EMODnet Coastal Mapping
Tender n° MARE/2014/10

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EMODnet Phase 2 – Executive summary

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Version 1.1

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1 Background

Following the signature in 2012 of the Memorandum of Understanding (MoU) between the International Hydrographic Organization (IHO) and the European Community (EC), the consequences for European Hydrographic Offices (HOs) was discussed in 2012 at the 30th meeting of the North Sea Hydrographic Commission (NSHC). At its 5th meeting (June 2013), the IHO Inter-Regional Coordination Committee (IRCC) decided to create a dedicated Working Group, the IHO-EU Network, to deal with European matters. France, on behalf of the NSHC, was tasked to develop the Terms of Reference of this Working Group.

For about one year, the IHO-EU Network WG composed with a significant number of Member States, has been working on a project of Joint European Coastal Mapping Programme (JECMaP) for fulfilling the needs in bathymetric knowledge on the European littoral. Definition of such a programme entails many aspects regarding the needs and means, according to the various conditions prevailing on the European coasts and requires a preliminary design scoping study.

Meeting the requirements of a Joint European Coastal Mapping Programme and of specifications needs the participation of the highest possible number of Hydrographic Offices within the European Union (EU) and the European Economic Area (EEA).

Concurrently, the Conference of Peripheral Maritime Regions of Europe (CPMR) has been working with its Mediterranean commission to develop a better knowledge of the situation of acquisition and diffusion of coastal data useful for the management of the coastal zone. The funding and the governance were focal points identified by the MAREMED (MAritime REgions cooperation for the MEDiterranean) projects, the results of which were presented to the members of the European Parliament and to the Commission by the political representatives of the Mediterranean regions, in the Parliament, in March 2013.

2 Objectives

This project is conducted by the French Hydrographic Office (SHOM) and its partners in answer to the DG MARE 2014/10 invitation to tender for Coastal Mapping.

The project's strategic objective is to develop an innovative analysis of the needs and means in Europe for the acquisition of marine data in coastal areas, as well as concrete propositions for the development of European strategy for marine data acquisition.

To address these objectives, the project Work Plan has been drawn up around 3 Work Packages (WP).

In the framework of **WP1 (Digital Mapping)**, the project develops propositions concerning an infrastructure enabling partners to prepare, update, aggregate and disseminate data produced by them, as well as develop tools to prepare and optimize data, provide high performance services disseminating the prepared layers with respect to INSPIRE recommendations, propose an ergonomic web portal and provide training to potential users.

In the framework of **WP2 (Share experience, standards and best practice)**, the project assesses consistency of the existing vertical datum, list and summarize past experiences and best practices, develop and test an algorithm for choosing the most appropriate surveying method, and build a technical and economical strategy.

Finally, in **WP3 (Future programme)**, the project develops a method to draw a Joint European Coastal Mapping Programme in shallow waters for bathymetric data, taking into account:

- WP2 outcomes, giving a review of the technical inputs, the possibilities of interoperability and the strategic algorithm;
- The existing data, at European, State and regional levels;
- Organizations like European Environment Agency (EEA) and programmes like EMODnet and Copernicus;
- The needs of bathymetric data for management of the coastal zones and the connection to be established with the land side;
- The governance of these data in the coastal zone and the economic models in place;
- The financial opportunities offered by the European financial period 2014-2020, for a Joint European Programme.

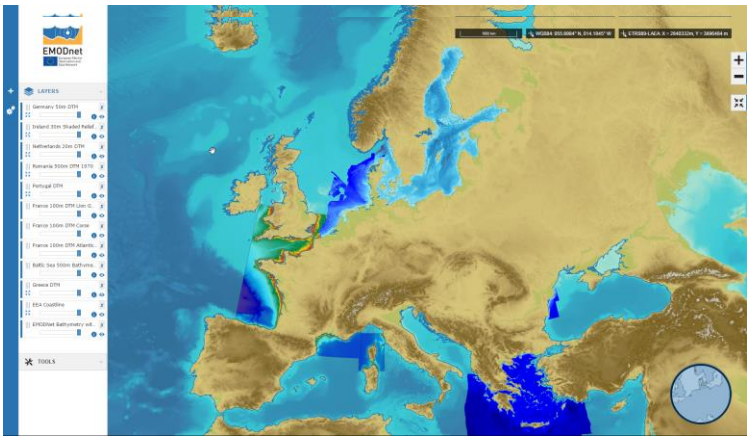
3 Consortium

The project's partnership directly involves a large number of European Hydrographic Offices (from France, Belgium, Germany, Greece, Ireland, Italy, Latvia, Norway, Portugal, Slovenia and Sweden), ISPRA (Institute for Environmental Protection and Research, Italy) having strong experience in coastal mapping from imagery and survey processing for coastal environments, Rijkswaterstaat (Ministry of Infrastruture and Environment, Netherlands), DDNI (Delta Danube National Institute, Romania), GeoEcoMar (Marine GeoEcology, Romania) CPMR (Conference of Peripheral Maritime Regions) representing 160 European regions, Regione Lazio (Italy) and the Worldline company, which has an internationally recognized expertise in the field of operational digital mapping and portal design.

