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Identification of common challenges and opportunities for synergies in MED area

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Author(s):	**PP2 – UNIVERSITY OF THE AEGEAN / DEPARTMENT OF SHIPPING TRADE & TRANSPORT**
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Executive Summary

The report "Identification of Common Challenges and Opportunities for Synergies in the Mediterranean Area" (Del. 3.2.2.) includes a comparative analysis based on five (5) Regional state of the art reports on maritime surveillance sectors completed by the project partners from France, Italy, Greece, Spain and Portugal in the context of Deliverable 3.2.1. (The regional state of the Art in Cyprus is still pending, so no findings for Cyprus are presenting in this version)

This report will facilitate the interested target groups and the project partners to build a concrete map of the national priorities of each country linked to Maritime Surveillance (MS) as well as a clear view of the gaps, the threats, the opportunities and the best practices/initiatives that have been identified in each target area.

Key points of the Comparative Analysis:

- **Four (4) out of the five (5) countries**[1] that will host the National Nodes identified the "**Maritime safety and Security**" **as the prominent MS sectors**.
- All partners have identified a significant number of key actors/stakeholders related to MS both from private and from public sector.
- The **capacity building potential of the identified involved stakeholders** to facilitate the achievement of the project objectives is **high**.
- The available information for the involved stakeholders and the overall capacity/ potential to extract further information is high.
- **Most of the identified stakeholders/actors** are involved in "**Maritime Safety** & **Security"** and **"Defence".**
- Several issues related to MS have been extendently recorded for all participating countries. Italy has identified most of them.
- The quality of the recorded data regarding the indentified threats related to MS is high.
- All countries present specific difficulties in order to address the identified threats.
- **Clusters related to MS have been recorded by all countries of reference**.
- All countries have recorded several best practices or/and innitiatives related to MS sectors.
- **The quality of** the available data regarding the **Best Practices** related to MS is considered **high;** the extend of data availability is moderate to high.
- The capacity to obtain further data from both the recorded clusters and the best practices/initiatives is high.
- All participating countries have identified strenghts and opportunities related to MS sectors.
- The RDI potential linked to MS sectors varies between Moderate and High.

[1] Cyprus is the 6th country that will host a national node, however the data related to MS is still pending

Additional findings that can be concluded from the analysis are the following:

- All the countries of reference have to face economic obstacles: lack of funds for investments, high cost of vessel's operations, increased ICT cost.
- In most cases, there is lack of well defined structures for maritime clusters in most of the areas of reference.
- There are obstacles in the Legal Framework (e.g. incompatibility) of the countries in order to ex-change MS data.
- The sharing of Information between sectors and countries is limited.
- Bureaucracy and delays were mentioned in public procurements due to the public nature of the MS sector.
- Mediterranean sea links over 20 countries from Asia, Europe and Africa, constituting the cooperation a big challenge.
- Due to the lack of a secure environment on the seas, maritime activities are being compromised.
- The market of security and surveillance products is fragmented because of sectoral, institutional and legal differences within and between EU Member States.

Following, a set of synergies, which is the outcome of the comparative analysis has been elaborated, taking under consideration the identified institutional, financial and technical capacity building potential of the study areas. Particularly, the main factors that are taken under consideration are:

1. The identified prominent MS sector per reference country.
2. The identified challenges and threats for each reference country.
3. The identified strengths and opportunities.
4. The involved stakeholders/actors capacity building potential.
5. The identified clusters, best practices and initiatives of the reference areas.

<u>Proposed Synergies:</u>

- The successful operational and structural model of the identified best practices Clusters should be taken under consideration when outlining the methodology for the establishment of the transnational MS cluster.
- The factors that will contribute to job creation through Blue economy should be further examined through cross-border cooperation and by exchanging knowledge and best practices.
- The development and the valorisation of financial tools in order to address funding challenges and difficulties. Systematized private-public partnerships will maximize the private and public capital flow contributing to further development and valorisation of RDI capacity related to MS that could potentially contribute to job creation.
- Improve capacity building of the indentified stakeholders/actors related to MS through the exchange of existing knowledge and experiences.

- Identification of obstacles and inconsistencies of existed legislation and define policy recommendations.
- The development of a favourable investment environment for the enterprises related to MS.

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1. INTRODUCTION

WP3 (Studying phase) aims to identify and present the state of the art regarding the Maritime Surveillance in the participating countries. The outputs will contribute to the preparation of the Methodologies that will act as innovative tools for the setting up and the creation, at first stage, of the national nodes and, at second stage, the MED cluster of Maritime Surveillance. In particular, through WP3 the following will be achieved:

- Mapping of Maritime Surveillance sectors per country that will host the national nodes during the Testing phase, focusing on priorities, involved actors, common challenges and gaps, best practices, existing clusters and regulatory framework.
- Collection of existing MS technologies and applications and identification of market and business opportunities and linkages with relative industries.
- Elaboration of a Methodology focusing on the design and development of the nodes that will constitute the national antennas of the MED level cluster.
- Implementation of a Methodology focusing on the operation of the MED level cluster and having as priority the increase of the share of transnational activities.
- The ultimate goal of the aforementioned tasks is the preparation of a common strategy that could be applied to the national nodes aiming at boosting their operation on Maritime Surveillance industry and the development of an action plan for the enhancement of MS in MED area focusing on predefined targets and factors.

Furthermore, the project partnership will take advantage of the available sources coming from relevant projects, the European Commission, the European Maritime Safety Agency etc, in order to achieve qualitative & updated results.

As a result, the interested target groups will have a more concrete map of the national priorities of each country linked to Maritime Surveillance and the partnership will have the necessary tools to start the procedures of pilot testing phase.

The **Activity 3.2** is dedicated to the regional and national analysis of the existing situation regarding Marine Surveillance (MS) in the participating areas. The initial phase includes the identification of the specific MS sectors (e.g. environment, port control, piracy, defense etc.), main actors, common challenges and threats regarding MS in the countries that will host the nodes in the Testing phase. In addition, the Project Partners will define the characteristics, members, operations of a cluster and will identify best practices in the focus sector of the project. The tasks will be completed with the elaboration of a benchmarking report taking into consideration clusters at international level, and the analysis of the Policy framework that is applied in MS sectors.

The report "Identification of Common Challenges and Opportunities for Synergies in the Mediterranean Area" (Del. 3.2.2.) constitutes a comparative analysis report based on the 5 Regional state of the art reports on maritime surveillance sectors[2], that will be addressed in the framework of

[2] The 6th report refering to Cyprus is still pending.

the Nodes' operation. (Del. 3.2.1.). The report is devided in 6 chapters in order to represent the common challenges, gaps and opportunities for partnerships and synergies in MED area as well as the effectiveness of the ongoing systems and best practices.

1. Identification and analysis of the sectors of the integrated maritime surveillance
2. Identification of involved stakeholders
3. Identification of common challenges and threats
4. Gap analysis: Clusters, Best Practices and Initiatives related to MS
5. Comparative analysis of the ongoing systems and the best practices
6. Opportunities for synergies in MED area

2. IDENTIFICATION AND ANALYSIS OF THE SECTORS OF MARITIME SURVEILLANCE (MS)

Integrated Maritime Surveillance is about providing to the authorities interested or activated in maritime surveillance with ways to exchange information and data in order to facilitate them in decision making. The aim of an Integrate Maritime Surveillance is to generate a situational awareness of activities at sea, impacting on:

- Border control
- Maritime safety and security
- Fisheries control
- Customs
- Maritime environment & pollution
- Defense
- General law enforcement

The chapter presents the main sectors in EU level and analysis the state of the art in the areas that will host the 5 national nodes in the context of the project.

2.1. MAIN SECTORS AT EU LEVEL

2.1.1. BORDER CONTROL

"with a focus in the prevention of illegal immigration and cross-border crime at EU external borders"

Since 1999 the European Council on Justice and Home Affairs has taken several steps towards strengthen cooperation in the area of migration, asylum and security. In the border management field this led to the creation of the External Border Practitioners Common Unit - a group composed of members of the Strategic Committee on Immigration, Frontiers and Asylum (SCIFA) and heads of national border control services. The Common Unit coordinated national projects of Ad-Hoc Centres on Border Control. Their task was to oversee EU-wide pilot projects and common operations related to border management.

