

Inventory of results

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Preface

The present document has been conceived and produced within the TECHERA project, as preliminary step to depict the scenario and starting point for the capitalisation of the cluster projects' outputs and results.

To this purpose, the present document maps the most significant outputs produced by cluster projects with the aim of outlining the findings in terms of data and IT operational capacities developed within the previous projects, in the field of blue economy. This mapping will be the starting point to build upon for new initiatives, as well as for finding out innovative schemes, avoiding to “re-inventing the wheel”.

Cluster projects involved in TECHERA are reported here below with their main features. All of them contributed factually to the growth of the blue economy sectors, even if under different focusses and scopes, involving different stakeholders and bringing to the development and provision of different outcomes and results.

Cluster project	Partnership	Project main scopes and activities
ADRIREEF Innovative exploitation of Adriatic Reefs in order to strengthen blue economy	<ul style="list-style-type: none"> • Municipality of Ravenna • ARPAE - Regional Agency for Prevention, Environment and Energy in Emilia Romagna • Zadar County Development Agency Zadra Nova • Association for Nature, Environment and Sustainable Development SUNCE • University of Zadar • National Research Council – CNR- IRBIM • Regional Agency for Environmental Prevention and Protection of the Puglia Region Public Body • National Institute of Oceanography and Experimental Geophysics – Ogs • Public Institution RERA SD for coordination and development of Split-Dalmatia county • Ruđer Bošković Institute • University of Rijeka - Faculty of Maritime Studies 	ADRIREEF has the ambition to combine innovative actions related to natural and artificial Adriatic reefs with possible socio- economic impacts originated from activities such as aquaculture and tourism, two sectors of Blue Economy. As the success of activities strongly depends on the structural and ecological performance of the reefs (both natural and artificial), the project will also include setting up and testing of suitable technologies with low impact for underwater monitoring. A White paper on the exploitation of Adriatic reefs will also include a specific plan for future funding projects in the forthcoming programming period 2021-2028.
BLUE KEP Blue Knowledge Exchange Program and integration of education systems in the cross border area	<ul style="list-style-type: none"> • Informest • Adriatic Ionian Euroregion • Marche Region - Education Vocational Training Guidance and Territorial Services Unit • Region of Istria • Šibenik Knin County - Public Institution Development Agency • Public Institution RERA SD for coordination and development of Split Dalmatia County 	The project capitalises the results and methodological approach of the IPA Adriatic project KEPASS. It aims at strengthening and harmonising the technical educational systems in the nautical and maritime sector through the standardisation of school curricula and a common scheme for the evaluation and recognition of credits and professional competences of students. The expected results are a better prepared labour force and the creation of new skills.

Cluster project	Partnership	Project main scopes and activities
<p>FAIRSEA Fisheries in the Adriatic region - a shared ecosystem approach</p>	<ul style="list-style-type: none"> • National Institute of Oceanography and Applied Geophysics - OGS • Institute of Oceanography and Fisheries – IOF • Ministry of Agriculture - Department for Professional Support to the Development of Agriculture and Fisheries • National Research Council - Institute for Biological Resources and Marine Biotechnologies (CNR-IRBIM) • Assam - Agency for Agrofood Sector Services of Marche • Coispa Research & Technology • National Interuniversity Consortium for Marine Sciences – CoNISMa • Public Institution RERA S.D. for coordination and development of Split-Dalmatia County • Association for Nature, Environment and Sustainable Development SUNCE • Lag Eastern Venice – VEGAL • University of Split - University Department of Marine Studies 	<p>The FAIRSEA project aims at enhancing transnational capacity and cooperation in the field of an ecosystem approach to fisheries in the Adriatic region by exchanging knowledge and sharing good practices among partners. The complementary expertise of the partners is shared, interlinked and integrated, considering also challenges and opportunities identified by stakeholders. The efforts are embedded in a spatially explicit management platform that will allow to share expertise, create a common pool of knowledge, boost the operational application of the ecosystem approach to fisheries, enhance the competence in complex system dynamics, and foster a consensus on the state of the environment and fisheries in the region. The process developed in FAIRSEA will provide an opportunity to describe best practices and define guidelines for a sustainable fishery management.</p>
<p>ITACA Innovative Tools to increase Competitiveness and sustainability of small pelagic fisheries</p>	<ul style="list-style-type: none"> • Veneto Region’s Agency For The Innovation In The Primary Sector - Veneto Agricoltura • Istituto Agronomico Mediterraneo Di Bari • Istituto Per Le Risorse Biologiche E Le Biotecnologie Marine (Cnr-Irbim) – Headquarter Of Ancona • Javna Ustanova Rera S.D. Za Koordinaciju I Razvoj Splitsko Dalmatinske Županije • Azrri– Agency For Rural Development Of Istria Ltd. Pazin • Confcooperative Regional Union Of The Veneto • Institute Of Oceanography And Fisheries 	<p>ITACA tackles the competitiveness of Adriatic fisheries sector, fostering the introduction of blue innovation and improving the sustainability of catch activities. ITACA focuses on small pelagic (SP) fisheries, meaning the fishing activities targeted on two main ichthyic species: anchovy and sardine that represent a significant share of income for the sector in the Adriatic. ITACA project contributes factually to the growth of the SP fisheries sector setting up (WP3), testing in 7 pilot regions (WP4) and fostering the large scale application (WP5) of innovative SMEs oriented tools to increase the competitiveness of SP fisheries, together with establishing a SP fisheries enterprises cluster for a co-management of Adriatic ichthyic resources oriented to sustainability.</p>

Cluster project	Partnership	Project main scopes and activities
<p>PRIZEFISH Piloting of eco-innovative fishery supply-chains to market added-value Adriatic fish products</p>	<ul style="list-style-type: none"> • Alma Mater Studiorum – University of Bologna • Zadar County • National Research Council – Institute of Marine Sciences (Cnr-Ismar) • Assam - Agency for Agrofood Sector Services of Marche • Cestha - Experimental Centre for Habitat Conservation • Secondary High School 'Remo Brindisi' - Pole of Sea Crafts • Institute of Oceanography and Fisheries – IOF • National Institute of Oceanography and Experimental Geophysics – OGS • Fisherman’s Cooperative Omega3 • Fishing Cooperative Istra • Organisation Producers of Bivalve Mollusc of the Veneto Sea (Adriatic Sea) • Ministry of Agriculture of the Republic of Croatia • Public Institution RERA S.D. for coordination and development of Split-Dalmatia County • Emilia Romagna Region - General Directorate for Agriculture Hunting and Fishing, Service for Wildlife and Fishing Activities 	<p>The PRIZEFISH project idea builds on the rationale to implement a cross-border, territorial and socio-economic developmental change in the cooperative renewable exploitation of Adriatic fishery resources and consequently in the long-term benefits on the Adriatic marine ecosystems. PRIZEFISH builds on knowledge that were capitalized on abundant synergies with several previous and ongoing cooperation projects in the fishery sector its overall objective to tackle the dual territorial challenge for Italian and Croatian Adriatic fishing SMEs and Producer Organizations (POs) to be more sustainable and to increase their economic competitiveness in the seafood markets, by developing and piloting innovative fishery products with added-value given by ecolabels fulfilling requirements of environmental, economic and social sustainability.</p>
<p>SUSHI DROP Sustainable fiSHeries with DROnes data Processing</p>	<ul style="list-style-type: none"> • Alma Mater Studiorum – University of Bologna • Institute of Oceanography and Fisheries – IOT • Marche Region - Fisheries Economy Department • Fisheries Local Action Group Costa dei Trabocchi • Association for Nature, Environment and Sustainable Development Sunce • County of Split-Dalmatia 	<p>Within SUSHI-DROP, a customized unmanned underwater vehicles will be developed and equipped with acoustical and optical technologies in order to implement a non-invasive mean to assess environmental status of habitats, fish stocks population and, in general, to monitor the biodiversity of marine ecosystems. We are planning to assess the accuracy of the opto-acoustic surveys in deriving single-species abundance indices (in numbers or weight) for direct input into stock assessments, and to evaluate the benefits brought by these new technologies with respect to the classical procedures based on fish sampling. Moreover, a dedicated open-access database system will be created to collect, maintain and share the scientific data acquired by the UUVs.</p>

