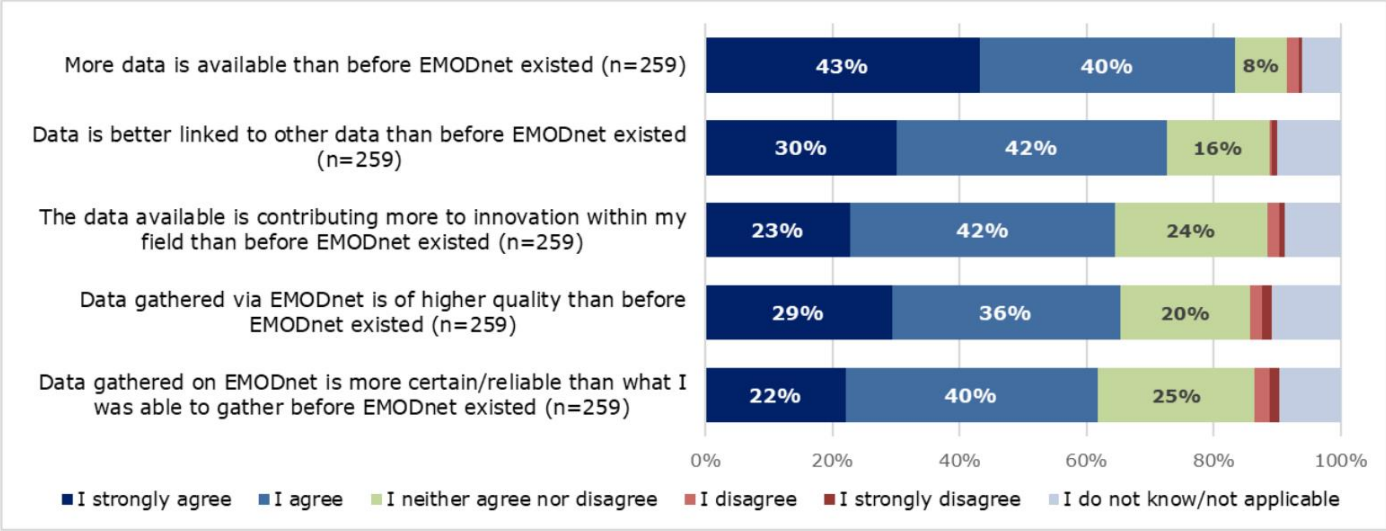

Figure ii) Impact of EMODnet on marine data availability

Regarding the effectiveness, the second consultation shows that 33% of those who expressed an opinion estimated that and it has improved greatly the productivity of those working in sea (e.g., by avoiding new measurements where they have already been made or reducing the time taken to gather data from different sources), 49% estimated that EMODnet has improved innovation i.e. contributed to develop have new products or services and 57% estimating that EMODnet has reduced uncertainty in our knowledge of the nature, state or dynamics of our seas and oceans. The first consultation shows that 82% of the respondents agree that to a great extent or a certain extent EMODnet allowed them to access new data or data that was previously difficult to access but only 45% agree that to a great extent or to a certain extent it contributes to provide new or additional services (innovation). The external evaluation study provides an assessment of the data accessible through EMODnet. While respondents agree or strongly agree that EMODnet data is multidisciplinary (86%), that the sources are clearly identified (85%) and consistent standards and formats are used (79%), they also point out at a partial coverage with only 57% of respondents finding that data gaps are clearly identified, 38% that the country coverage is adequate and 26% that data is complete. Clearly, there are still significant efforts needed to improve the coverage.