4 Results of the main tasks

4.1. Results for task 1(a) (WP1: Digital mapping)

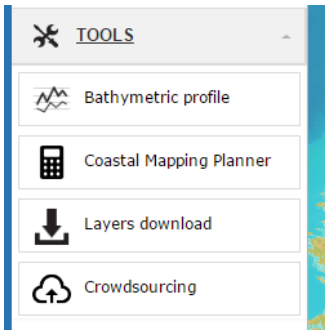
The aim of task 1 was to implement a web portal, presenting the available data as digital maps, with the ability to navigate and zoom in the dataset.



The resulting web portal, available at www.coastal-mapping.eu, is a data vizualiser, with a **simple and modern design** that leaves a maximum of space for data, and able to display data from any INSPIRE compliant Web Map Service (WMS) or Web Feature Service (WFS) server.

Users can choose data to display from a data catalog, containing all coastal and bathymetric information selected by partners for the Coastal Mapping project. Selected data can be handled through a layer manager, allowing users to order the different layers, and modify their transparency for better data visualization.

Users can also add to the portal data from third parties WMS services, to allow cross comparison between project data and external data.

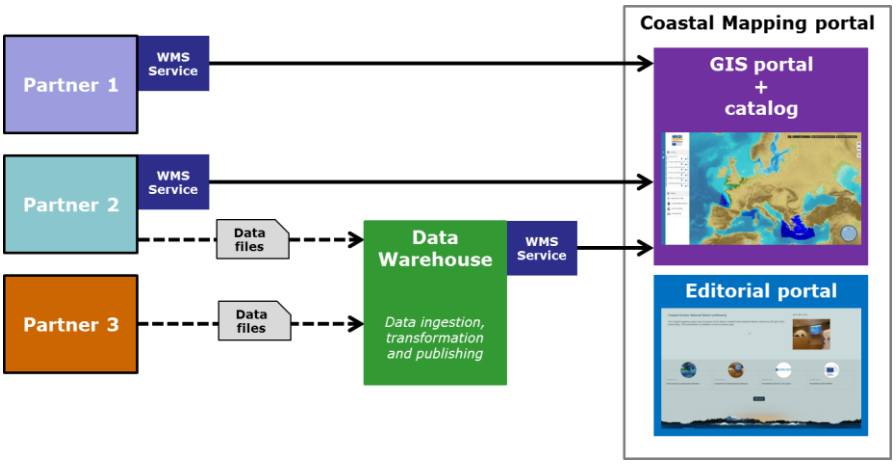


Several geographic tools are also available :

- draw a bathymetric profile along a line drawn by the user, for bathymetric data layers;
- use the coastal mapping planner algorithme developed in WP2;
- download data by drawing a box of interest on the portal;
- upload GPS points in order to crowdsource a European coast line.

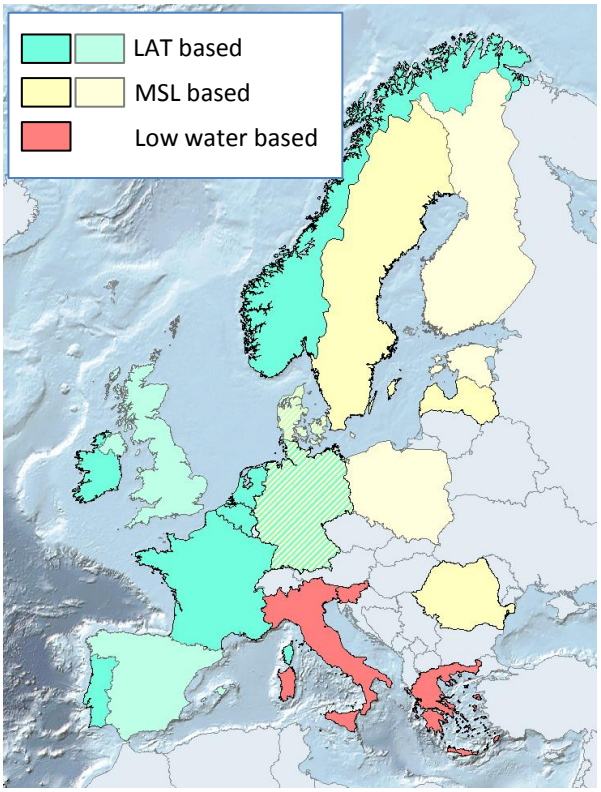
The layers available in the Coastal Mapping portal come:

- either from existing WMS services from the project partners,
- or from built-in WMS and WFS service, from the "DataWarehouse", whose role is to ingest, transform and publish data provided by the partners as data files (GeoTiff, netCDF, gml, XYZ…).