All project cluster deal with the blue economy sectors and their outputs represent a set of several tools and solutions in most cases data-driven or oriented to data management for the deployment of innovative solutions. The aim of the present document is therefore to outline main features of the outputs developed by the previous project, starting from their analysis and characterisation.

Methodology

Outputs produced by cluster projects have been mapped and analysed with a twofold aim: first, they have been outlined, i.e. for each project partners have been asked to detect which of the several products of cluster project could represent an “output”. For this purpose, an **“output” is meant as a tool/solution/best practice that brought a significant change in the scenario of the blue economy sectors, both in terms of innovation in process and products and in stakeholders behaviours, and that can be capitalised in future initiative.** Secondly, the main features of the detected outputs have been investigated in order to understand possible overlapping or, more conveniently, possible synergies that could be established in their exploitation.

On the whole, partners involved in cluster projects detected **a total of 24 project products that could be considered as “output”**. The list of selected outputs is reported in the following paragraph.

Once detected, the investigation of the features of single outputs has been conducted applying a common methodology, based on an analytical questionnaire (Annex 1) that allowed to depict common traits and potentialities of outputs.

The questionnaire includes several questions oriented to define:

1. The typology of output, distinguishing the following typologies: technical or scientific study/analysis; database, dataset or structured list of information/data; ICT and operative tool; analysis, document and /or recommendations to improve policy scenario; methodology, best practice and/or tool for effective stakeholders involvement.
2. The blue economy sector targeted: fisheries; aquaculture; coastal tourism; maritime transport & ports activities; shipbuilding;
3. The geographical scope: local; regional; national; whole Adriatic level; worldwide;
4. The focus on data used by the output: typology, origin, accessibility, availability, etc..
5. The typology of ICT system set up with the output;
6. The possible transferability and capitalisation of output.

The questionnaires filled in per each output are reported in Annex 2. The results that emerged from the examination of outputs detected are reported in next paragraphs.

Overview of outputs achieved by cluster previous projects

On the whole, the projects involved in TECHERA produced 24 main outputs. The following list reports all the project outputs achieved by project, with a short description of their contents:

ADRIREEF PROJECT

Code of Conduct and guidelines for sustainable exploitation of reefs

The main purpose of the Code is to give recommendations to users (stakeholders, citizens, tourists) for conducting activities for sustainable use of the reef that go beyond the legal framework.

Output typology: Analysis, document and /or recommendations to improve policy scenario

Study on ecosystem services of reefs

The study showed that this ecosystem service provided by reefs as well as food production and fruition still seem to have wide margins of valorisation. Reefs, both natural and artificial, as well as wrecks, are habitats of high natural value and have a high potential for socio-economic valorisation, but there is a need for a legislative framework covering both nature conservation and socio-economic issues to be shared with neighbouring countries

Output typology: Analysis, document and /or recommendations to improve policy scenario

Photogrammetry derived products

Underwater Structure From Motion photogrammetry was tested at the Paguro wreck study case, to estimate the volume of the fouling community. The survey results were associated to the outcomes from the laboratory analysis on species diversity and biomass estimation to provide relevant information for planning the routinary activities needed for the maintenance of the assets offshore. The 3D maps generated from the lower resolution surveys were also converted for the interactive rendering of 3D graphics within any compatible web browser, to raise the public awareness on the protected area and his peculiarities and inform scuba divers and operators. Moreover, the same photogrammetry data source was reprocessed, optimised and embedded in a virtual reality application for promoting a scuba diving experience at site (available through Oculus Quest headsets and designed for engaging a large and generic public to scuba diving and the site protection.

Output typology: ICT and operative tool

Map of Adriatic reefs webGis

The has Map of Adriatic reefs webGis been built with the purpose of geographically representing data regarding the Adriatic natural reefs, artificial reefs and wrecks and making them accessible to scientists, public administrations and citizens. Input data come from a wide

recognition, both from literature review and from surveys conducted through the project partners. Database building included three main steps: literature and available data review, questionnaire design and data aggregation.

Output typology: ICT and operative tool

White paper of innovative exploitation

The document provides recommendations to policy makers for drafting regulations related to the sustainable use of the underwater reefs. Natural and artificial reefs support habitats of high natural value and have a high potential for socio-economic valorisation. However, the legislative framework covering both nature conservation and socio-economic issues need to be improved and harmonized across member states of the same marine sub-regions. The outcomes include the detailed description of the reefs' vocations at the selected case studies used for the definition of guidelines to ease the management and the use of the reefs by existing and potential stakeholders.

Output typology: Analysis, document and /or recommendations to improve policy scenario

BLUE KEP

Cooperation agreements

The agreements aimed at starting cooperation among IT-HR education systems in the nautical and maritime sector. Several Croatian and Italian technical high-schools were actively involved in the creation and endorsement of the documents, which were the basis for planning students' mobility exchange programmes, including the involvement of sector clusters and companies in hands-on training. With such output, the project achieved the goal of building and testing a sustainable mobility scheme that can be considered a basis for future actions by other national or EU financed programmes. The output was hence needed for standardising school curricula and for harmonising recognition of students' credits in the cooperation countries through a shared recognition scheme and common assessment criteria of students' competences and qualifications. This was an answer to a growing need of specialised and skilled labour force that are key to boosting the blue sector's competitiveness and innovation.

Output typology: Methodology, best practice and/or tool for effective stakeholders' involvement

FAIRSEA

FAIRSEA integrated platform

The objective of the FAIRSEA integrated platform is to enhance the conditions for supporting sustainable fisheries management and ecosystem approach to fisheries in the Adriatic and

Ionian Sea. It was achieved through the implementation of a spatially explicit and territorially integrated tool that integrates datasets (years 2000-2020) from physics of the sea to bioeconomy of fisheries. The platform is populated with several layers of data organized into modules. The massive amount of data are integrated as much as possible and the technical integration was adapted to address stakeholders' and policy makers' issues.