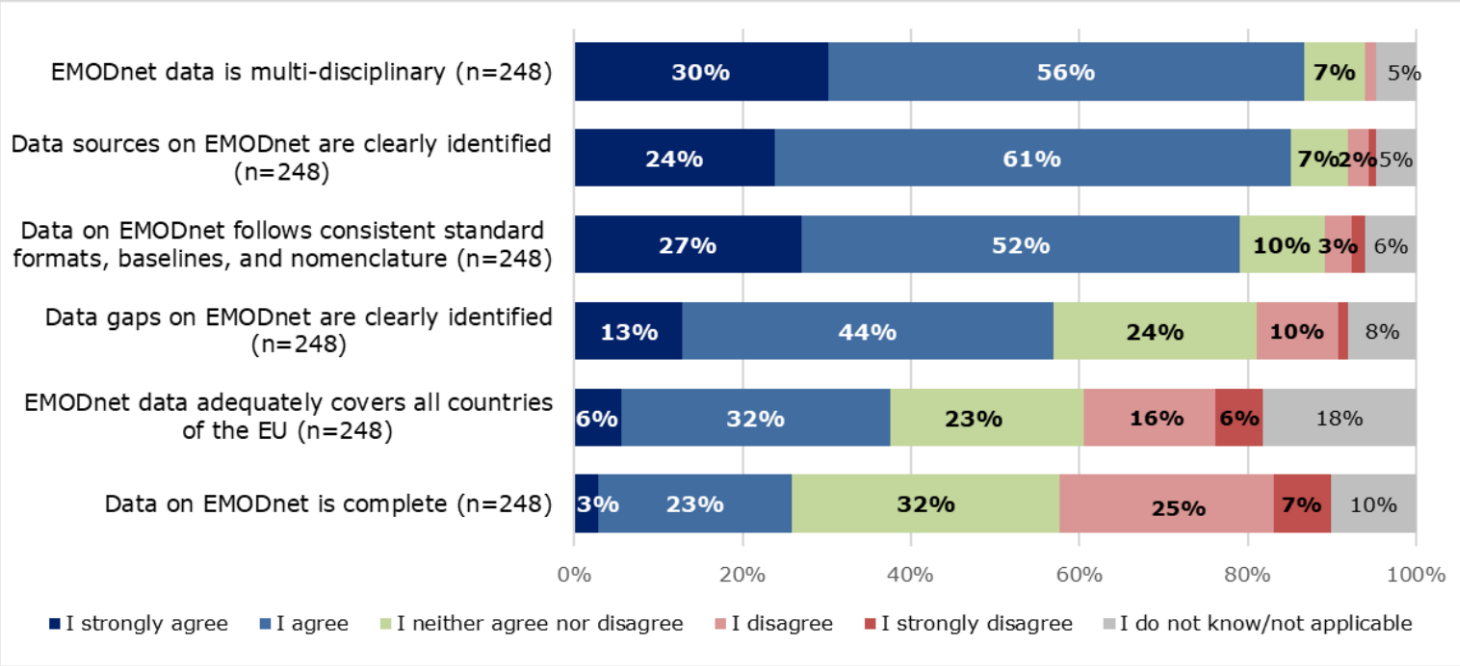

Figure iii) Assessment of EMODnet data

Regarding efficiency, the second consultation shows that 56% of the respondents estimate that results could not have been achieved with fewer resources. The first consultation reports that 56% of the respondents estimate that EMODnet increased their organisation productivity (to a great extent, 12%, to a certain extent 42%). Both public consultations did not put much emphasis in collecting feedback on the efficiency. In the main report of the external evaluation study however (section 6), a thorough and quantified analysis is carried out which shows that the benefits are estimated to 20 times the costs. One should recognise that external stakeholders do not have the budgetary elements to assess quantitatively the efficiency.

On Coherence, the second consultation concluded that 22% of respondents found that EMODnet was completely complementary with other EU or regional initiatives on marine data and 65% expressed that it could be better coordinated. It is to be noted that on all the questions related to coherence, about half of the respondents did not have an opinion. The first consultation took a data-oriented approach and found out that 71% of the respondents considered that data on other portals complements EMODnet data to a great or a certain extent while only 35% considered that EMODnet provide access to the same data than other sources, see Figure iv).