4.2. Results for task 2(c) (WP2.1: Assess consistency of the existing vertical datum)

The aim of WP2.1 is to assess the consistency of vertical datums within the European coastal zone and to recommend a European standard datum for coastal mapping. Within Europe many different vertical reference systems are used. In the coastal zone the situation is of special interest as, depending on the application, elevations may be referenced to a sea based system, such as Mean Sea Level (MSL) or Lowest Astronomical Tide (LAT), or to a land based system. The fusion and exchange of land and sea data is a difficult task as the relations between the various systems are not always known with sufficient accuracy. In order to map coastal data from different sources, one unique vertical reference system should be used.



To acquire information on the use of vertical datums in the European coastal zone, a questionnaire was compiled and distributed among partners. Based on this questionnaire and literature study, a vertical datums inventory has been made in the European coastal zone. This resulted in an overview of the height systems on land and a quantification of offsets to the European Vertical Reference Frame (EVRF2007). Furthermore, a detailed analysis of the definitions of

Chart Datum, as used by the countries in the European coastal zone, has been given, as well as the relations to the European Terrestrial Reference System (ETRS89-GRS80) ellipsoid.

The implementations of Chart Datum can be divided in three groups as shown in the figure right. For the North Sea and the Atlantic Ocean regions, water levels are mainly determined by tides and hence realizations of LAT are adopted as Chart Datum, following IHO resolution 3/1919 as amended. In the Baltic Sea, where there is no appreciable tide effect, MSL-based surfaces are used as Chart Datum. In the Mediterranean the tidal effect is also small. Because water levels are significantly influenced by surge and temperature, a low water surface is often used for safety reasons.

In this work package three candidates for a European standard are considered: ETRS89-GRS80, the European Vertical Reference System (EVRS) and a harmonized Chart Datum on a maritime basin level. As the actual choice of a vertical datum depends on the application, these candidates can be considered complementary. ETRS89 is the recommended coordinate system by the INSPIRE directive for the horizontal component when sharing geo-information. When a local or regional vertical datum is referenced to the ETRS89-GRS80 ellipsoid, it directly enables ellipsoidal referenced surveying, data combination on land and sea, and comparison of datums between countries and maritime basins. Hence, it is important that the transformations (or separation models) to the ETRS89-GRS80 ellipsoid are defined and available to users.

On land, the INSPIRE guidelines recommend EVRS to express gravity related heights. For countries that are connected to EVRS, it provides the off-sets between national systems and gives the possibility to tie the reference tide gauges to a common datum. However, not all countries in the European coastal zone are connected to EVRS and the relations between sea based systems and EVRS are not always available. In order to use EVRS for marine applications, a next version of EVRF should include a European quasi-geoid as an equal realization of EVRS.

A harmonization of Chart Datum should be done at the level of maritime basins. For areas where tides have a large effect on water levels, it should be LAT, otherwise MSL or level close to MSL could be used, in accordance with the IHO resolution. Care should be taken at the boundaries between basins to establish seamless connections. A harmonization of Chart Datum is already being realized and implemented in the Baltic Sea region. For the North Sea region, the NSHC Tidal Working Group (NSHC-TWG) aims at the dissemination of discontinuities along the maritime boundaries and the realization of a seamless LAT surface. For the Mediterranean region, there are opportunities when the basin wide marine geoid becomes available as it can form the basis for height system unification.

4.3. Results for task 2(d)i (WP2.2: Listing and summarising past experience)

The aim of WP2.2 is on the one hand, to collect and analyze different experiences of coastal data acquisitions. On the other hand, to assess and compare the products that can be obtained by means of

different technologies in relation with the characteristic of the area to be surveyed and the different purpose of the acquisition (i.e. nautical chart production or scientific product development). The information collected is the benchmark through which the implementation of the algorithm will be developed in WP 2.3.

An online questionnaire was implemented by ISPRA to gain information regarding the characteristics of the surveyed areas, the instruments and the methodology utilized, the purpose and the products obtained.

ISPRA server has hosted the questionnaire and the first release was online on 10 November 2015. Other releases were developed according to the partners' discussions and reviews during meetings (Ostend and Bezons) and on the project portal forum. The final version was online on 22 December 2015 to collect partner responses (http://www.sondaggi.sinanet.isprambiente.it/).

Past experience information concerning coastal data surveys was sent by the partners filling in the online form or the related Excel file. The Excel file was filled, setting up an automated way, by the partners that had a lot of surveys to add.

Out of 15 partners that gave feedback on the past experience, 11 partners filled the online form and 4 the Excel form, for a total of 1500 surveys, 645 of which concerning surveys run after the year 2000.

The first results show a broad database of coastal data acquisitions, with information available for the other work tasks of WP2: the vertical datum harmonization (WP 2.1), the algorithm structure (WP 2.3) and the platform sharing (WP 2.5).

The online questionnaire is still running on the ISPRA platform but despite the advertising done during international meetings, no more information was collected.

So were gathered only information from the partner with the limitations already highlighted that could be summarized in:

- ✓ Not all the european coastal regions are represented due to a lack of partners from that regions.
- ✓ The main purpose for data acquisition in coastal area is focused on nautical charting due to the high representative of Hydrographic offices involved.
- ✓ Almost all the surveys have been performed using Multibeam Echosounder, just few reports about others instruments.
- ✓ Few informations about the survey costs. The provided ones are not homogeneous.