There were 7 Ad-Hoc Centres:

1. Risk Analysis Centre (Helsinki, Finland)
2. Centre for Land Borders (Berlin, Germany)
3. Air Borders Centre (Rome, Italy)
4. Western Sea Borders Centre (Madrid, Spain)
5. Ad-hoc Training Centre for Training (Traiskirchen, Austria)
6. Centre of Excellence (Dover, United Kingdom)
7. Eastern Sea Borders Centre (Piraeus, Greece)

Two years after the establishment of "Ad-Hoc" centres the European Council decided to go a step further. With the objective of improving procedures and working methods of the Common Unit, on the 26 October 2004 the European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union (FRONTEX) was established by Council

Regulation (EC) 2007/2004. This Regulation was repealed by Regulation (EU) 2016/1624 establishing European Border and Coast Guard Agency (FRONTEX), on the 14 September 2016.
Since 2006, FRONTEX carries out a series of joint operations in the area for the purposes of addressing illegal immigration. In 2008, FRONTEX is coordinating a number of such joint operations at the southern maritime borders (including South Aegean Sea) such as:

- HERA
- MINERVA
- POSEIDON
- NAUTILUS

FRONTEX operates also in the framework of the European Patrol Network (EPN) to establish a permanent regional border security concept.

2.1.2. MARITIME SAFETY AND SECURITY

"to protect shipping and port facilities against threats of intentional unlawful attacks- and prevention of pollution caused by ships"

Maritime industry constitutes a crucial source of employment and income for the European economy and it is directly connected with economic development and prosperity of EU.
Each year, more than 400.000.000 passengers embark and disembark in European ports. Maritime transport enables trade and contacts between all the European nations and provides the main vehicle for European imports and exports to the rest of the world. Almost 90% of the EU external freight trade is seaborne, while short sea shipping represents 40% of intra-EU exchanges in terms of ton-kilometers. The quality of life on islands and in peripheral maritime regions depends on good maritime transport services.
Overall, maritime industries are an important source of employment and income for the European economy. The EU focuses its efforts to improve maritime safety and security by developing systems to improve maritime surveillance capabilities and to collect information about maritime accidents. The research focuses on investigating the value and usage of raw data on the movement of containers, previously not systematically used by customs authorities.

While 90% of the world's cargo is transported in maritime containers, only 2% is physically inspected by customs authorities, opening the possibility for illicit activities.

Member States are organized differently in safeguarding national and the EU's strategic maritime security interests and protecting against maritime security risks and threats. Some Member States use civilian authorities for surveillance and law enforcement, such as Coast Guards; others use Navies or other maritime forces; others share responsibility between civilian and military administrations. Cooperation at sea between all actors involved has a positive spill-over in other policy areas.

Based on Maritime EU Security Strategy (2014), Maritime security is understood as a state of affairs of the global maritime domain, in which international law and national law are enforced, freedom of

navigation is guaranteed and citizens, infrastructure, transport, the environment and marine resources are protected.

For this reason Maritime Safety and Security is set as a priority in EU and that's why established the European Maritime Security Agency (EMSA). EMSA is one of the EU's decentralised agencies. Based in Lisbon, the Agency provides technical assistance and support to the European Commission and Member States in the development and implementation of EU legislation on maritime safety, pollution by ships and maritime security. It has also been given operational tasks in the field of oil pollution response, vessel monitoring and in long range identification and tracking of vessels.

Sources: https://ec.europa.eu/jrc/en/research-topic/maritime-safety-and-security, http://www.emsa.europa.eu/about.html

According to UN report "Oceans and the Law of the Seas", there are 7 threats regarding Maritime Safety and Security:

1. piracy and armed robbery at sea
2. terrorist acts involving shipping
3. offshore installations and other maritime interests
4. illicit trafficking in arms and weapons of mass destruction
5. illicit traffic in narcotic drugs and psychotropic substances
6. smuggling and trafficking of persons by sea
7. illegal, unreported and unregulated fishing and intentional and unlawful damage to the marine environment

However, Maritime Security and Safety is a complex procedure as many factors can act and react generating multiple impacts. The matrix of Figure 1 presents the types of relations established by different actors between maritime security and other concepts. The matrix provides moreover a basis for scrutinizing what actors include and exclude in their concept of maritime security. Interpretations of threats can differ remarkably. For some actors, an issue might be primarily linked to the economic dimensions, while it is for others an issue of national security or safety. It is important to note that drawing on the matrix does not imply starting out from any idealized understanding and to argue that maritime security should integrate all of the four other concepts.

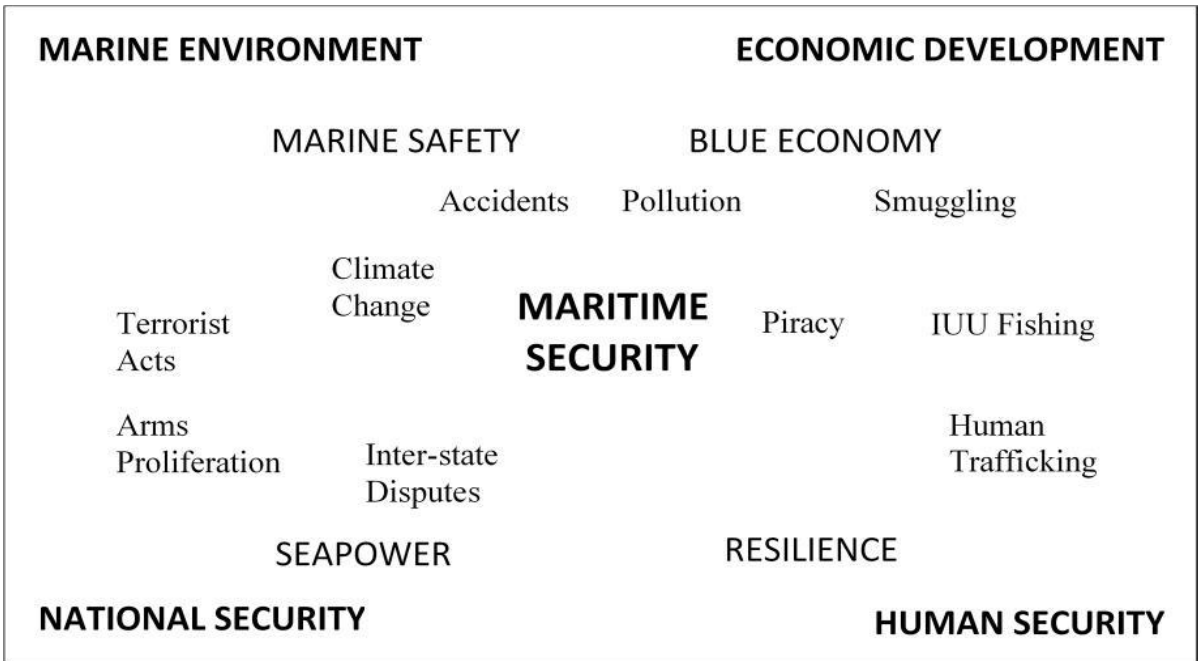


Figure 1. Maritime Security Matrix

Source: Bueger (2015) 'What is Maritime Security?', Marine Policy, 53:161

2.1.3. FISHERIES CONTROL

"to combat illegal, unreported and unregulated (IUU) fishing"

In the Mediterranean Sea, 93 % of assessed fish stocks were overfished in 2015. The EU is the 5th largest producer worldwide, accounting for about 3.2% of global fisheries and aquaculture production. 80 % of production comes from fisheries and 20% from aquaculture. Spain, the United Kingdom, France and Denmark are the largest producers in terms of volume in the EU.

In several EU regions the fishing sector plays a crucial role for employment and economic activity – in some European coastal communities as many as half the local jobs are in the fishing sector (as shown in the map on the right-hand side). Employment in the fishing sector tends to be concentrated in a handful of countries. Spain alone accounts for a quarter of total employment, and the four countries with the highest levels of employment (Spain, Italy, Greece and Portugal) make up around 70 %.

The aquaculture sector is also significant in socio-economic terms, with roughly 80.000 staff (including part-time and full-time jobs in both marine and freshwater aquaculture). The processing industry counts approximately 3.500 enterprises centered on fish processing (5 % less than in previous years). The mainstay of EU production is conserves and ready meals of fish, crustaceans and molluscs. Employment too has decreased by 5% to around 123.000 people across the EU between 2008 and 2012. Of these, 55 % are women, and 86 % are employed in firms with less than 50 staff. Figures 2 and 3 present some statistics regarding the importance of fishing and aquaculture sector in terms of economic values and employment.