Output typology: Database, dataset or structured list of information/data

Fish N' Ships

In order to increase awareness on difficulties and solutions for an Ecosystem Approach to Fisheries and to create an impact on all target groups a Food Web Card Game was developed reproducing the Adriatic/Mediterranean marine food web and fisheries complexity. The game was used to increase the awareness of the general public and especially the younger generations on what is fishing, the large complexity of species targeted by exploitations, what is the impact on marine ecosystem processes induced by fishing, but also what is the complexity of fisheries techniques. The game was developed as an online website that is used to collect the information on the playing activity to study the behavior of stakeholders.

Output typology: Methodology, best practice and/or tool for effective stakeholders' involvement

Ensemble Species Distribution Model (e-SDM)

Ensemble Species Distribution Models (e-SDM) was developed for setting scientific basis for optimizing spatial fisheries management, through identification of hot spots of aggregation of juveniles and adults demersal species. E-SDM includes a procedure for integrating oceanographic, fishery independent and fishery dependent data in order to identify areas of aggregation in the Adriatic and North Western Ionian Sea (Central Mediterranean Sea). E-SDM is involving different modelling approach, each trained and tested using an increasing set of variables in order to identify the best available model for each approach. e-SDM provides as result the maps of species abundance, presence/absence and biomass as the weighted average of the estimates of the ensemble components. Results provide identification of hot spots of aggregation by single and multispecies that might be used to identify priority areas for fisheries management (e.g., new fisheries restricted areas or marine protected areas).

Output typology: Technical or scientific study/analysis

Adriatic SMART modelling

This output represents the estimated bio-economic consequences of several management scenarios of fisheries policy application in the Adriatic Region. Namely, spatial and temporal restrictions of fishing effort (i.e. bottom otter trawling) were evaluated using SMART, an

interactive software platform in R. SMART works using different data sources including: Vessel Monitoring System and Automatic Information System data, Logbook data, Survey data and additional socio-economic parameters. SMART returns four main types of outputs: 1) the new fishing effort pattern (including the fishers' reaction – or displacement - determined by the scenarios of fisheries policy; 2) the corresponding changes in some socio-economic indicators (revenues, costs, profits); 3) the new exploitation pattern (catch by species/size/age) and 4) the mean-long term effects on stocks (i.e. fishing mortality, spawning stock biomass). This kind of output is needed to advice the competent authorities and the stakeholders. The benefits and the advantages arising from the availability of this output are: 1) the possibility to explore different potential management choices and to choose the best options considering all aspects (both biological and socio-economic); 2) The possibility of identifying management measures through a shared path with stakeholders.

Output typology: Analysis, document and /or recommendations to improve policy scenario

Adriatic Ecospace model

The objective of the Adriatic Ecospace model was to integrate dynamically information deriving from multiple sources and providing indication about possible effects of alternative management scenarios of fisheries at the Adriatic basin level considering multispecies interactions, multi-gear fisheries, oceanographic and climatic effects . To this purpose an ECOSPACE model for the Adriatic Sea (GSA 17 and 18; resolution 1/16 degree; years 2000-2020) was developed to provide indication about the possible implications and evolutions of the fishing system. The Ecopath with Ecosim and Ecospace approach (ECOSPACE in the following) was developed because it considers all the relationships among functional groups characterizing the food web of the Adriatic Sea and among those and fishery and useful to produce scenarios. The model development was carried out taking into consideration both the current and future recommendations of the GFCM and the suggestions received from the stakeholders during dedicated meetings. In particular, results from other models were used to provide future changes in environmental and oceanographic variables in the future. Then in Ecospace these variables were used as drivers and future simulations included management scenarios of fishery in the Adriatic Sea including representation of spatial and temporal ban of several fishing grounds, establishment of FRAs, ban of trawlers up to 6NM and reduction of the fishing effort.

Output typology: ICT and operative tool

Management scenarios of policy using BEMTOOL outputs

The module BIOECO is part of the integrated platform as informative layer to highlight potentialities of an Ecosystem Approach to Fishery (EAF) at different target groups. BEMTOOL

(in FAISEA a component of the BIOECO integrated platform) is a tool useful for setting scenarios that allow to evaluate how fishery-driven impacts (e.g. fishing mortality, population and gear selectivity) and management or fishing strategies (e.g. closed season, changes in fishing opportunity) affect stock and fisheries dynamics in terms of landings, discards and economic performance. Monthly time scale, several fleet segments and their selectivity, species with stock assessments are the key elements for setting management scenarios. The applications for showing the effects of different management measures through simulation provide the basis for informing policy makers of best practices and guidelines also transferable beyond the project scope. The approach developed is based on simulations and forecast using scenario modelling to predict short and medium term changes in key bio-ecological, impact and economic indicators. This is particularly useful for several stakeholders that can evaluate the trade-off deriving from different options.

Output typology: Technical or scientific study/analysis

ITACA

DATASET on catches and prices

The dataset collected within the ITACA project includes set of data on catches and producers' selling prices on a daily basis for the two main commercial species, considering the pelagic resources (i.e. anchovies and sardines). The database includes annual series from 2018 onward and is under permanent update with the support of fisheries operators involved in the project. The database in fact is built up with the direct support of fisher, who provide data periodically, and is structured at local level. It does not have any statistical validation.

Output typology: Database, dataset or structured list of information/data

ITACA WebAPP

ITACA project has developed an ICT system (the ITACA WebAPP), which is based on a predictive statistical-mathematical model that makes possible to predict the selling price of the fish product and, consequently, to calibrate the fishing effort on a daily and / or monthly basis based on market demands. The model runs on an econometric algorithm merged with an ecological module, that starting from historical statistical data, provides as output the most probable price in the market for the coming days. The ITACA WebAPP is operating on two pilot species (anchovies and sardines) and has been tested by a group of Adriatic fisheries operators of the Adriatic region, covering on the whole the 80% of the fleet of the small pelagic sector.

Output typology: ICT and operative tool

ITACA Cluster

ITACA established a cluster (the ITACA Cluster) among the project partners and 20 fisheries enterprises (the one participating in the pilot testing), by which parties engaged in pursuing the cooperation established within the ITACA project and the maintenance and exploitation of the ITACA WebAPP also for the future years, through the launching of new initiatives. The cluster represents one of the first examples of formalised cooperation among companies in the pelagic sector.

Output typology: Methodology, best practice and/or tool for effective stakeholders' involvement

PRIZEFISH

PRIZEFISH APP for the valorization of the Adriatic Fish products

The App developed has been conceived as an opportunity to create a direct contact with consumers which recognize and add value to Adriatic seafood products obtained by more sustainable fishing practices and tools. The App has served a dual purpose: 1) Informative function, to inform consumers on daily available fish products thus adding value to the whole chain; 2) Operative function, to facilitate the direct contact with the consumers, the products selling and delivery.

The App allows the consumer to know the “zero mile” fish available around him and start a direct contact with the fishermen.