4.4. Results for task 2(d)ii (WP2.3: Develop and test an algorithm)

The aim of WP 2.3 is to develop and test an algorithm for choosing most appropriate surveying method.

The algorithm, called Coastal Mapping Planner (CMP), is designed to give indication about the optimal survey techniques to obtain the main coastal mapping products, playing different scenarios. The final

end of the CMP is to be a decision support system for the European and transnational coastal mapping management plans.

The CMP will help to define the best survey methodology and technologies considering:

- the requested coastal mapping final products (charts for navigation, habitat maps, morphological maps, etc);
- the physical and quality parameters of the area (depth range and Secchi disk).

The CMP integrates the knowledge gathered from literature, the infield experience of the partners (Hydrographic Offices and research institutes) and the available information.

The CMP, based on the fuzzy theory, was implemented using R language and free software and it has a scalable structure which permits easily to add instruments and products together with their technical characteristics.

The CMP implements three main survey technologies (Multibeam Echosounder – MBES; Light Detection And Ranging - LiDAR, Airborne Hyperspectral sensor) for nine coastal mapping final products (Low resolution DSM, High resolution DSM, High resolution DSM for navigational purposes, High resolution DSM for navigational purposes (Order 1b), Shore line, Vegetation presence map, Vegetation cover type map, Floor Cover Type map, Properties of the Emerged Sediment).

Depending on the characteristics of the survey area, the CMP generates a relevant appreciation of how the different technologies can obtain the products that are selected by the user for the different coastal mapping purposes.

The CMP is available on the coastal mapping portal (http://coastal-mapping.eu/) under the “tools” section in two versions: geographical and interactive.

If the user prefers to use his own data of elevation and water clarity, he can use the interactive version of the CMP and obtains a table with the suitability of the different technologies to acquire the selected product.

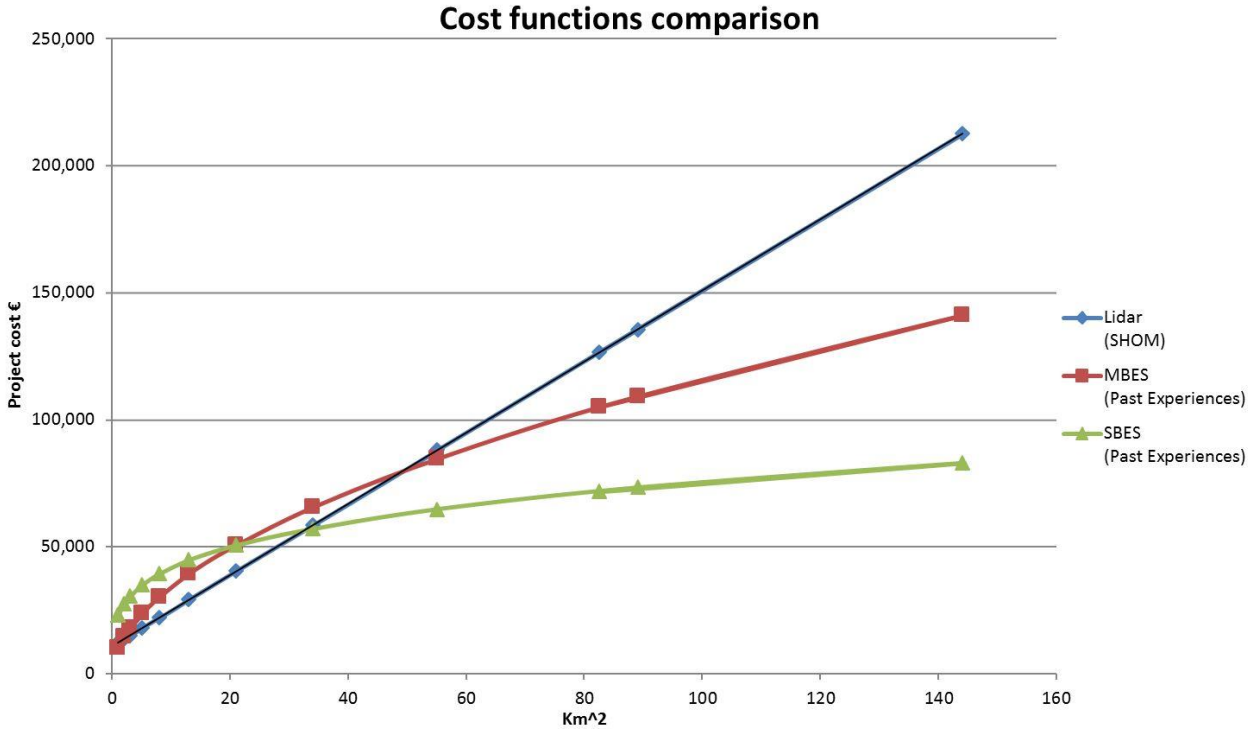
Otherwise, in the geographical CMP the user can use the elevation data from the General Bathymetric Chart of the Oceans (GEBCO) dataset and the water clarity data from an elaboration of the Copernicus Marine Environment Monitoring Service (CMEMS) maps of Secchi disk depths. In this case, the output will be a geographical representation that shows which technologies can acquire the selected product and where such instruments can be used.