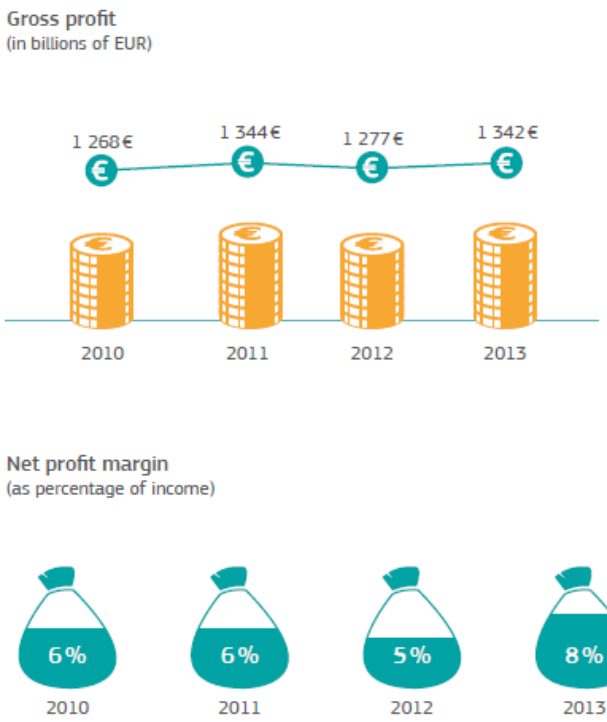


Figure 2. EU fishing fleet economic performance indicators between 2010-2013

Fisheries (2013)

ES	33 129
IT	26 758
EL	24 486
PT	17 875
UK	12 022
FR	10 262
HR	4 872
IE	3 169
PL	2 430
NL	2 123
EE	2 046
FI	1 817
DE	1 647
SE	1 577
DK	1 489
CY	1 290
BG	895
LT	763
LV	680
MT	389
BE	355
RO	304
SI	107

Aquaculture (2012)

ES	19 892
FR	18 640
PL	5 583
IT	5 164
EL	4 900
UK	3 231
RO	2 968
PT	2 572
HR	1 892
IE	1 708
NL	467
BG	454
DK	432
FI	402
SE	370
CY	259
MT	167
EE	22

Figure 3. Employment in the fisheries, aquaculture

Illegal fishing is a major threat to global marine resources. It depletes fish stocks, destroys marine habitats, distorts competition, puts honest fishers at an unfair disadvantage, and destroys the livelihoods of coastal communities, particularly in developing countries. It is estimated that between 11 and 26 million tons of fish are caught illegally a year, corresponding to at least 15 % of the world's catches. Until 2020, the loss from smuggling fishery in EU is estimated to € 10 billion from catch, €8 billion from stocks while 27.000 vacancies will be lost.

As the world's largest importer of fisheries products, the EU has adopted an innovative policy to fight against illegal fishing worldwide, by not allowing fisheries products to access the EU unless they are certified as legal. Besides, the European Fisheries Control Agency (EFCA) is a European Union body established in 2005 to organize operational coordination of fisheries control and inspection activities by the Member States and to assist them to cooperate so as to comply with the rules of the Common EU Fisheries Policy in order to ensure its effective and uniform application.

2.1.4. MARINE ENVIRONMENT

"preparedness and response to tackle challenges for the marine environment"

Shipping is perceived to be the cleanest mode of transport, mainly in terms of CO2 emissions, but pollution derived from maritime shipping activities still has significant implications for air and water quality and marine and estuarine biodiversity.

Due to environmental awareness in the last few decades, other modes of transport have improved their energy and environmental performance. The shipping sector also needs to become more sustainable in order to meet the obligations of European and international legislation. The European Commission, the Member States and the EU maritime industry have to work together towards the long term objective of 'zero-waste, zero-emission' maritime transport in line with European environmental and transport policy.

At EMSA, the Marine Environment Sector is responsible for providing technical, operational and scientific advice and assistance to the European Commission and the Member States in the development, implementation and enforcement of and European and International legislation. In particular, we support a coherent implementation of legal requirements and best practices through the organization of working groups on specialised subjects and the provision of technical reports, guidance and training.

The different areas of Marine Environment, and particularly the study of the different pollutant mass and energy cycles associated to ships' operation, maintenance and disposal, are directly related to the complex nature of ships, interacting with the surrounding media, either atmospheric or aquatic. Different types of ships, operational profiles, cargoes carried, fuels consumed, materials used, different arrangements and control systems make ships probably one of the most important systems operated by men. Since ships move around in the particular interface between sea and air, the question of sustainability in shipping needs always to address both impact in air and water. The Figure below shows the different types of pollutant emissions possible from a generic ship.

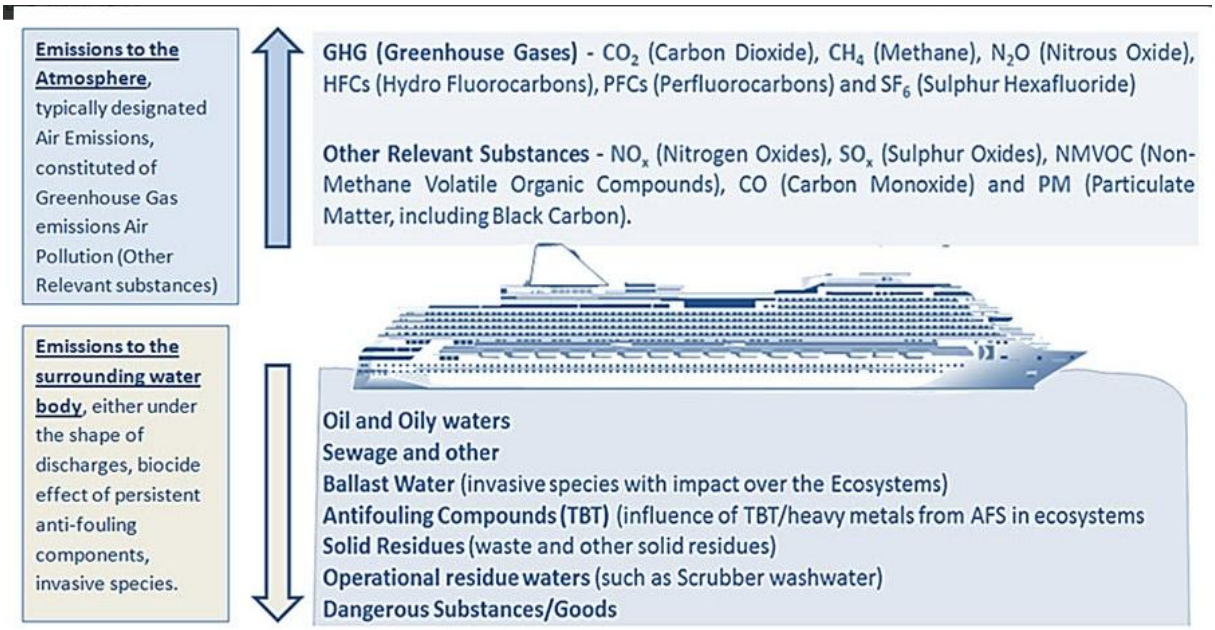


Figure 4. Emissions by type

Source: http://emsa.europa.eu/implementation-tasks/environment.html

MSA's current working areas are those concerning the provision and use of port waste reception facilities and the minimisation of waste on board ships, ship recycling activities, air pollution (SOx, NOx) and alternative emission abatement methods including the use of alternative fuels, greenhouse gas emissions and the implementation of the new MRV regulation (Monitoring, Reporting and Verification), ballast water management, leachates from anti-fouling paints, sanctions for ship source pollution and the rules on liability and compensation.

2.1.5. DEFENCE

"to battle piracy and terrorism threats"

Following a tasking by the EU-Defence Ministers in late 2005, EDA launched in September 2006 the Maritime Surveillance project (MARSUR), with the aim to create a network using existing naval and maritime information exchange systems. Overall goals are to avoid duplication of effort and the use of available technologies, data and information, to enhance cooperation in a simple, efficient and low-cost solution for military and civil cooperation, and to support safety and security.