Output typology: ICT and operative tool

Model-based Ecological indicators to support Certification of fisheries products

Ecological indicators can be used to quantify the performances of fisheries and, together with indicators based on catches or socio-economic parameters, support assessment of the fisheries sector. This result developed in PRIZEFISH, consists in a series of ecological indicators that evaluate 1) direct and indirect ecological effects the fisheries on the specific target species and the ecosystem as a whole, and 2) the role of target stocks in the food web. The former addresses the most probable adverse impacts of fishery on the ecosystem and estimating the level of risk of each fishery in an ecosystem and can guide to develop mitigation measures. The later considers the role of the stock in the food web with the aim of reducing fisheries impacts on key species (such as wasp waist species) to avoid severe adverse impacts on dependent preys and predators. The set of indicators allows to quantitatively assess the fisheries toward criteria set in the Adriatic Responsible Fisheries Management scheme.

Output typology: Methodology, best practice and/or tool for effective stakeholders' involvement

Adriatic Responsible Fishery Management standards

These guidelines define the standards that need to be met by Adriatic fisheries operating within the GFCM-GSA 17 and GFCM-GSA 18 to achieve the Adriatic Responsible Fisheries Management (ARFM) certification label, which has been developed in the framework of the Prizefish project. These guidelines, therefore, are mainly used to develop the standards to be used in order to understand if a fishing activity can be considered as 'responsible' in the Adriatic Sea context during the following pre-assessment activities.

Output typology: Methodology, best practice and/or tool for effective stakeholders' involvement

Guidelines to develop new eco-innovative fishery products

Besides the pilot actions of innovative technologies taken and described in guidelines, it is important for the producer organizations to detect the possibilities on creation of innovative products with added values, which will be piloted. Due to its own specialties, and the results gathered from the piloting of innovative technologies, each of the producer organization has made a clear insight into what kind of new product is possible to innovate, in order to widen the market possibilities and satisfy consumer needs.

Extension of sardine fresh filets shelf life – ozonized water + MAP with mixture of Argon and Carbon dioxide gases. The study shows that the use of ozone reduces the microbial load making the product much more stable during the storage period. Washing with ozonated water made it possible to keep the values of histamine and total volatile basic nitrogen low. Prolonged shelf life by 6 days.

Shrimp burgers HPP treatment and new recipe - using new technology, it has been decided to create a new innovative product – fish burger, made from fresh shrimp meat and minced mullet fillet, as an example of possible business diversification, which will add new market value to its product, reduce the load on resources, reduce labour costs and increase business profitability. The results are shown as a better usage of deep rose water shrimp meet, to 90 %, and prolonged shelf life of burgers up to 30 days.

Clams HPP treatment with and without tomato sauce - The stripped venus without HPP treatment lasted until day 8, while on the day 15 the package although still under vacuum but not anymore skin and there were specimens with open valves and with a decaying scent. On the other hand, the stripped venus with the tomato sauce had their packaging regular, under vacuum and skin in the days 1, 8 and 15, while at day 22 the package was under vacuum, but not skin and with a decaying scent.

Output typology: Methodology, best practice and/or tool for effective stakeholders' involvement

Guidelines for transferring sustainable fishing practices

They includes several recommendations to transfer sustainable fishing practices:

“Sea pump” pelagic fish - By piloted innovative technology, significant progress has been made in the management of responsible fishing, which is visible in the positive economic, social and environmental indicators, again the reason and need for the improvement. By achieving better quality, fishermen benefit with a higher purchase price, while with the reduction in operating costs support higher earnings. Positive social effects are visible through greater safety on board, especially during bad weather conditions. Special emphasis is placed on the ecological aspect in terms of preserving the population of sardines and anchovies in the Adriatic Sea, because the piloted technology allows further progress in terms of the possibility of separating juveniles from mature populations, through the direct return of a live fish to the sea.

De-peeling deep rose water shrimp machine - The innovative production process aimed to repurpose an already existing fish boning machine, which is the machine separation of shrimp shell and head from body separation. The technical operating principle of the machine is based on creating pressure with a flexible PVC tape on the perforated drum. For the separation of the Adriatic shrimp the 2 mm perforation is used. The machine is producing highest quality products thanks to the gentle, so-called “soft processing”. It achieves a compact performance in allows easy handling, cleaning and maintenance of the machine (saving time, reduces labour costs), and ensures the highest world-class hygiene standard.

Modified clam harvesting tool - The piloting activity of innovative technology involved adopting different modified clam dredges. The main objective of the innovation process is to reduce the physiological stress of the caught clams that are otherwise subject to high water pressure jets and vibrations throughout the fishing process. The reduction of physiological stress will benefit the fresh product allowing a possibility to extend the shelf life of the product and reduce the quantity of sand that the clams “ingest” during fishing.

Output typology: Methodology, best practice and/or tool for effective stakeholders' involvement

Database and analysis of consumer preferences

The output addresses the current consumption trends of seafood products in Italy, Spain and Croatia, with a focus on the appreciation of three eco-innovative products. The output consists of two databases and the respective analysis. The first database contains qualitative impressions expressed by 191 participants of 6 online discussion rooms in the three countries. The second database contains quantitative data collected from 3760 consumers from the three countries. A report has been produced to highlight the main findings obtained by the surveys. In general, the output tends to evaluate customers' perceptions and appreciation

towards fishery products, including main social and psychological drivers and barriers to seafood consumption. This has been investigated both for traditional and eco-innovative products, searching for discrepancies and peculiarities. Collecting reactions and feedbacks from consumers on these aspects is fundamental for the future development of eco-innovative products

Output typology: Analysis, document and /or recommendations to improve policy scenario

Eco-innovative value chains design recommendations

This output draw recommendation about the design of eco-innovative value-chains for the fresh fish market. These recommendations are mainly intended to be implemented by Producers Organizations (or co-operatives) involved in fisheries and processing but could also be used by companies of other legal forms (or by companies of other supply chain stages) after specific adaptations. Through an iterative process undergone along the whole Prizefish project, some eco-innovations have been identified as particularly capable of adding more value to the supply chain while respecting the environmental ecosystem, opening in this way the road to new valorization paths for local species and resources. The selected eco-innovations took the final form of four items: three eco-innovative fishery products and the concept of an e-commerce capable to distribute fresh local fish. Each of these items is supported by a specific Business Model Canvas, highlighting key aspects that should be followed for creating value. This tool contains a set of elements and allows expressing a company's logic of earning money. It is a description of the value a company offers to one or several segments of customers and the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, in order to generate profitable and sustainable revenue streams.

Output typology: Analysis, document and /or recommendations to improve policy scenario

SUSHI.DROPS

Unmanned Underwater Vehicle "Blucy"

The Blucy is a multipurpose Unmanned Underwater Vehicle for noninvasive underwater habitat monitoring, developed and tested during the project. The test was oriented to assess the effectiveness of the underwater drone for surveying the benthic zone in shallow and deep-water environment of the Adriatic Sea and has been made by collecting optical and acoustic data to produce digital models of the underwater environment. At the end, an evaluation of the benefits brought by the adoption of the UUV technology in monitoring deep-water ecosystems has been made.