4.5. Results for task 2(d)iii (WP2.4: Build a technical & economical strategy – WP2.5: Sharing platforms)

4.5.1. Build a technical & economical strategy

Public policy has already begun to implement the principle of integrated management of coastal zones. In 2002, the European Union adopted a Recommendation on Integrated Coastal Zone Management (ICZM), setting out basic principles. These principles are still valid and include: stakeholder involvement, sensitivity of policy to local needs, the adoption of a long-term perspective and the creation of links between all levels of governance, from local to European. The evaluation of the available data and the identification of the gaps of knowledge were the fundamental actions to implement. The analysis shows that the coastal environment is a highly complex system and poses specific challenges for the collection, updating and representation of data due to its dynamic and multi-dimensional nature. Data should represent the temporal dimension and be incorporated into planning and decision support tools in order to represent different realities of an area at different given times (e.g. seasonal activities).

As a first step we have implemented, based on the availability of data from the consortium, a preliminary cost function analysis using only LiDAR (from SHOM and ISPRA), MultiBeam (MBES) and SingleBeam (SBES) acquisition cost calculated for square meters.



Issues regarding data and the implementation of a technical and economical strategy include a set of evidences based on the above analysis:

- **Lack of data:** Despite the growing interest and effort put in to developing greater knowledge and understanding of the coastal environment, many gaps still exist and this do put a bias on the analysis showing an increasing cost for square meter using Lidar technology. Different projects point out a lack of data, mainly in coastal regions and regions where fewer human activities take place. This may be explained by the costs of collecting and updating data.
- **Availability:** In many cases, datasets exist but remain unavailable for the public. For example, data collected for scientific research or by private companies are not always available for public use due to academic or commercial sensitivities. Data may also only be available if purchased from its owner, sometimes at prohibitive costs. The longevity of data after the end of a project may be an issue. These situations may impair the validity and accuracy of the plan or add extra costs if data have to be collected again considering that the only constant acquisition is always related to navigation bathymetry.
- **Quality:** Different methodologies to assess data quality can be used and therefore, the definition of standardised criteria to assess data quality should be agreed upon by the relevant authorities. Factors affecting data quality may be: the data acquisition process, resolution, accuracy, precision, etc. Sometimes, data are available but the quality is not sufficient for planning purposes and therefore cannot be used. The relevant data scale for coastal areas depending on the dataset itself and the planning scope may also affect the quality of the data for the project purposes.
- **Scope:** Data tends to stop at political or administrative borders instead of ecosystem's borders. This may limit the applicability of an ecosystem-based approach. Since environmental processes (e.g. upwelling and sediment transport) and human activities (e.g. maritime transportation) go beyond national borders, the scope of data collection should take into consideration the relevant spatial distribution.

That is to say the past experiences are not sufficient to build a reliable cost function valid on the whole of Europe leading to a very possible development: other environmental variables, together with surface, should be investigated to model a reliable function to quantify the time cost of the survey more than only square meter. It must be developed a market economic model that takes into account the specific needs of stakeholders and characteristics of each area that influence the time acquisition, considering the user segmentation in coastal areas ("scientific users" and "application users").

4.5.2. Sharing platforms

Through the research of the main platform categories, we have evaluated the possible technical synergy effects available today. Further, we have reviewed how sharing platforms through cooperation and combination of efforts may maximize current and future survey potential.

The key goal is to survey once, and to use collected data multiple times and for different purposes. This approach requires high-resolution mapping of different data types simultaneously while keeping induced errors to a minimum.

The approach requires combining different types of sensors, to maximize the number of data types collected, but it does introduce restrictions on how data may be collected. The challenge of close to shore, shallow surveys limits the types of survey platforms that may be used: size matters, and for this work, bigger vessels are not suitable, and data collected with LIDAR/Satellite is supplementary at best, since high resolution data cannot be collected with current technology, and collected data are distorted by induced errors.

Combining efforts, through shared planning may result in improved cross border mapping efficiency, but unresolved national restrictions on both survey permissions and data distribution, do represent a challenge.

Combining tenders and thus increasing the volume of the work will result in reduced price. It aids in avoiding overlapping efforts, and may give an increased focus on data requirements and standards for such survey operations, resulting in output that is more valuable.

In conclusion, on the maritime part of the coastal areas, survey platform of choice is a surface vessel. The surface is the ideal spot for mapping many data types while keeping induced errors to a minimum and maintaining high position accuracy. On the emerged part of the coastal areas, the surveys must be completed using near surface or orbital platforms.