On the 27th October 2011 Belgium, Cyprus, Finland, France, Germany, Great Britan and Northern Ireland, Greece, Italy, Ireland, Lithuania, The Netherlands, Poland, Portugal, Spain, Sweden, signed the Technical Agreement (TA) for the MARSUR LIVE PHASE, followed in 2012 by Bulgaria, Latvia and Norway. The MARSUR LIVE PHASE aims to further develop a capability that fulfils the need of maritime surveillance information sharing and networking whilst maximizing interoperability and

standardization. It is based on the demonstration Network, as delivered by the 10-CAP-08 “MARSUR Networking – Architecture experimentation” EDA contract.

MARSUR Networking improves what among naval personnel is called the “recognised maritime picture”, i.e. a consolidated, verified picture including civilian vessels, the so-called white shipping. The recognized maritime picture is a key element for Maritime Situational Awareness which is the basis for any maritime operation. MARSUR Networking therefore enhances the maritime security of the participating nations.

The scope of the MARSUR LIVE PHASE ranges from the Basic Level with the exchange of national point of contact information with the intention of manually sharing maritime surveillance information to the Advanced Level of information exchange. While the Basic Level is mandatory for all participants, the Advanced Level including the automated exchange of data obtained through national analysis of information, according to applicable national regulations is not yet fully implemented. The MARSUR Management Group has decided in May 2016 to pursue the implementation of the Advanced Level for all participants as soon as possible ideally within three years.

The main objective of MARSUR is to contribute, pursuant to national laws and regulations, to security, safety and protection of the environment in the maritime domain and improve maritime situational awareness, produce and share maritime situational awareness information, improve interoperability and co-operation between EU military and civilian maritime authorities and other international maritime actors.

On 28 October 2014 the developed MARSUR Exchange System (MEXS 2.0) was introduced into the operational MARSUR LIVE PHASE during the main event at the EURONAVAL, Le Bourget, Paris, France.

As the MARSUR Networking was designed to support CSDP operations from the beginning, EDA has decided to promote the use of the MARSUR networking in support the CSDP Operation SOPHIA. For this purpose, EDA has sponsored the training of MARSUR Operators and Technicians in a Workshop in January 2017 in Rome and has sponsored and supported the conduct of a capability demonstration at the EUNAVFORMED OHQ for the Operation SOPHIA in May 2017. This capability demonstration included a mobile MARSUR component to demonstrate the potential use of MARSUR as a Maritime Situational Awareness tool deployed on a Force HQ afloat directly connected to the OHQ.

EDA currently facilitates the negotiation of a Service Level Agreement for the adaptive Maintenance of the MARSUR hard and software under the umbrella of Project Arrangement “MARSUR II – Adaptive Maintenance”. The PA MARSUR II has been signed by 13 Member States so far.

Source: www.eda.europa.eu/what-we-do/activities/activities-search/maritime-surveillance-(marsur)

2.1.6. CUSTOMS

"protecting trade and the economic interests of the European Union"

In the customs function, a further integration of maritime surveillance and security has potential to tackle more effectively with illegal activities and avert thereby economic losses to the EU and its Member States. For instance, through customs fraud and smuggling, counterfeit products are introduced into the European economy evading therefore import duties. According to UNODC estimates, in 2008, the European seizures from all counterfeit sources were worth roughly €606 million, taking as a reference the 7% rate of interception of counterfeit goods this study proposes, this leaves counterfeit goods for a value of €8.7 billion going unaccounted. Other illegal activities (partly) undertaken through maritime trade such as cigarette smuggling entail as well great losses for the EU Member States, Europol estimates that the losses to national and EU budgets resulting from the smuggling of this type of products amount to €10 billion per year.

2.1.7. LAW AND ENFORCEMENT

"with a focus on the prevention of any criminal/illegal activity and on police administrative activities"

At the EU level, the European body Europol contributes to the function of general law enforcement in the sea. In general, it serves as a support centre for law enforcement operations, criminal information hub, and centre for law enforcement expertise. Its role as a facilitator in the exchange of information among Member States is particularly relevant for surveillance activities in this function Among others, Europol supports certain law enforcement activities of Member States part of their maritime surveillance and security, such as the fight against illicit drug trafficking, illicit immigration networks, terrorism, trafficking of human beings and illicit vehicle trafficking.

Illegal, unreported and unregulated (IUU) fishing Regulation

The IUU Regulation entered into force on 1 January 2010. It concerns EU Member States and non-EU countries alike and applies to all vessels that commercially exploit fisheries resources destined for the EU market.

Under the Regulation, the EU enters into a structured process of dialogue and cooperation with the third countries that have problems meeting international IUU rules, with the aim of helping them undertake the necessary reforms (see illustration on the right).

In this context, the EU is currently in dialogue with 50 third countries. Thanks to this cooperation, more than 30 third countries have improved their systems to join the EU in fighting IUU fishing.

The IUU Regulation has also helped to improve EU control standards. It has allowed Member States to better verify and, if appropriate, refuse imports into the EU, for instance by sharing intelligence.

The EU fleet is tightly controlled thanks to a comprehensive legal framework and elaborate control system that applies anywhere and under any flag.

The EU also regularly publishes a list of IUU vessels. More than 200 cases of alleged IUU fishing activities involving vessels from 27 countries have been investigated. As a direct consequence, sanctions against more than 50 vessels have been imposed, amounting to roughly EUR 8 million.

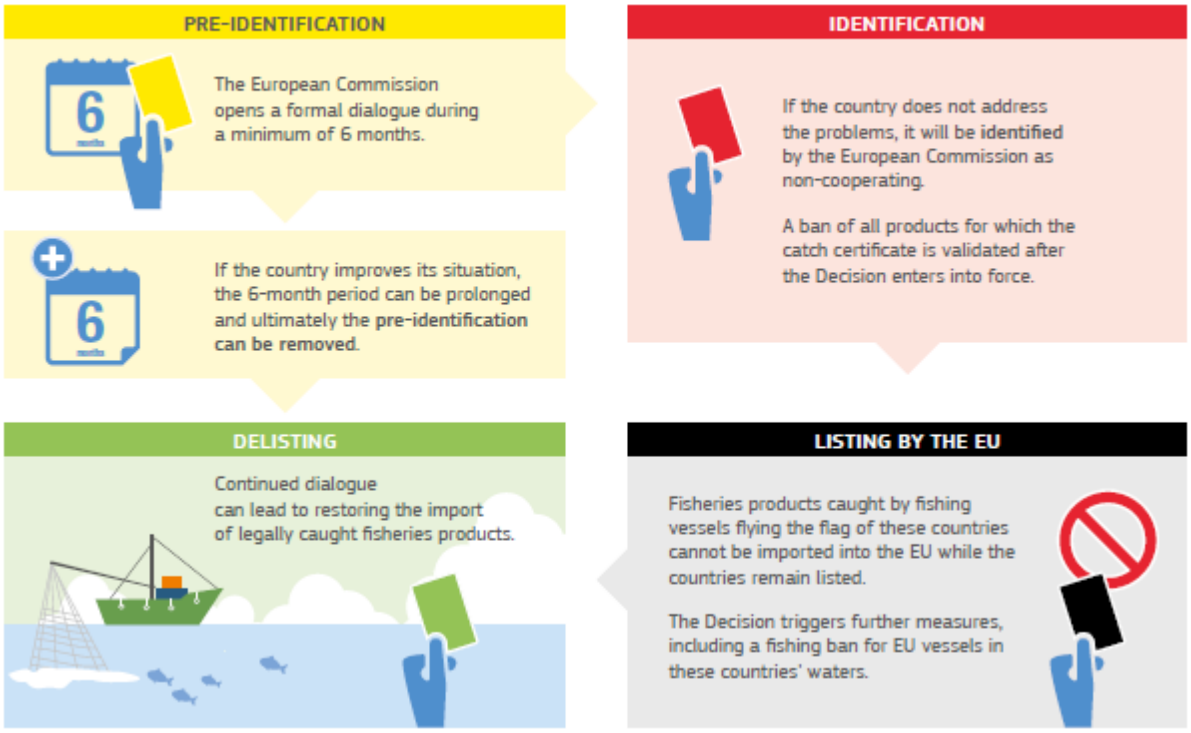


Figure 5. The IUU process explained

Source: European Commision/Facts and figures on the Common Fisheries Policy, 2016

2.2. FRANCE

2.2.1. AREAS OF REFERENCE

The areas of reference are the two regions in France which border the Mediterranean:

1. Provence Alpes Côte d'Azur (PACA region)
2. Occitanie (The Languedoc-Roussillon and Midi-Pyrenees Regions)

PACA region: located in the South of France. It shares borders with Italy and also with the French regions of Rhône-Alpes and Languedoc-Roussillon. The region is Attractive for RDI, the region invests on high tech industries. Agro-food, petrochemicals, steel, aeronautics and space industries, micro-computing, pharmaceutical industries highly contribute to the growth of the added value in the region.