Output typology: ICT and operative tool

Open access GIS with data gathered during SUSHI DROP Missions

During the missions of the SUSHI DROP project, large volumes of data were collected from the sensors of the Blucy UUV. Data of the seafloor frame sequences acquired during the missions enabled the creation of products such as orthophotos and digital models of the seafloor have been processed. The availability of these outputs enables a better understanding of natural elements in mission areas and a digital exploration of habitats.

Output typology: ICT and operative tool

Analysis of surveyed outputs

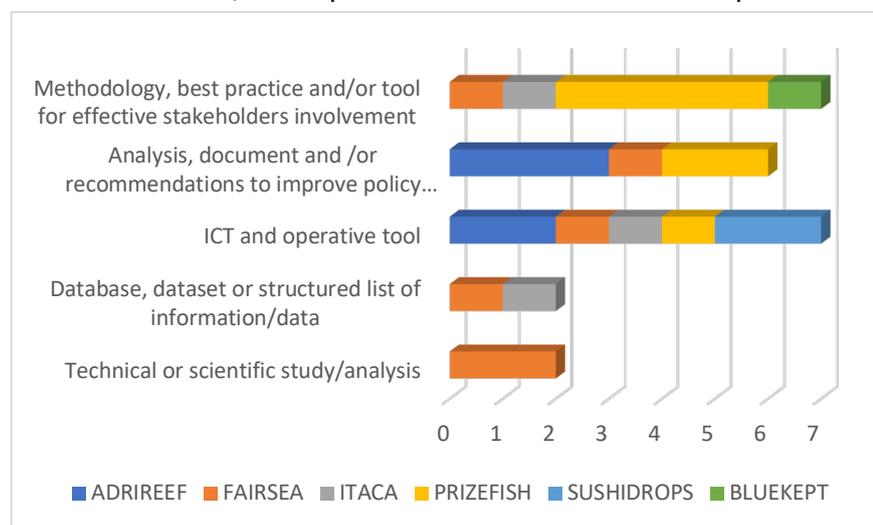
Typology of surveyed outputs

Generally speaking, all the cluster projects produced outputs with a strong operative level. Indeed, a large part (n.7) of outputs developed by projects can be gathered as *“ICT and operative tool”*. They represent an answer to the need, for cluster projects, to provide for active tools oriented to improve the ordinary stakeholders’ activities.

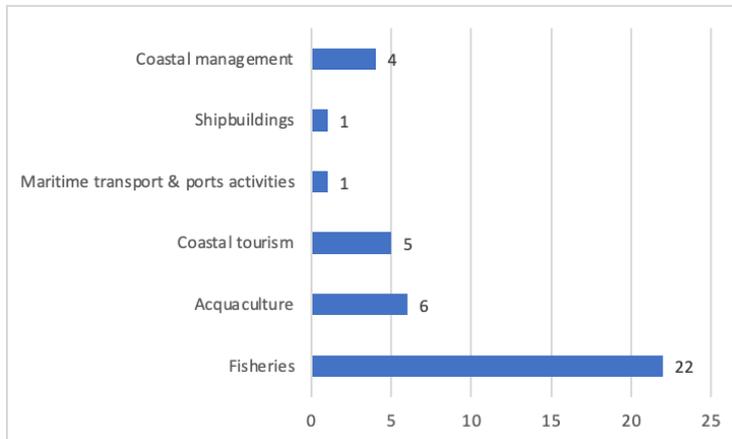
In this sense, it has to be considered that n. 4 outputs achieved by cluster projects fall under the typology of *“Database, dataset or structured list of information/data”* and *“technical or scientific study/analysis”* and in most cases, these products can be considered as preliminary steps, functional to the achievement of the outputs mentioned above.

On the other hand, another, even larger, part of outputs is composed by *“Analysis, document and /or recommendations to improve policy scenario”* or *“Methodology, best practice and/or tool for effective stakeholders’ involvement”*

(a total of n. 13 outputs, respectively n. 6 and n. 7 outputs), supporting, in this case, the need to provide for tools to improve the framework conditions (at policy and governance levels) of the economic sectors involved, as well as for a better involvement of actors and stakeholders of the interested economic sectors, according to a participatory process.



Targeted sectors

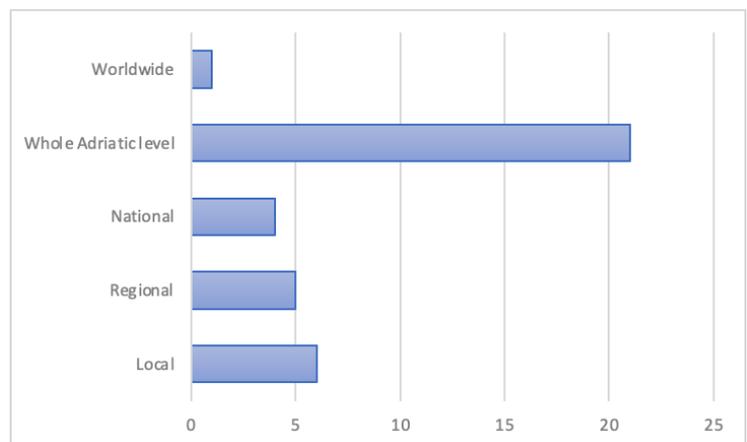


All the outputs developed by cluster projects are targeted to blue economy sectors and specifically to traditional blue sectors. Considering that a single output could contribute to more than one blue sector, fisheries and aquaculture are the most targeted economic activities, receiving an active contribution by respectively n. 22 outputs and n. 6 outputs. Coastal tourism and coastal

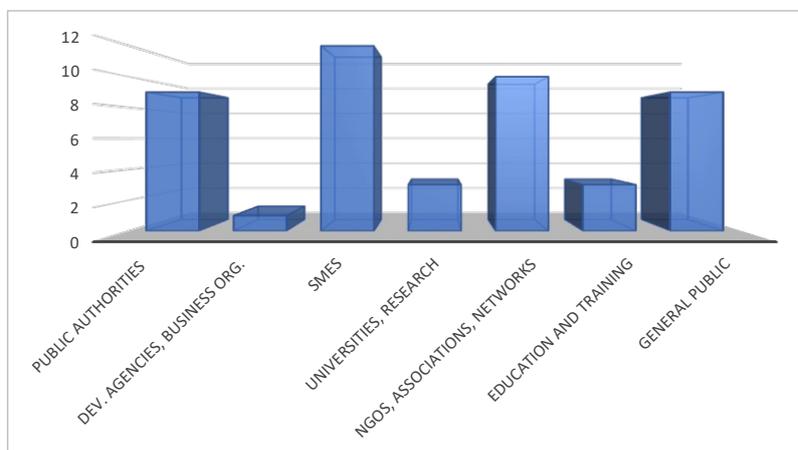
management are addressed by respectively n. 6 and 5 outputs, while maritime transport and shipbuilding were not considered as a primary target by involved cluster projects.