Current development of AUSV “autonomous unmanned surface vessels” will significantly reduce survey cost while greatly increasing efficiency. Combined with new submersible survey instruments, it holds great promises towards our goal of “surveying once, and reusing many times”.

Various national restrictions limit shared efforts. Permissions required to perform surveys near the shore are difficult or even impossible to obtain. Limitations on who may have access to data surveyed and different policy's on what data resolution that may be freely distributed, continue to be challenges for a necessary transnational cooperation.

Combined tenders is still desirable, and will increase focus on cross border issues that need to be resolved. It will also reduce price for all stakeholders involved.

4.6. Results for task 3 (WP3.1: Inventory of the current economic models – WP3.2: Financial-transnational programmes – WP3.3: Governance of data – WP3.4: Validation of the proposed programme)

4.6.1. Inventory of the current economic model – Governance of data

This report deals with both WP3.1 and WP3.3 which have many overlapping themes in an inventory of current economic models and the governance of data. A questionnaire was compiled and sent to all partners in November 2015. There were 18 responses from 15 countries (Estonia and Lithuania joined this work thanks to the Latvian partner). The questionnaire was divided into six themes as follows.

The spatial extents of the coastal zone.

Only two countries uses the exact same definition for the coastal zone. The two main parameters are either a depth contour or a seaward distance. Some countries have no definition but refer to the coastal zone in terms of the type of survey required to map it. The population of the coastal areas is also difficult to define without agreed onshore boundaries. Human activities requiring good data in the coastal zone are well understood however it is apparent that the broad range of activities are almost common to all countries.

The responsibility for onshore and offshore data is usually divided at the water's edge and sometimes the inter-tidal zone is a no-man's land. The use of different vertical and horizontal datums is a significant obstacle in creating a seamless data set and it would be difficult to get any one country to harmonise datums and a major challenge for EU harmonisation.

***Recommendation**: Future EMODnet effort should seek to form a working group to define a set of standard definitions that can be used to measure the coastal extents with a view to establishing comparative effort required for data acquisition in the 'coastal zone'. The definition should be innovative taking into account the sustainable coastal management and the specificities of the different basins, and not only choosing physical caracteristics.*

Governance of Data

The EMODnet Coastal Mapping consortium is predominantly comprised of National Hydrographic Authorities or proxies thereof. The legal frameworks are either set with roots in a Military, Environmental or Transportation background or combination thereof. Most of the partners have a responsibility for producing products for the safety of navigation as the primary reason for data acquisition. It is important to understand that these products are derived from much denser data that

is archived and not always available to the general public. The governance of the core data is generally held at a national level but in some countries regional authorities are responsible for some data sets.

Various budget scenarios are connected to both data acquisition and data management. In general all funding is through central exchequer funding at the state level. Some projects utilise regional and/or local funding. WP3.2 deals with this in more detail.

Data Sharing Tools

All partners except Italy (IIM), Portugal, Romania and Slovenia have a web presence where data is available to download in various resolutions. Data has also been incorporated into the EMODnet portal at low resolution.

Very high resolution or raw data are not as readily available either through data policy or possibly lack of resources to host data. Most partners do offer a consultative process to allow stakeholders to engage in negotiation for access to data but surprisingly only a few actively search out engagement with stakeholders to find out their needs. However in many cases this is mitigated by engagement in public media, social media and industry events.

The questionnaire showed some common tools between data holders and users but not always on a formal basis. The most common tool for sharing data is through a WMS/WFS for bringing data into a GIS environment and this probably negates some of the needs for formal agreements.

We would prevent the use of WMS/WFS data without the technical knowing and the intelligence attached to the data.

Transnational Governance

All countries except Slovenia indicated some involvement in at least one of the following networks or organisations: International Hydrographic Organisation (IHO), North Sea Hydrographic Commission (NSHC), Baltic Sea Hydrographic Commission (BSHC), Arctic Regional Hydrographic Commission (ARHC), Nordic Hydrographic Commission (NHC), General Bathymetric Chart of the Oceans (GEBCO), Intergovernmental Oceanographic Commission of UNESCO (IOC), Int Oceanographic Data and Information Exchange Commission (IODE), EuroGOOS European Marine Observation and Data Network (EMODnet), SeaDataNet, OSPAR, HELCOM, Infrastructure for Spatial Information in Europe (INSPIRE), Bologna Charter.

Data Policy

All countries are funded through central state funds with some regional and EU funding for specific projects. Romania (DDNI) and Sweden (SMA) are the only organisations that rely mostly on internal funding.

The cost of bathymetric data acquisition is high and especially in the coastal zone but warranted by the need to provide safe navigation data under the Safety Of Life At Sea Convention (SOLAS). The fact that the data is also useful to a number of stakeholders then raises the problem of cost recovery for data

storage and dissemination. Another factor is whether the data is considered to be classified, predominantly for military reasons.

In the Coastal Mapping consortium there is general agreement that a free data policy would be beneficial to many users and some countries do provide free access but most have some restrictions.