Main strengths relate to R&D expenditure in the public sector as % of GDP, with a performance above EU average, thanks to a large number of universities, higher education institutions and research centres. However, Business R&D expenditure as percentage of GDP is still low in comparison to EU average, especially because innovation are limited to a small number of sectors and companies.

Regional weaknesses relate to SMEs innovating in-house as % of SMEs, innovative SMEs collaborating with others as % of SMEs, SMEs introducing product or process innovation as % of SMEs However, Business R&D expenditure as percentage of GDP is still low in comparison to EU average, especially because innovation are limited to a small number of sectors and companies. The regional authorities are aware of these weaknesses and are trying to mitigate them, with support to clustering initiatives targeting SMEs.

Occitanie Region:

Languedoc-Roussillon: located in the south part of France. The main areas of innovation in Languedoc-Roussillon are: agro-food and agronomy (one of the leading international research complex is located in the region, Agropolis), health and biotechnology, environment and sustainable development (energy, materials), and ICT. Languedoc-Roussillon relies on an important public research potential and knowledge offer, but lacks large industries.

Main strengths relate to R&D expenditures in the public sector as % of GDP, with regional performance above EU average.

Regional weaknesses are linked to the share of SMEs innovating in-house among SMEs and the share of innovative SMEs collaborating with other, with a performance below EU average.

Midi-Pyrénées: France's largest region. It is one of the leading regions in France in the field of research and innovation, both in terms of jobs and expenditure, with high-profile specialisation in aeronautics, space and health.

Description of the Innovation eco-system, main business models and markets of reference:

Toulon, is the principal military port in Europe and the main naval base for the Defence of the Mediterranean with major armed forces capabilities. A Marine Science & Technology Park has been developed in the area, where both the DCNS and the headquarters of the Pôle Mer Méditerranée (PMM) are located. Today, 30.000 people work in the defence sector of excellence in the Toulon Provence Méditerranée. Large companies, high tech SMEs and cutting edge infrastructure are at the very heart of the Toulon agglomeration's economy.

2.2.2. Socio-economic & Technological Trends

The economic and social development of a nation is based on safety and security requirements, whether maritime, air or land. These requirements are constantly evolving: the accident and its consequences are less and less tolerated, and the security threat in perpetual change. With more than 90% of the international trade volume using the seaway (major raw materials, manufactured goods, etc.) and a majority of intercontinental communications operated through submarine cable networks. Blue economy remains particularly vulnerable to endogenous threats and illicit activities.

The maritime spaces, their immensity and the development of licit activities offer infinite opportunities for concealment, with an increasing porosity between the various threats (piracy,

terrorism, arms, narcotics or migrant trafficking, cyber-attacks, etc.). The United Nations Office on Drugs and Crime (UNODC) estimates that illegal trade accounts for 7% of world merchandise exports. As the latter are mainly carried out by sea, the extent of the corruption of flows is thus measured. The explosion of trade and the gigantic nature of ships also increase the difficulty of control.

While it is now recognized that solutions of global maritime security and safety systems exist and are offered to States, the fact remains that most of these systems are, by nature and by necessity, infrastructures open to changes and improvements. It is in this context that for the past 10 years, The French Government and local authorities have strongly invested in a national cluster policy. To support the marine safety and security sectors, PMM has sought to promote and expand French companies' contribution to improving safety and maritime safety in France and around the world. These major investments demonstrate the ability of the members of Marine and maritime Clusters to seek new market shares by seeking innovative and differentiating solutions. They must support us, the Pôle Mer, to continue our efforts to accompany and cleanse new markets, techniques and uses in France and throughout the world.

For this period, these efforts must take into account the elements of strategy related to the environment in the field of safety and maritime security and to our internal forces at the Sea Clusters. The actors in the maritime domain constitute an environment composed of organizations and private industries, which are the source of the needs. It is therefore essential for the Sea Clusters to increase their communication and exchange efforts with these local, national and global players. In particular, the creation of events associating security and maritime security actors specific to the two seafronts could be envisaged.

In the technical environment, if the trends of the period to come are in continuity of the previous period, we can nonetheless note the elements conducive to economic growth:

- Communicating and intelligent electronic or computer products, which remain the means of choice for observation, detection and monitoring;
- A robotization or "dronization" which is an alternative to the material and human resources used in certain surveillance or intervention tasks;
- A global awareness of the need to protect against cyber-attacks.

These trends, combined with the skills of our engineering and leadership teams and those of our members, should serve as a basis for targeted actions to promote the development of low-level concepts and ideas (TRL < 5), and to speed up the marketing of solutions (TRL> 6) integrating these technologies.

Thus, from a sustainable development perspective, the maritime and river sectors will now need to use operational monitoring and intervention processes with high interoperability requirements: observing, detecting, monitoring and anticipating to better understand, prevent and to intervene.

Technological challenges combine development of innovative solutions and services with a model that is economically viable for public and private participants. The major trend we have identified regarding technologies are the followings:

- **Improved performance and operation of radar, optronic and sonar sensors,**

Sensors covers a wide range of devices used to measure the physical environment in which a vessel may be operating. Sensors technologies are developing rapidly to meet the growing demand for data and information. An example is the internet of thing, which allows the real time monitoring of systems and process.

  - Key Tool to address increasing of data requirements
  - Evolution: Miniaturization - Energy self-sufficiency - Single use – Easy integration- Standardization – Intelligence
  - Example of use: Steering and positioning support - Acoustic domain networking of sensors and information fusion

- **Data enrichment to aid decision making for operators and autonomy of drones,**
  Human computer interaction refers to the study and design of the interface between people and computers, especially with the new arrivals of drones that must be integrated with already existing system, without a "revolution"
  - Key to IT efficiency
  - Pluridisciplinary: Computer Science - Psychology - Cognitive Science - Design - Visualization
  - Today: Gestural, Vocal, Eye tracking ...
  - Tomorrow: Brain-Computer Interfaces, Intelligent Personal Assistance?

- **Upgraded speed, range and security for data transmission particularly for e-navigation**
  Remote operation is the norm in marine industry due to distance. Communication technologies are crucial for situation awareness and exchanges of information. Radio communication and satellites are good examples of state-of-the-art technologies.
  - Maritime in-service units are expected to double in 15 years.
  - Smart ship will exploit this trend to be efficient
  - A key to open the big data challenges
  - Low cost satellite or balloons solutions?

- **Deployment of drones for surveillance and intervention**
  Autonomous systems will improve safety, by taking people out of dirty, dangerous jobs, particularly in air and naval transport.
  - Replacement of Man - Scientific Measurements in Autonomy on Large Spaces / Long Periods - Smart connected mobile system
  - Risk and cost reduction

- Opening to multiple markets

- **Handling and storage of Big Data.**

Process of analysing hidden patterns, correlations, useful information

- Data analysis
- The 4 V: Volume - Speed - Variety - Veracity
- Extracting information from a cloud of data
- Tool to aid decision

2.2.3. THE MARITIME SURVEILLANCE KEY SECTORS

PACA benefits from the establishment of global players of the defence industry and civil security on its territory. The Var is the first defence department in France thanks to the presence of the first French and Mediterranean military port that drains a vast network of subtracting SMEs with a solid technological base. The main skills are detection tools (physical, chemical or biological sensors), intelligence and data processing (modelling, simulation, 3D technologies, and virtual reality), vectors of aerial surveillance (drone), submarine (Robotics) and means of intervention (helicopter). Three major international systems integrators DCNS, THALES and EADSCASSIDIAN / SIGNALIS act as locomotives. The technologies concern in-situ instrumentation networks and satellite observation of the sea surface, forecasting models, alerting tools. Whatever the vector of surveillance, it is often necessary to add specific equipment to accomplish a mission. To date, the majority of surveillance and response missions are carried out using vectors and manned nautical means. The trend is towards the development of remote-controlled robotics.

2 key sectors have been indentified in the areas of reference. These are: **MARITIME SECURITY & SAFETY** and **MARITIME ENVIRONMENT**.