Geographical scope

As tools were developed within the Italy-Croatia Cross-border cooperation Programme, most of them are relevant at whole Adriatic level. It has been said, however, that some outputs, even if applicable at Adriatic level, find their validity also at a lower territorial level, such as local, regional or national. Only one output is applicable worldwide.



Target and accessibility of outputs

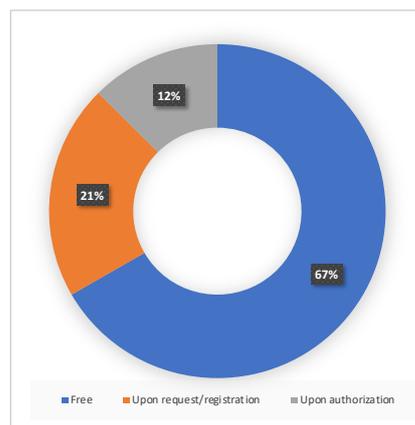


The high operative feature of the outputs produced by the cluster project emerges also surveying the target to which they are oriented. In fact, almost half of the outputs surveyed are dedicated to SMEs, proving a factual support both for innovating productive process and products and for improving ordinary business

management. To these mentioned 12 outputs, also another one targeted to development agency and business support actors should be added.

On the other hand, several outputs offer a support for public institutions and NGOs, association and network, providing tools and decision support instruments for the above mentioned change in the framework conditions for the blue economy sectors as well as for a wider participatory approach.

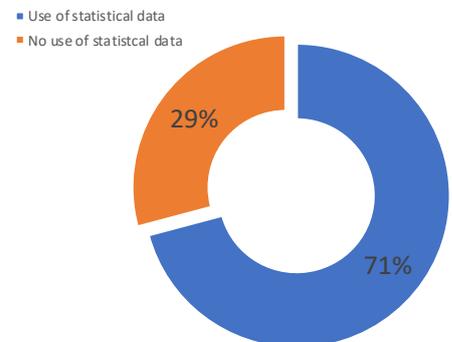
Lastly, a total of n. 6 outputs are dedicated to research and education sectors (respectively n. 3 outputs targeted to university and research centers and n. 3 outputs targeted to education and training institutions), supporting the production and circulation of knowledge at the academic level.



Almost all outputs are freely accessible, only few of them (and especially APPs and ITC tools) are accessible after registration or authorization.

The exploitation of statistical data in the surveyed outputs

A large part (71%) of outputs surveyed are based on the exploitation of statistical data. The use of statistical data for the development of outputs occurred in different manner. Most of the outputs exploited already available statistical data, taken them from official registers, while others built up their own datasets, gathering new data. Precisely, out of the 17 outputs that are data-based, only 3 use only data available in official databases, while the remaining ones, either use already available data (10 outputs) and collect new ones, or just use data collected within the project lifetime (4 outputs).



Considering the outputs that were based on already available statistical data, in half cases, this exploitation processed has not been enough smooth: in fact, data were not available at the geographical level needed for the project purposes or administrative and permission constraints hindered their easy utilisation.

New statistical data have been gathered

mainly in three different ways:

- through direct survey, i.e. throughout the exploitation of surveying devices (i.e. in the SUSHI.DROPS and ADRIREEF projects). In this case, data collected were then processed, obtaining digital models and entering them into the project statistical database, with a statistical validation and scientific value;
- through direct involvement of project stakeholders (i.e. mostly all the cluster projects worked tightly with stakeholders and proceed with interviews on quantitative and qualitative information). In this case, data collected were then processed, entering them into the project databases, not always with a statistical validation and scientific value (i.e. in the ITACA project a wide database on catches and producers' selling price of anchovies and sardines has been gathered but without any scientific revision);
- through the treatment of previous official data and their combination (i.e. in the FAIRSEA project VMS raw data for estimating effort have been combined with CMEMS oceanographic data), entering them into the project statistical databases, with a statistical validation and scientific value.

Typology of data exploited by surveyed outputs

In order to classify the data exploited by surveyed output, two categories of data have been analysed: data related to sea status and data related to blue economy sectors. Then, for each of the two categories, both the data taken from official register and the ones elaborated *ex-novo* by cluster projects have been detected.

The complete list of the data exploited, at different stage and way, by surveyed outputs is reported in the Annex 3. It is an extensive list that includes, in several cases, long historical series of data, mainly referred to:

- for the data extracted from official register: the status of marine ecosystems and indicators representing the status of ichthyic resources;
- for data collected *ex-novo* by cluster projects: qualitative and quantitative information on fishing effort and the ichthyic chains, gathered with the support of fisheries operators.

It can be useful to underline that almost all cluster projects, during the process of outputs development and implementation, start up several campaigns to collect new data, contributing to enlarge the basis for further scientific and technical findings and knowledge.

OUTPUTS EXPLOITING DATA FROM OFFICIAL REGISTERS		
PROJECTS	Status of the sea	Blue economy sectors
Fairsea	Yes	Yes
Prizefish	Yes	Yes
Itaca	Yes	Yes

OUTPUTS EXPLOITING NEW COLLECTED DATA BY PROJECT CLUSTER		
PROJECTS	Status of the Sea	Blue economy sector
Adrireef	Yes	No
Fairsea	Yes	Yes
Itaca	No	Yes
Prizefish	No	Yes
Sushidrop	Yes	No

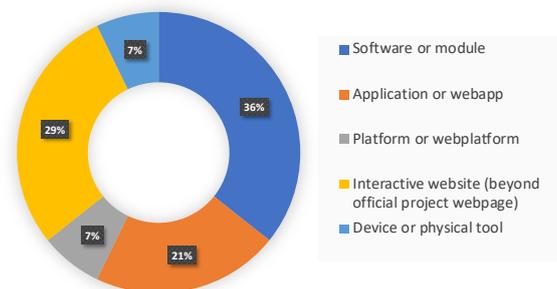
Focus on operative and ICT tools

Considering only the n. 7 outputs that have been categorised as “*ICT and operative tool*”, it emerges that they are mainly interactive website (n. 4 outputs), followed by application or web application (n. 2 outputs) and one software or module. Nevertheless, widening the meaning of “*ICT and operative tools*”, it is possible to include under this category also other surveyed outputs, that originally have been considered as “*Technical or scientific study/analysis*” or “*Database, dataset or structured list of information/data*” because of their main scope. In a wider meaning, they can in fact be considered as “*ICT and operative tool*”, thanks to the fact that they are based on ICT solutions to be readable.

This considered, the cluster projects contributed with the implementation of n. 14 “*ICT and operative tools*”: most of them are software/modules or interactive websites.

Applications raise up at n.3 tools and both n. 1 web-platform and n. 1 physical tool can be added.

All of surveyed ICT tools have been conceived as independent tool and are based on different languages and software codes/sources. However, most of them are potentially able to interoperate: this applies especially to outputs based on geographic information systems, in which data can be downloaded and integrated as layers of other GIS. Moreover, database are exportable and readable from several statistical analysis tools, while multiple software codes are developed in R, allowing therefore to be implemented/elaborated with other systems, if the coding language is compatible.