Cost Benefit Analysis

Ireland is the only partner to have published (2008) a Cost Benefit Analysis (CBA) with a 5 year evaluation completed in 2013 by Price Waterhouse Coopers (http://www.infomar.ie/publications/Reports.php). **This report confirmed that INFOMAR data is a key enabler of national marine policy with a *cost to benefit ratio of 4-5:1***. This CBA ratio is deemed to be conservative in relation to similar evaluations done in the USA (35:1), Cameroon (8:1) or Philippines (5.5:1). The Evaluation report analysis several European countries organisations engaged in similar undertakings to underpin the analysis.

Two other countries (Norway and Lithuania) are in the process of doing a CBA evaluation and results should be available in 2017. The Irish analysis gives positive indications which are very useful to justify the expenditure by the state where the private market is not able to sustain the cost of data acquisition.

It should be important, to realize a "Cost-benefit" analysis at the European level to promote the evolution of the situation in the European member states.

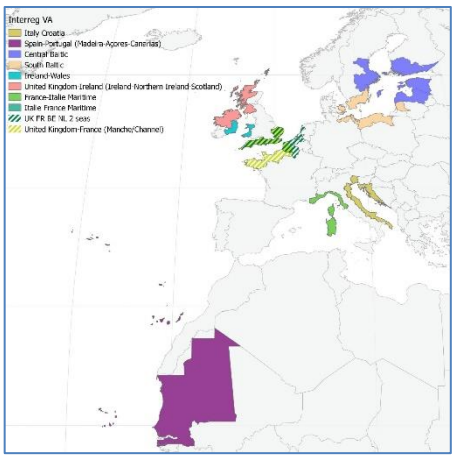
4.6.2. Financial-transnational programmes

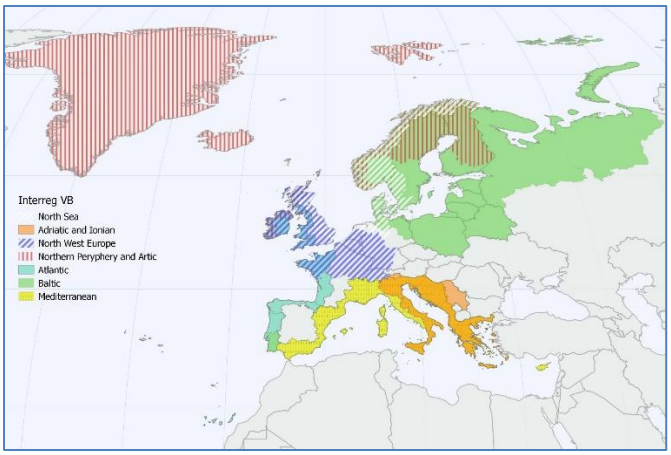
In the Framework of the Work Package 3, the CPMR analysed the potential support from EU Funds for coastal bathymetric data acquisition. This survey mixed two approaches combining desktop analysis and compilation of information from the project partners.

The following funding opportunities were analysed:

- ✓ Horizon 2020 and previous Research Framework Programmes (FP);
- ✓ European Maritime and Fisheries Fund (EMFF);
- ✓ LIFE Programme;
- ✓ Connecting Europe Facility (CEF) and TEN-T Programme.
- ✓ European Regional Development Fund (ERDF) through Transnational and Cross-Border Interreg Programmes and through the Research and Innovation Smart Specialisation Strategies (RISSS) and Operational Programmes (OP) of a selected panel Regions.

The work on the Interreg Programmes lead to the development of two interactive maps compiling information related to opportunities offered for coastal bathymetric data acquisition.





This analysis of different funding sources shows that coastal bathymetric data acquisition can be supported by various EU funds. Every Interreg programmes offers funding possibilities while some bathymetric data projects are funded by the LIFE Programme, the CEF or the TEN-T Programme. However, most of those opportunities are implicit. The Operational Programmes offering a potential to support coastal bathymetric data acquisition actually refer to other activities such as "transport efficiency" for example.

Therefore, the multiplicity of funding sources combined with the lack of explicit reference to coastal bathymetric data, implies high funding analysis skills and generates complex project development procedure.

This situation demands:

- Acknowledgement of coastal bathymetric data by EU funds supporting it;
- Coordination of EU's efforts to support coastal bathymetric data acquisition through its funding programmes.

4.6.3. Validation of the proposed programme

ICZM-Monitoring Center of Lazio Region[1] has high cooperation and project management experiences already acquired in the framework of projects co-financed by the European Regional Development Fund also as lead partner, and it is a component of Bologna Charter coordination board[2]. Since year 2015, Lazio Region is one of the Working Group coordinator of the National Board on Coastal Erosion[3] promoted by the Ministry of the Environment and Protection of Land and Sea of Italy (MATTM).

[1] www.cmgizc.info
[2] www.bolognacharter.eu
[3] www.isprambiente.gov.it/it/news/istituito-il-tavolo-nazionale-sull2019erosione-costiera

During Coastal Mapping initiative, with the aim of suggesting the more sustainable and useful Joint Programme at the European scale, Lazio region has solicited coastal zone stakeholders coming from Bologna Charter coordination board, for being as exhaustive as possible with description of the situation in the EU Member States.