MARITIME SECURITY

Maritime security is the combination of preventive measures intended to protect shipping and port facilities against threats of intentional damage from unlawful acts (sabotage, subversion and terrorism). These threats potentially cover national and international illegal acts like illegal fishing, piracy, trafficking (drug, weapons, humans, animals…), smuggling, terrorism, armed robberies of ships, hostile forces.

Security measures and regulations are needed. Assets and communication networks need to be implemented in order to identify risks. Resources also need to be coordinated to reduce risks, mitigate threats and consequences on the security of personnel, facilities, vessels and the public.

The Maritime Security covers four main activities:

- Crisis management;
- Piracy & Terrorism protection;

- Illegal Trafficking fight;
- Sensitive zone protection.

The challenges identified in the regions concern specifically:

- Crisis management: consist of preventing or fighting against the development of land conflict from the sea, through maritime task forces deployed or prepositioned worldwide, implementing the strategic function "knowledge and anticipation"
- Piracy & Terrorism protections are both forms of violent interference with shipping. Their global reach and negative impact on sea transportation, safety and marine environment, as well as the threat they both pose to human lives and property, call for effective counter-measures. Among such counter-measure, those directed at strengthening the legal protection of shipping become of paramount importance
- Illegal Trafficking fight is in the French State customs domain. In the last few years, a set of international rules has been drawn up to facilitate intervention at sea and standardize control, with systematic efforts to disrupt business models and trafficking networks, to identify, capture and dispose of assets / vessels used by smugglers or traffickers.
- Sensitive zone protection include the protection of specific areas of facilities (e.g. oil and gas platforms, offshore wind farms), even at long distances from the coast. Barge fleeting facilities, container terminals, passengers vessel terminals are also vulnerabilities that need security measures.

MARITIME SAFETY

Maritime Safety is the ability to continuously maintain and enhance safety in shipping and the protection of life, health, property, and the maritime environment. It concerns ships, crew and passengers and/or cargo, navigation and environmental safety. The threat to their safety are potentially maritime terrorism, illegal fishing, emergency Search And Rescue (SAR)

To cope with these threats, permanent detection, identification, and assessment are needed, aiming for permanent reaction availability. This means implementing regulation, management, and technology development in four major complementary domains:

- Vessel traffic management;
- EEZ & continental shelf;
- Search and Rescue;
- Port & Coastal surveillance.

The challenges identified in the regions concern specifically:

- Vessel traffic management especially in areas of heavy traffic for preventing accidents and controlling environment damage. In addition to existing international and national laws and regulations (traffic separation schemes…), regional control and coordination are needed, for detecting abnormal routes or behaviour that may generate navigation risks.

- Exclusive Economic Zones (EEZ) & continental Shelf extension is a priority for States with important maritime expenses, with sovereignty on islands and/or new continental shelf extension of EEZ. Large maritime areas that have not yet been explored need to be monitored and protect in the future. New technologies are essential to monitor and protect all these zones, to gain a more extensive vision of the seas and react in a timely manner.
- Search and Rescue (SAR), Air and Sea SAR concerns accident and disaster responses as well as maritime leisure activities. The SAR zones are very large and require substantial means and resources, especially when weather conditions at sea are severe and deteriorate rapidly.
- Port & Coastal surveillance including ports and approaches. These are considerable vulnerabilities in terms of potential critical infrastructures and densely populated areas.

MARITIME ENVIRONMMENT

Maritime environment concerns the waters and the land and resources in and under these waters =: navigable waters, fishery resources, seabed and subsoil resources, continental shelf resources. The issue are safe shipping in this marine environment and protection from the adverse effects of shipping with regulations for averting the introduction of invasive species, preventing unauthorized ocean dumping, oil and chemical spills.

Casualty prevention, response plans, systems and processes in a joined forces approach are needed. These will address the following missions:

- Waste management;
- Hazardous Traffic control;
- Pollution control;
- Fisheries control.

The challenges identified in the regions concern specifically:

- Waste management plays an important role in controlling and reducing the amounts of waste entering the marine environment from ships. This includes chemical, sewage, rubbish, ballast wate.
- Hazardous Traffic control includes tankers and containers ships carrying hazardous materials: control of their routes through territorial waters and report of any damage they suffer, using inspection systems and coordinated standards.
- Pollution control includes the fight against illegal discharge of oil at sea and accidental pollution. In the first, measures will implement aircraft fitted with special remote sensor equipment. In the second case, maritime pollution intervention plans will be implemented.
- Fisheries control includes enforcing regulations in order to protect fishing resources, supporting crew moral or offering technical help, establishing peaceful coexistence with seamen from other countries

2.3. GREECE

2.3.1. AREA OF REFERENCE

The **region of Attiki**, where the capital city of Athens is located, is economically the most important region of Greece, accounting, in 2009, for 43.3% of the country's total GDP and housing 35.8% of the population, despite the fact that it accounts for only 3% of the national territory. Nevertheless, Attiki's R&D expenditure (0.71%) remains significantly lower compared with the EU average (1.82%), as does the contribution of the private sector (64% for the EU27 compared to 40,8% for Attiki). At the same time, while regional firms are also performing above the EU average on a number of innovation indicators, Attiki as a region is still grouped within the Medium – Low innovators. The significant gap in innovation indicators to the EU average is partly the outcome of limited demand from the industry, reflecting the low-to-medium technology structure (based on R&D intensities) and low level of openness of the economy and the regional specialization in services. Greece's extensive coastal waterways and its geographic location have traditionally served as a gateway to the central Balkans and the Middle East as well as a passage to the Black Sea. Piraeus, where Piraeus Port Authority S.A (PPA) is based, is located within the Athens urban area, 12 kilometres southwest from its city center (municipality of Athens), and lies along the east coast of the Saronic Gulf.

The **port of Piraeus** is the chief port in Greece, the largest passenger port in Europe and the second largest in the world, servicing about 20 million passengers annually. With a throughput of 1.4 million TEUs, Piraeus is placed among the top ten ports in container traffic in Europe and the top container port in the Eastern Mediterranean.

Description of the Innovation eco-system, main business models and markets of reference

According to the Regional Innovation Scoreboard 2016, Attiki region is a Moderate Innovator. Innovation performance has decreased (-4%) compared to two years ago. The trends show that the relative strengths in the regional innovation system are Tertiary education attainment, Employment in knowledge-intensive industries, and SMEs with marketing or organisational innovations. Relative weaknesses are in EPO patent applications, Public R&D expenditures, and Business R&D expenditures.

According to the Regional Innovation Monitor - Regional Innovation Report (Attiki), the major innovation challenges and policy responses that Attiki region faces are the following:

- Expand cluster policies to cover new dynamic sectors and technologies
- Strengthen knowledge intensive services
- Balance regional development by supporting the manufacturing base

The following figures provide an overview of the innovation eco-system in Attiki region.