Follow up and further development of outputs

All the outputs detected have been produced as running and operative tool at the time of conclusion of previous projects. However, they can be improved in order to increase their efficacy and operability. The possibilities for making the outputs more performing depends typically on different typology of outputs, but generally could be referred as an improvement that arises from new input data.

Almost all *“ICT and operative tools”* need a constant update of data to maintain their operative capacities and be able to up-to-date analysis and decisions.

Moreover, they can be further developed by introducing new data that are able to interact with already exploited data in order to formulate new relation and give an more exhaustive capacity of modelling and interpretation of phenomena (e.g. FAIRSEA integrated platform and Adriatic smart modelling). Others can be improved in their response capacity (i.e. Blucy’s modular design philosophy allows to integrate or to switch additional science sensors according to the tasks and targets to be conducted).

On the other hand, outputs that are linked to stakeholders involvement, as *“Analysis, document and /or recommendations to improve policy scenario”* or *“Methodology, best practice and/or tool for effective stakeholders’ involvement”* could benefit from wider, more precise and updated feedback from them. For instance, the *“Database and analysis of consumer preferences”* and the *“Eco-innovative value chains design recommendations”* of PRIZEFISH could be further improved by new studies respectively on consumers’ preferences and on business models and behaviors of operators.

Capitalisation and transferability of outputs

All the surveyed outputs have been conceived in order to be transferable and capitalised. The process of transferability of outputs suggested by the same output developers can follow the traditional paths and be:

- towards new areas and territories not covered by the original project. This can be applied both to ICT and operative tools as well as to outputs oriented to support a change in the framework conditions and a better involvement of stakeholders. In the first case, the transferability occurs tout-court by the integration of new input data representing the situation and the indicators of the newly involved areas. It is the example of the FAIRSEA e-SDM, that can be transferred to others area in Mediterranean Sea, using data derived from MEDITS survey, effort from VMS and oceanographic variable from CMEMS: the approach is anyway applicable everywhere trawl survey data are available. Instead, in relation to recommendations and methodologies to increase the participatory processes, the transferability process is affected by the involvement of new stakeholders

and the analysis of the legislative/policy scenario. For instance, the ecosystem service study of the ADRIREEF project could be replicated in different marine sub regions across the EU for promoting sustainable use of artificial and natural reefs. While the game elaborated by FAIRSEA is representing a typical Mediterranean ecosystem and its fisheries: it can be transferred to other systems by readapting card species and fisheries species to the new areas quite easily (although some care in keeping the actual play capability is needed). At the moment the development of the Fish N' Ships Southern Benguela Version is ongoing through a collaboration with University of Cape Town;

- towards new economic sectors. This transferability is factually achievable in case of *“Methodology, best practice and/or tool for effective stakeholders’ involvement”* outputs that, thanks to their nature. As an example, the cooperation agreements of the Blue KEP project are part of a methodology that was tailored to technical schools in maritime/ship sector, but can be easily fine-tuned for other educational fields such as tourism, hospitality and catering training schools, as well as for any kind of sector.

In case of ICT tools, the transferability toward new sector is however possible, i.e. the PRIZEFISH and ITACA APPs could be employed also for other fish species and fisheries operators, the SUSHIDROP Blucy to submarine surveys can be applied in other sectors such as: marine infrastructure monitoring, underwater archaeology, aquaculture monitoring, harbour security.

Capitalisation of detected outputs, meaning their horizontal mainstreaming, could be achieved throughout spreading the outputs utilisation by new stakeholders, in their ordinary activities. In this sense, the guidelines for eco-innovative fish products and sustainable fishing practices as well as the eco-innovative value chains recommendations elaborated by the PRIZEFISH project represent a way to improve widely the know-how of a large part of fishers and ichthyic chain operators also beyond the ones involved by the same project.

On the other hand, capitalisation of surveyed outputs, meaning “building upon” them, could be achieved by making the single outputs interoperating among them or with other systems or solutions. For instance, the ADRIREEF GIS could embed also the source dataset within repository for predictive species distribution modelling, or the FAIRSEA Platform can incorporate easily other scenarios of fisheries management and climate or new kind of data (e.g., visual, maps, high resolution details), at any scale, for increasing information and data layers, as well as the SUSHI.DROP open access GIS could be integrated with other layers or made interoperable with other Geographic Information System. These process of building upon could be reach also by stakeholders-oriented outputs: for instance, the guidelines for developed by the PRIZE.FISH project could represent the basis to outlined new professions within the blue careers.

Lesson learned and conclusions

Cluster projects (ADRIREEF; BLUE KEP, FAIRSEA, ITACA, PRIZEFISH, SUSHI.DROPS) produced significant outputs that have the potential to bring changes in the scenario of the blue economy sectors, both in terms of innovation in process and products and in stakeholders behaviours.

In fact, the cluster projects and partners developed a set of 24 outputs, that could be shared into two main typologies:

- data driven ICT tools, including supporting database, dataset or structured list of information/data and supporting technical or scientific study/analysis;
- stakeholders-oriented tools to improve the policy scenario and the participatory approach.

Most of these tools are oriented to fisheries and aquaculture sectors, among those of the blue economy, being these ones preeminent economic activities in the Adriatic sea and, at the same time, having a strong relevance in terms of environmental possible impacts.

Most of the outputs are data-driven and, for their development, several and multi-level data collection campaigns have been launched: it can be considered that, on the whole, cluster projects and partnerships acted as a “knowledge hub”, developing and gathering new information suitable to enhance the framework of blue economy.

Moreover, through their outputs, the cluster project achieved a large number of results that improved the sustainability of the blue economy, both at policy level (thanks for instance to the wider availability of decision supporting tools for management of resources) and operative level (thanks to the extensive number and typology of SMEs-oriented tools and best practices).

Taking stock of these experiences, it is suggested to:

- further spread the development of analytical and forecasting data-driven tools to support strategic planning and managing decisions;
- extend the use of data-driven solutions and tools to support economic activities linked to the sea resources that can combine the economic sustainability and the environmental one.

To these purposes, the outputs and the knowledge developed is available for future “building upon” approaches, such as capitalisation, transferability and mainstreaming processes. Those processes are not alternative and could take place by:

- transfer the outputs towards new areas and territories not covered by the original projects as well as towards new economic sectors;
- capitalise the output, i.e. mainstream them, towards new stakeholders;
- build upon the outputs, lastly supporting the development of new and integrated knowledge and skills for the blue economic growth.

Previous Project Acronym Project logo

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Schematic description of project output n.