A set of EU initiatives has been promoted by Lazio Region in order to give visibility to Coastal Mapping products and results such as:

- ✓ the official adhesion of Coastal Mapping Project to the European Cluster Facecoast[4] with the signature of the Memorandum of Understanding between the representatives of Coastal Mapping project and Medsandcoast[5] project;
- ✓ the promotion of the Coastal Mapping Portal[6] during the Bologna Charter Coordination Board meeting of April 28th 2016 in Rome;
- ✓ the promotion of the Coastal Mapping Algorithm during the "National guideline on coastal erosion" Conference of Ferrara Remtech2016[7] on September 21-23, 2016. During this initiative several regional public authorities with competences on coastal zone management have been involved for testing the Coastal Mapping tools and some feedback and suggestions have been collected thanks to the realisation of the "tools interest interview" realised in the face to face modality during the test tools experience.

The main feedbacks are:

The evaluation of the proposed tools quality was positive for all interviewed. They were partially interested because of the geographic scale. More detailed geographic scales for local uses would have been appreciated. They suggested that the Algorithm should take into account the survey costs and be able to compare them too. They also suggested use of some other technology (like Single Beam Echosounder) in the case of beach profile monitoring for the evaluation of very shallow water morphology. All regional authorities expressed their interest in collecting and sharing coastal mapping data if they can use it for the production of thematic maps in the integrated coastal zone management context.

[4] www.facecoast.eu
[5] medsandcoast.facecoast.eu
[6] www.coastal-mapping.eu
[7] www.remtechexpo.com

5 Data acquisition programme proposal

☞ *Toward a European strategy for high resolution bathymetric data*

Connecting all the results, a proposition of EU Strategy was produced. It was approved by all the partners and presented to the DG MARE. This Strategy is based on three axes and should be implemented by three pillar actions.

THREE AXES

- AXIS 1: Set up coordinated programmes for data acquisition at maritime basin scale;
- AXIS 2: Seize opportunities for bathymetric data acquisition in the framework of the EU operational programmes and funds; and ensure that those data are standardized and capitalized;
- AXIS 3: Promote good practices for the production of bathymetric data from multiple sources, standardized for re-use by all coastal stakeholders for maritime policies.

THREE PILLAR ACTIONS IN SUPPORT OF THE STRATEGY

- Design a European organization for steering the Strategy;
- Design digests of standards and hydrographic practices for all potential contributors to acquisition of these data;
- Design a better partnership with the coastal stakeholders for the use of high resolution (HR) bathymetric data in Europe.

Recommandations from the "Coastal Mapping Partnership" which represents 13 countries, 160 Maritime Regions, on all the EU maritime basins:

- ✓ By stakeholders experiences in coastal zone, all the maritime policies, their integrated management and ecosystemic approach need, standardized and validated, high resolution bathymetric data. Each maritime planification begins with the acquisition of HR bathymetric data and it should be considered as a public service.

- ✓ The coastal area is a key zone for blue growth, ecosystems and habitats, high-risk climate change area, but due to different conditions, it is necessary to take into account the specificities of the maritime basins in the future acquisition strategy for coastal data.
- ✓ Standardized, safe, authoritative, and high resolution data is the condition of re-usability of data by all the stakeholders for the maritime policies. The IHO rules must be used, no data should be gathered without an assessment about their uncertainty, the final certification must remain, to the responsible organization for the considered country
- ✓ It is strongly recommended that the use of standards should be mandatory when bathymetric data is acquired with EU funds in the context of maritime policies and research. It seems mandatory that specialists of the bathymetry be involved in the preparation of EU programmes with maritime objectives. This would facilitate the use of standards, the IENWG can be associated.
- ✓ The partnership promotes the pooling of these data in the EMODnet products, to permit the implementation of all EU maritime Directives particularly for the transnational cooperation needed for the ecosystemic approach.
- ✓ Coastal mapping project has produced different tools that it recommends to use and develop further; the coastal mapping portal, the algorithm for choosing the technology of acquisition of data and a tool for better fund the acquisition of data using European programmes in relevant areas.
- ✓ A cost-benefit study could demonstrate the interest for Europe of a secured mechanism of acquisition and sharing of coastal bathymetric data, and the "coast benefit" of the Strategy proposed.

In conclusion, for the partnership, since an integrated maritime policy needs an integrated vision, and since coastal areas are a major stake for blue growth but also highly sensitive from an environmental point of view, a strong action must be taken to progress significantly on the knowledge of these areas.

For that reason, the coastal mapping project strongly recommends that a ***European Strategy with the above 3 axis and 3 pillars actions*** *be implemented. For the sake of efficiency the project team recommends platform sharing and/or organizing common campaigns for data acquisition, systematic requirement that any EC funded project including data acquisition must respect standards and ensure data capitalization and promotion of good practice to maximize the benefits of community/crowd sourced data.*