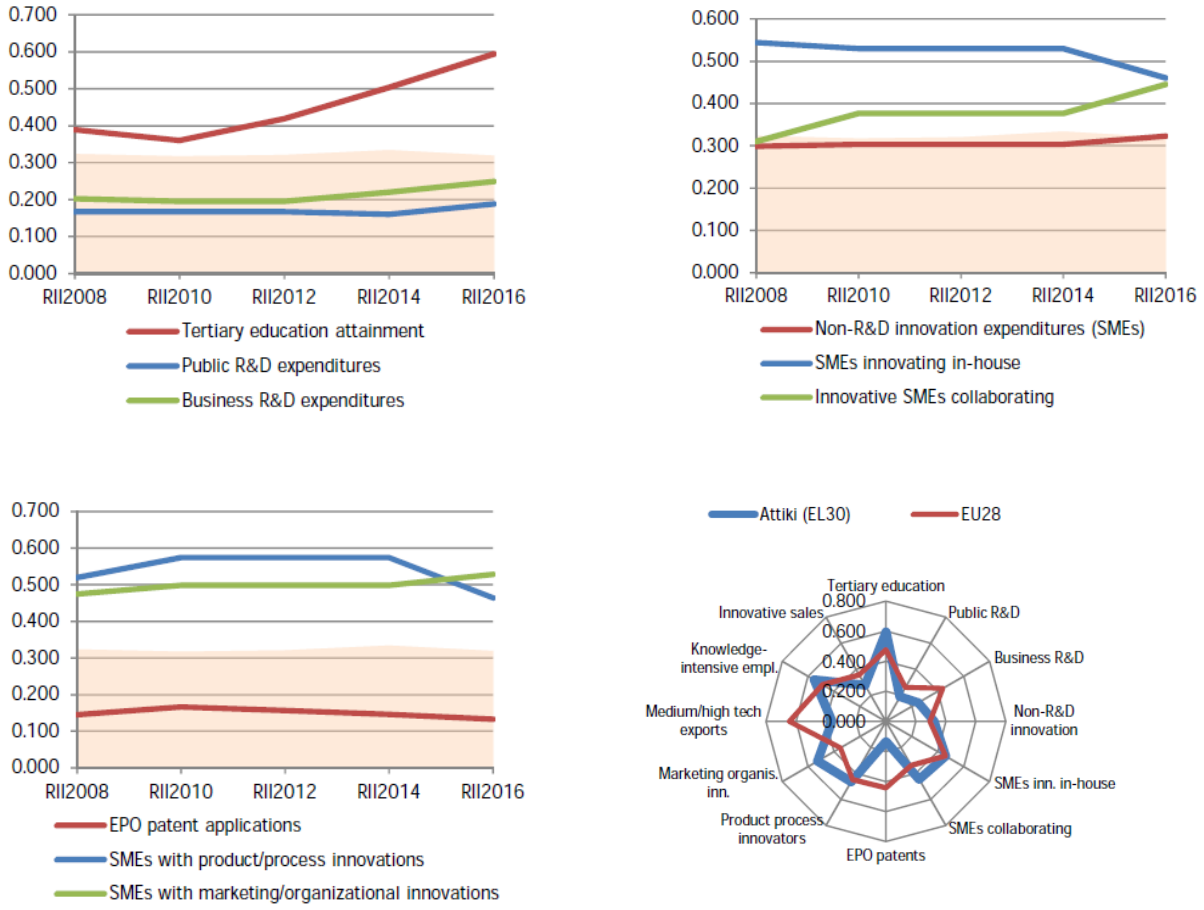


Figure 6. Overview of the innovation eco-system in Attiki region

2.3.2. SOCIO-ECONOMIC & TECHNOLOGICAL TRENDS

- **Population** accounted for 6.9 billion in 2010 and is expected to reach 8 billion in 2036, with 96% of growth coming from developing countries.
- **Urbanization**. Most major cities are usually sea ports or inland ports, with easy access to waterborne transport. For the next 20 years, the earth's urban landscape will continue shifting towards the emerging nations.
- Global economic focus moves East. **China's** contribution to world GDP in expected to rise up to 20% in 2030.
- **Global trade liberalisation** and integration will accelerate economic growth.
- Consumers expanding **purchasing power**.
- **Intra-regional trade** will nearly double by 2030. Global seaborne trade will be dominated by Intra-Far East, between Oceania and Far East, Far East and Latin America, and Far East and the Middle East.

- World trade relies on ships and the cargoes they carry, and the service industries that support them, as well as the security provided by navies. The underlying trend of increasing economic growth is closely tied to growing **naval capability**.
- The 20th century naval **adoption of technology** from mechanical to electro-mechanical to electronic systems continues.
- Maritime security issues stem from a combination of coastal access to the seas, and relative local weaknesses in policing and economics. Conflict and low levels of economic development are linked.
- The potential of **conflicts at sea** is growing and higher rates of defence expenditure as a percentage of GDP are expected.
- **Information, communication and weapons systems** will be substantially more capable in 2030. **Remote operation** will have increased and **cyberspace** will be the new battleground. **Artificial intelligence** will support, or deliver naval capability. Governance of automated systems will be a key issue.
- **Disruptive technologies** (KETs – key enabling technologies – sensors, actuators, micro-power systems and software platforms, behavioural algorithms, artificial intelligence). The advance of robotics and 3D printing will localise manufacturing – reducing container shipping demand (especially on longer routes). A new generation of naval ships are designed for nearly autonomous operation.
- **Unmanned aircrafts – Drones -** Within 20 years, the European drone sector is expected to directly employ more than 100 000 people and have an economic impact exceeding €10 billion per year, mainly in services. A recent survey undertaken in shipping found that more than two thirds of the ship-owners expect to start performing data analytics for their vessels for strategic decision making http://www.safety4sea.com/connectivity-at-sea/
- **The Internet of Things -** It is fundamental for moving the industry forward. It creates a new maritime ecosystem that brings together value added manufacturers, software developers and solutions vendors in an environment where they can optimize vessels performance via solutions such as e-navigation, cyber security and engine room data analytics. All of these types of services will be fundamental in reshaping the maritime industry.

2.3.3. THE MARITIME SURVEILLANCE KEY SECTORS

Greece is a maritime nation by tradition, as shipping is the oldest occupation of the Greeks and has been a key element of Greek economic activity since ancient times. Today, shipping is the country's most important industry (worth €251.1 billion in 2015). It accounts for 6.5% of GDP, employs about 290,000 people (7% of the workforce), and shipping receipts are about 1/3 of the nation's trade deficit. In 2015, the Greek Merchant Navy controlled the world's largest merchant fleet, in terms of tonnage, with a total DWT of 334,649,089 tons and a fleet of 5,226 Greek-owned vessels, according to Lloyd's List. Greece is also ranked in the top for all kinds of ships, including first for tankers and bulk carriers.

Attiki region, according to the RIS3 platform for Smart Specialization, has as an EU Priority Blue Growth, as well as Sea Transport.

The sector identified as most prominent one for the Greek National MS Node, is **MARITIME SECURITY AND SAFETY**. The criteria used for the selection of the focus sector are:

- No of actors operating in the sector according to the National Mapping (main selection criterion)
- Capacity of the sector to meet trends and megatrends identified (additional selection criterion)

With regards to the public actors, 17 out of 35 (Figure7) are mainly related to Maritime Security and Safety sector (as 2nd closest the sector defense was identified). In addition, taking into account the additional applicable sectors, 24 out of 35 actors relate to the Maritime Security and Safety sector (as 2nd closest the sectors marine environment and border control were tied during the identification).

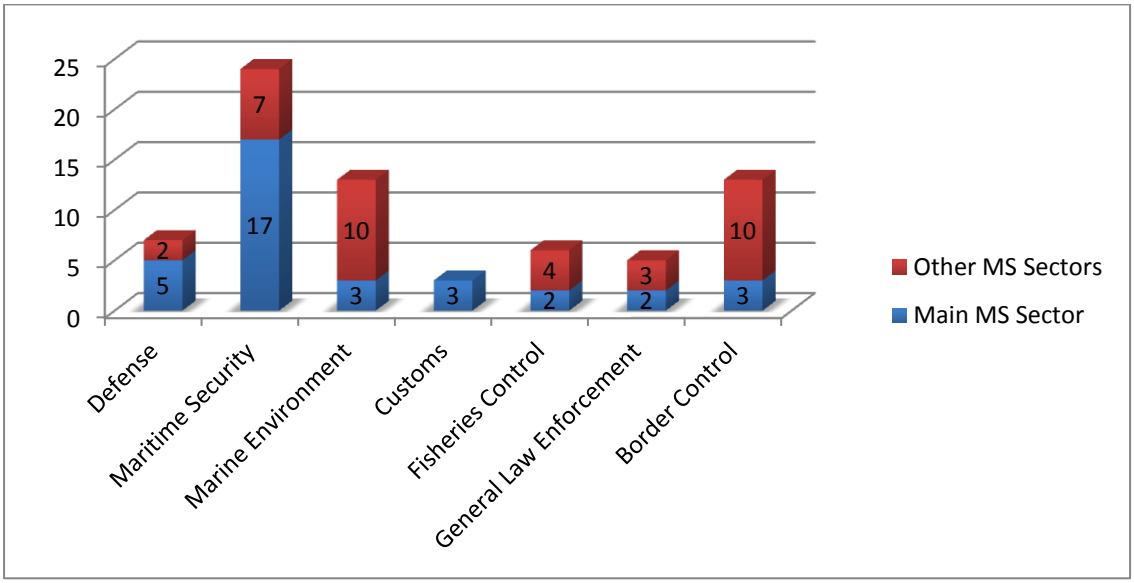


Figure 7. Public actors related to MS sectors

Concerning the private actors identified, the majority of them operate in Maritime Security and Safety as well, with defense emerging as the 2nd closest sector (Figure 8).