Output title	<i>Please, provide the title of output</i>
Deliverable references	<i>Please add the deliverable number and name in the original AF. If the output does not represent a project deliverable, just put "not applicable"</i>
Type of output	<input type="checkbox"/> Technical or scientific study/analysis <input type="checkbox"/> Database, dataset or structured list of information/data <input type="checkbox"/> ICT and operative tool <input type="checkbox"/> Analysis, document and /or recommendations to improve policy scenario <input type="checkbox"/> Methodology, best practice and/or tool for effective stakeholders involvement <input type="checkbox"/> Other, <i>please specify</i>
Brief description of the output	<i>Please, provide a detailed description of the output, focusing on:</i> <ul style="list-style-type: none"> - <i>its contents or functioning</i> - <i>why there was a need for this output</i> - <i>the scope/aim of the same output</i> - <i>the benefits and advantages that arise from the availability of output</i>
Blue economy sector targeted	<input type="checkbox"/> Fisheries <input type="checkbox"/> Acquaculture <input type="checkbox"/> Coastal tourism <input type="checkbox"/> Maritime transport & ports activities <input type="checkbox"/> Shipbuildings <input type="checkbox"/> Other, <i>please specify</i>
Geographical scope	<input type="checkbox"/> Local <input type="checkbox"/> Regional <input type="checkbox"/> National <input type="checkbox"/> Whole Adriatic level <input type="checkbox"/> Worldwide

Input data used	<i>If relevant, describe briefly on which data you output is based. Please consider, any kind of data such as bio-ecological, socio-economic, etc...</i>
Output data produced	<i>If relevant, describe briefly which data you output produced or elaborated. Please consider, any kind of data such as bio-ecological, socio-economic, etc...</i>
Output available here	<i>Please, indicate the URL or physical support where the output is available</i>
Accessibility of the output	<input type="checkbox"/> Free <input type="checkbox"/> Upon request/registration <input type="checkbox"/> Upon authorization <input type="checkbox"/> On payment
Data policy (FAIR?)	<i>Please, describe the policy adopted for management of data in your output and beyond</i>
Target groups and final beneficiaries of the output	<i>Please, describe and quantify the target groups and final beneficiaries of your output</i> Achieved: <input type="checkbox"/> Yes, n. <input type="checkbox"/> No
Transferability and capitalization of output	<i>Can the output be transferred to other areas/scenarios/sector? In positive case, how?</i>
Possible upgrading/updating of the output	<i>Can the output be further upgraded or updated? In positive case, how?</i>
Contact person for further information	<i>Name, Surname and e-mail address</i>

Specific focus on data used within the output

<p>Does the results is bases or made us of statistical data on its implementation?</p>	<p><input type="checkbox"/> Yes <input type="checkbox"/> No <i>(no need to proceed in filling in the questionnaire)</i></p>
<p>Does the result collect data or produce data?</p>	<p><input type="checkbox"/> Collect new data <input type="checkbox"/> Use only data previously collected and available in official databases <input type="checkbox"/> Use available data and collect new ones <i>Please briefly explain:</i></p>
<p>What type of data your project “made use of” during the project implementation</p>	<p><input type="checkbox"/> Official data from official registers <input type="checkbox"/> Data collected through project activities <input type="checkbox"/> Both of them <input type="checkbox"/> Other sources, <i>please specify:</i></p>
<p>If relevant, did you find difficulties in obtaining official data?</p>	<p><input type="checkbox"/> No <input type="checkbox"/> Yes, because data were not available at the geographical level needed for the project <input type="checkbox"/> Yes, because data were not available in an updated form <input type="checkbox"/> Yes, because of administrative permission in obtaining the data <i>Please briefly explain:</i></p>
<p>In case of new data collection, how did you proceed in gathering data? Are collected data finally included in official databases?</p>	<p><i>Please, describe briefly the modalities/methodology applied and how you manage the process of officialization of data collected, if occurred</i></p>
<p>Do data follow FAIR protocol (Findable, Accessible, Interoperable, Reusable)?</p>	<p><input type="checkbox"/> No <input type="checkbox"/> Yes <i>Please briefly explain:</i></p>
<p>Are data available for further use?</p>	<p><input type="checkbox"/> No <input type="checkbox"/> Yes, used directly on the project result form <input type="checkbox"/> Yes, downloadable and used in any other form <input type="checkbox"/> Yes, after specific request and elaboration</p>
<p>Are data georeferenced?</p>	<p><input type="checkbox"/> No <input type="checkbox"/> Yes <i>Please give some details:</i></p>

REGARDING DATA DIRECTLY FROM OFFICIAL REGISTERS, WHICH OF THEM DID YOU EMPLOY IN PROJECT ACTIVITIES?

Data on Status of the Sea

Data	Units	Source (be detailed; include link)	Resolution	Georeferenced	Geographical scope (area: local, regional, Adriatic...)	Year/period

Data on blue economy sector

Data	Units	Source (be detailed; include link)	Resolution	Georeferenced	Geographical scope (area: local, regional, Adriatic...)	Year/period

DATA COLLECTED by the project result

Data on Status of the Sea

Data	Units	Collection method	Resolution	Georeferenced	Geographical scope (area: local, regional, Adriatic...)	Year/period

Data on blue economy sector

Data	Units	Collection method	Resolution	Georeferenced	Geographical scope (area: local, regional, Adriatic...)	Year/period

Specific focus on ICT and operative tools

<p>What kind of ICT and/or operative tool has been developed?</p>	<p><input type="checkbox"/> Software or module</p> <p><input type="checkbox"/> Application or webapp</p> <p><input type="checkbox"/> Platform or webplatform</p> <p><input type="checkbox"/> Interactive website (beyond official project webpage)</p> <p><input type="checkbox"/> Device or physical tool</p> <p><input type="checkbox"/> Other, <i>please specify:</i></p>
<p>Which are the basics characteristics/features of the ICT and/or operative tool?</p>	<p><i>Please briefly explain describe the main architectural features and the languages/support used to set up the tool</i></p>
<p>Is the ICT and/or operative tool standing alone or is it part of a more complex system?</p>	<p><input type="checkbox"/> It is an independent tool, able to run without interfacing with external tool</p> <p><input type="checkbox"/> It is part of a more complex system, <i>please specify:</i></p>
<p>Is the ICT and/or operative tool able to interoperate with other systems?</p>	<p><i>Please briefly explain if, during the setting up of the ICT and/or operative tool, some specific attention was given to interoperability and how</i></p>
<p>Who are direct and indirect users of the ICT and/or operative tool?</p>	<p><i>Please briefly describe who are direct users and potential user (i.e. who can benefit from outcomes/report of the tool)</i></p>
<p>How do the users access and use the ICT and/or operative tool?</p>	<p><i>Please briefly describe how users could access the tool and how they interact with it</i></p>
<p>After the conclusion of the previous project, does the ICT and/or operative tool has been further used by target groups?</p>	<p><i>Please, briefly describe if the ICT and/or operative tool has been maintained and/or upgraded after project end or if it is foreseen to</i></p>
<p>After the conclusion of the previous project, does the ICT and/or operative tool has been further updated in its functions?</p>	<p><i>Please, briefly describe if the ICT and/or operative tool has been maintained and/or upgraded after project end or if it is foreseen to</i></p>
<p>Who is the owner of the ICT and/or operative tool?</p>	