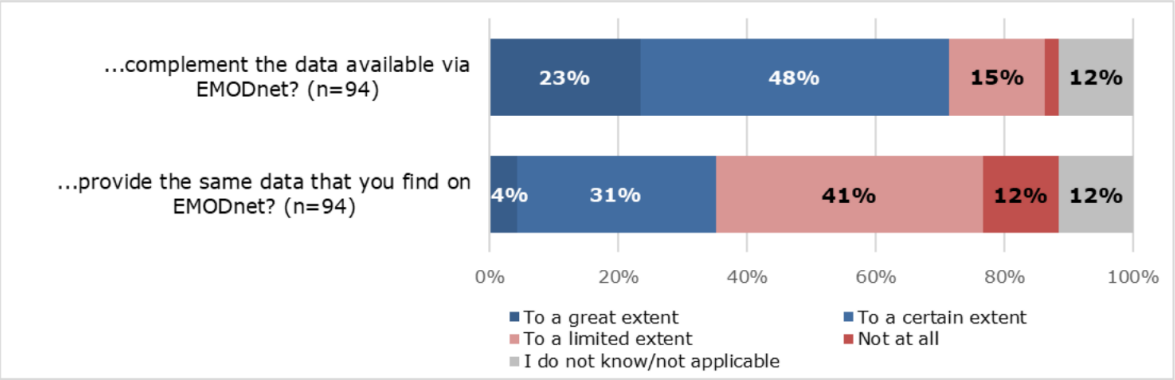

Figure iv) Coherence with other data sources

Regarding EU-added value, 86% of respondents to the second consultation estimate that EMODnet network could not have been done without EU intervention. The first consultation took a different angle asking if EMODnet was covering the geographical scope they needed to what 36% responded that their need was limited to EU Member States but 50% required that data covered a wider international scope. The external study also points out at other added values such as the facilitation of the creation of digital tools (78% agree or strongly agree), an increased willingness to invest in the blue economy (56%) and the facilitation to find greener and safer solutions (57%) but only 39% estimate that EMODnet contributes to employment in the blue economy.

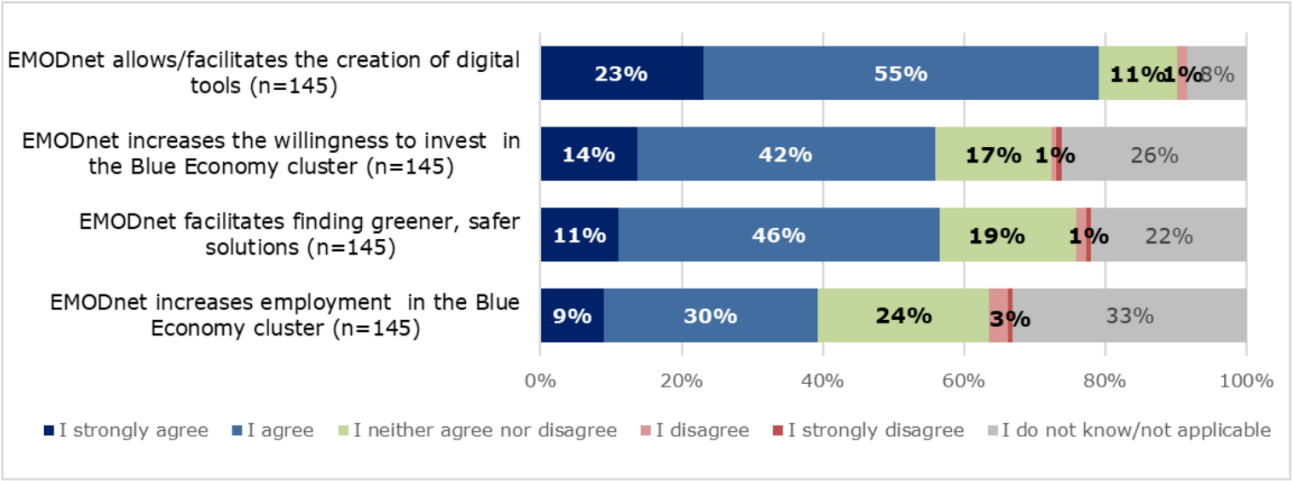

Figure v) Other added value of EMODnet

12 ANNEX VI TIMELINE BEFORE 2014

Before EMODnet

In 2003, the Environmental Information Directive [30] was published. It requires public authorities to make available environmental information held by or for them to any "applicant" requesting that information and without the applicant having to state an interest, in line with the Aarhus Convention [31]. The Public Sector Information Directive [28], also from 2003, aimed to facilitate requests for the re-use of documents held by public bodies for commercial or non-commercial purposes other than the initial purpose within the public task for which they were produced. In 2005, the EU signed the UN Aarhus convention on access to information, public participation in decision-making and access to justice in environmental matters.

In 2007, The INSPIRE Directive [17] was more ambitious, shifting from asking users to request data, to making data available from where it is produced. It aimed to create a digital infrastructure that would allow the users to identify and access spatial or geographical information from a wide range of sources, from the local level to the global level, in an inter-operable way for a variety of uses.

Researchers were well aware of the value of reliable data, with common standards across national borders and a number of EU-funded projects were devoted to creating interoperable databases. The existence of such database was a necessary condition to develop new innovative services based on these data.

In spite of all these initiatives, a number of issues persisted:

- the legislations did not addressed well enough issues such as copyright, confidentiality and in some cases, research centres or universities were not covered by the legislation.
- Government agencies were encouraged to become self-sufficient and were not overly keen to hand their expensively–collected data over for others to undercut the services they offered using these data
- Attempts by government agencies to recover funds by charging some of the costs resulted in usage dry up (e.g. Landsat images)

- Databases did not maintain themselves and once research projects finished, the databases were abandoned; the FP7 project EGDI-Scope: 'Scoping study for a pan-European geological data infrastructure'[19] estimated that between €400 and €700 million had been wasted in this way. A possible exception was the SeaDataNet which linked national ocean data centres. Owing to the high level of support from national research ministries, it was funded from successive EU research infrastructure.

This was the rationale for setting up a European Marine Observation and Data Network (EMODnet).

2007-2013 Setting the foundations

First prototype

In the absence of any legal basis to fund such steps, in 2007 the European Parliament voted a budget of €6.3 million for Preparatory Actions to develop a prototype to improve the interoperability of data held by public bodies, to facilitate access to the data and prepare data products. The Commission launched calls for tender to select contractors to do the work.

The data products can be understood as digital maps where individual observations are interpolated to provide a value of a parameter such as water depth, seafloor sediments or pollution concentrations at all locations in a sea-basin. The tenders called for the work to be done by groups specializing on the parameters being measured – topographical, biological, geological, chemical etc. - and not focusing on a particular technology, a particular EU policy or a particular geographical area as had been usual in research projects with similar aims. The initiative was funded through procurements rather than grants in order to define better what needed to be delivered and to secure European Commission's ownership.

The successful contractors were obliged to provide written permission from data owners to distribute these data openly and free of charge. In this preparatory phase, the focus was to cover data and observation to a limited number of sea-basins. The projects were of 3 years duration and began in mid-2009. An additional budget was voted in 2009 which allowed the coverage of the bathymetry to be extended and for a thematic group to be set up dedicated to physical parameters which had not been covered in the first batch.

[19] https://cordis.europa.eu/project/id/312845

Theme	Coverage	Budget (M€)	Start
Habitats	North Sea, Baltic, Celtic Seas, Western Mediterranean	0.8	February 2009
Bathymetry	North Sea, Celtic Seas, the Western Mediterranean, the Ionian Sea and the Central Mediterranean;	1.175	May 2009
Biology	North Sea, Bay of Biscay and the Iberian Coast	0.750	May 2009
Chemistry	North Sea and Black Sea	0.700	June 2009
Geology	North Sea, Baltic and Celtic Seas	0.925	July 2009
Bathymetry	Iberian Coast, Bay of Biscay, Adriatic Levantine	1.0	June 2010
Physics	All European waters	1.0	December 2010

Table 1 Prototype EMODnet supported by preparatory actions

Impact assessment, interim evaluation and second prototype EMODnet

In 2010, an impact assessment confirmed that the benefits of an operational EMODnet would greatly exceed the cost [9]. Based on this, the Commission's 'Marine Knowledge 2020' Communication of 2012 [3] proposed that the preparatory actions be evaluated to determine whether or not the same structure could form the basis of an operational system that could achieve these benefits.

An interim evaluation confirmed that the basic structure of EMODnet was sound but that continuity was needed in order to give confidence to those public and private bodies that were building new services and products based on the EMODnet data and data products. A second prototype was then launched financed by a new instrument adopted in 2011 covering the last years of the EU's 2007-2014 multiannual financial framework.

The scope of the network moved from a limited number of sea-basins to all European sea basins, including the waters shared with non-EU neighbours. In addition to the 6 existing thematic groups, a new group was set up to assemble data on human activity in order to meet the needs of environmental policy and spatial planning. The duration of the projects was again set to 3 years.

Theme	Budget (M€)	start
Bathymetry	2.0	July 2013
Geology	4.3	October 2013
Habitats	1.38	August 2013
Chemistry	4.0	July 2013
Biology	1.7	August 2013
Physics	0.985	July 2013
Human activity	2.0	October 2013

Table 2 Second prototype of EMODnet

Vision for longer-term, and consultation

The 2010 Green Paper on marine knowledge for 2020 [3] the following vision was set out for EMODnet:

'A seamless multi-resolution digital seabed map of European waters by 2020. It should be of the highest resolution possible, covering topography, geology, habitats and ecosystems. It should be accompanied by access to timely observations and information on the present and past physical, chemical and biological state of the overlying water column, by associated data on human activities, by their impact on the sea and by oceanographic forecasts. All this should be easily accessible, interoperable and free of restrictions on use. It should be nourished by a sustainable process that progressively improves its fitness for purpose and helps Member States maximise the potential of their marine observation, sampling and surveying programmes'.

A public consultation was then launched with a scope that was wider than EMODnet covering also, for instance, observation technology and Copernicus. There were 244 replies. Although some suggested that the bathymetry and geology could be merged, those consulted agreed that the 7 groups should be retained, at least for the next phase of EMODnet. The biology group did not deal with fisheries in order not to overlap with the Data Collection Framework but an overwhelming majority of civil society, researchers and private bodies as well as a substantial minority of public authorities considered that an additional EMODnet group on fisheries should be set up in order to foster collaboration between the fisheries and marine research communities. The respondents, moreover, considered that that the groups should meet regularly to avoid divergence. The need to provide a portal giving access to data and data products from all groups was emphasised.

In June 2013, the Council invited the Commission "to develop a roadmap towards a sustainable structure that is driven by the needs and priorities of public authorities, industry, the research community and other stakeholders" and to "continue building synergies between the various EU data, information and knowledge initiatives".

In November 2013, the European Parliament also considered that the initiative needed 'a specific action plan setting out medium- and long-term goals, based on a concerted effort by the EU and the Member States'. A dedicated budget has been set aside for this purpose within the part of the 2014-2020 European Maritime and Fisheries Fund earmarked for the integrated maritime policy. Since 2014, EMODnet is supported by the EU's integrated maritime policy EMFF and updated in 2021 by EMFAF.

Evolution of Thematic data coverage after 2014:

Thematic Groups	Starting time	Thematic DATA coverage before 2014	Thematic DATA coverage after 2014
Physics	Q4 2010	Temperature Waves currents Sea-level Light penetration	Temperature Wave height and duration Wind speed and direction Salinity Horizontal speed of the water column Water clarity Changes in sea level Inflow from rivers Water conductivity Atmospheric parameters Underwater noise

Geology	Q3 2009	Sediment map at a scale of one to one Million Strata Coastal erosion Geological hazards	Seabed substrate Sediment accumulation rates Seafloor lithology Seafloor stratigraphy Coastal behaviour Geological events and probabilities Mineral occurences
Chemistry	Q2 2009	Concentrations of chemicals in water, sediments and biota	Acidity Antifoulants Chlorophyll Dissolved gases Fertilisers Hydrocarbons Marine litter (micro, beach, seafloor) Heavy metals Organic matter Polychlorinated biphenyls Pesticides and biocides Radionuclides Silicates

Biology	Q2 2009	Abundance of living species	Occurrences and abundances of species of: Phytoplankton Zooplankton Macro-algae Angiosperm Fish Reptile Benthos Bird Sea mammal
Sea Bed Habitats	Q1 2009	Habitat classification based on physical parameters: (water depth, light penetration, sediments)	Seabed habitat maps (broad-scale and specific per basin) Individual seabed habitat maps from surveys Environmental variables influencing habitat type (depth, salinity, currents, light, …)

Human Activity	Q3 2013	Aggregate extraction Mariculture Cultural heritage Dredging Fisheries zones Major ports Ocean energy facilities Hydrocarbon extraction Pipelines and cables Protected areas Commercial shipping, recreational shipping Waste disposal Wind farms Other forms of area management/designation	Aggregate extraction Aquaculture Cultural heritage Dredging Fisheries Hydrocarbon extraction Traffic in main ports Ocean energy facilities Pipelines and cables Protected areas Status of bathing sites Vessel density Waste disposal Wind farms Other forms of area management/designation
Bathymetry	Q2 2009	Hydrography – bathymetry (water depth), Coastlines, Underwater feature (wrecks)	Survey tracks Water depth and depth profiles Undersea features High resolution bathymetry in coastal areas