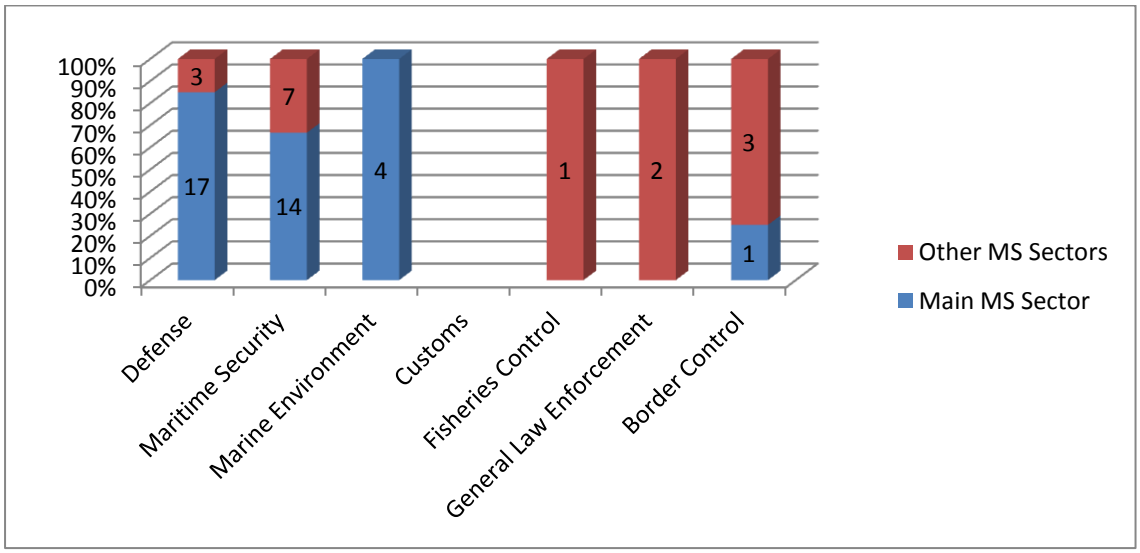


Figure 8. Private actors related to MS sectors

As an outcome from the mapping of maritime surveillance **the most prominent sector identified was Maritime Security and Safety** (49 out of 71 actors are operating in related field). Other important sectors are considered **defense** (43 out of 71 actors) and **border control** (11 out of 71 actors), which will be addressed by the Greek National Node as additional to the focus sector.

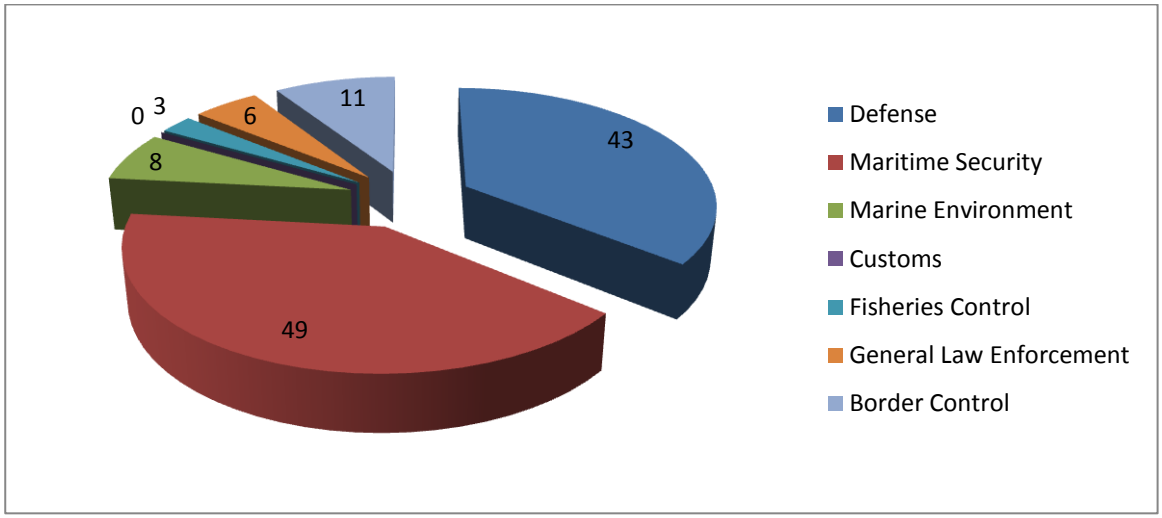


Figure 9. Operating actors per MS sectors

2.4. ITALY

2.4.1. AREA OF REFERENCE

Italy has more than 8,000 kilometres of coastline and a natural maritime vocation involving the whole national social-economic structure.

It is located in southern Europe an consists of a mountainous peninsula extending into the Mediterranean Sea and includes the islands of Sicily, Sardinia and about 70 smaller islands which can be grouped in 15 main archipelagos. Italy borders with Switzerland (698 km), France (476 km), Austria (404 km), and Slovenia (218 km). San Marino (37 km) and Vatican city (3,4 km) are enclaves. It' total area is 301.340 square Kilometers of which 294,140 Km is land and 7.200 km is water.

Italy, based on its geographical location as well as its political strategic positioning, is an eminently maritime nation. The country's maritime profile is considered an ambivalent space that offers many opportunities for prosperity and development, but the difficulty of controlling it is conducive to the emergence of risks and threats to its security.

Italy does not have a National Security Strategy (NSS) in the strict sense of the word, ie, a single governmental document for the medium-to-long term identifying the main security threats and response guidelines at a strategic level. Instead, it has several documents on the institutional responsibilities for the external (military) and internal (civil) dimensions of security. By 'external security' is meant the assessment and countering of threats from the exterior, or those developed abroad before materializing at a national level. The military are traditionally in charge of this task. By 'internal security' is meant responding to interior risks and threats, both of an intentional or accidental nature.

In December 2013 Italian Government adopted the National Cyber Strategy through the National Strategic Framework for Cyberspace Security and the National Plan for Cyberspace Protection and ICT Security that outline Italy's cyber security strategy.

With regards to the economic performance, the Italian economy is the third-largest in the Eurozone, based on nominal GDP statistics.

The economic importance of Mediterranean coastal area for Italy accounted to 53% of the national Gross value added (GVA).

Italy's maritime border along the Mediterranean is the country's only extra-European frontier. Italy's location and coastal development continue to ensure the country a flow of income from its role as a strategic European hub in what has come to be known as the new "maritime century". In addition, Italy boasts the largest ferry fleet, the twelfth most extensive merchant shipping fleet in the world (fourth in Europe), and the third biggest European fishing fleet, with the national maritime cluster generating 3% of GDP.

It was further noted that while the Mediterranean only represents 1% of the planet's water surface, it is traversed by 19% of the global maritime traffic, 30% of world oil, and 65% of all other energy resources en route to Europe (including transport by underwater pipeline), with the area also containing significant recently discovered energy reserves. However, that issues impacting on these transit flows arise well beyond the geographical boundaries of the Mediterranean basin, and are closely linked to prevailing conditions in the Persian Gulf, the Gulf of Guinea, the Gulf of Aden and

the Indian Ocean. Indeed, Italy's national maritime interests have expanded, reaching as far as Mozambique and Angola, in areas where growing piracy calls for greater protection of strategic commodity flows.

There was recognition in this regard of the persistent difficulties hampering the reform of international cooperation mechanisms that governance of the Mediterranean requires. In particular, in addition to European collaboration, cooperation with countries on the sea's southern shores is also necessary in order to anticipate and possibly prevent the migration flows of biblical proportions that have dominated the headlines in recent years.

Attention was thus drawn to the need for support of a policy that protects Italian and European interests, including by congruent military means. Such an approach was considered the only way of ensuring that Italy will play a stronger primary role in advanced defense and security, all with the strategic aim of maintaining order in the region, serving as a role model to countries in North Africa and the Middle East, and offering a shared response to the humanitarian and strategic challenges which the area poses.

Description of the Innovation eco-system, main business models and markets of reference

The indicators in the table below present a synthesis of research and innovation (R&I) performance in Italy for 2012, in relation to the EU and US averages[3]. They relate knowledge investment and input to performance and economic output throughout the innovation cycle. They show thematic strengths in key technologies and also the high-tech and medium tech contribution to the trade balance.

Table 1. Synthesis of research and innovation (R&I) performance in Italy for 2012

Key indicators of research and innovation performance

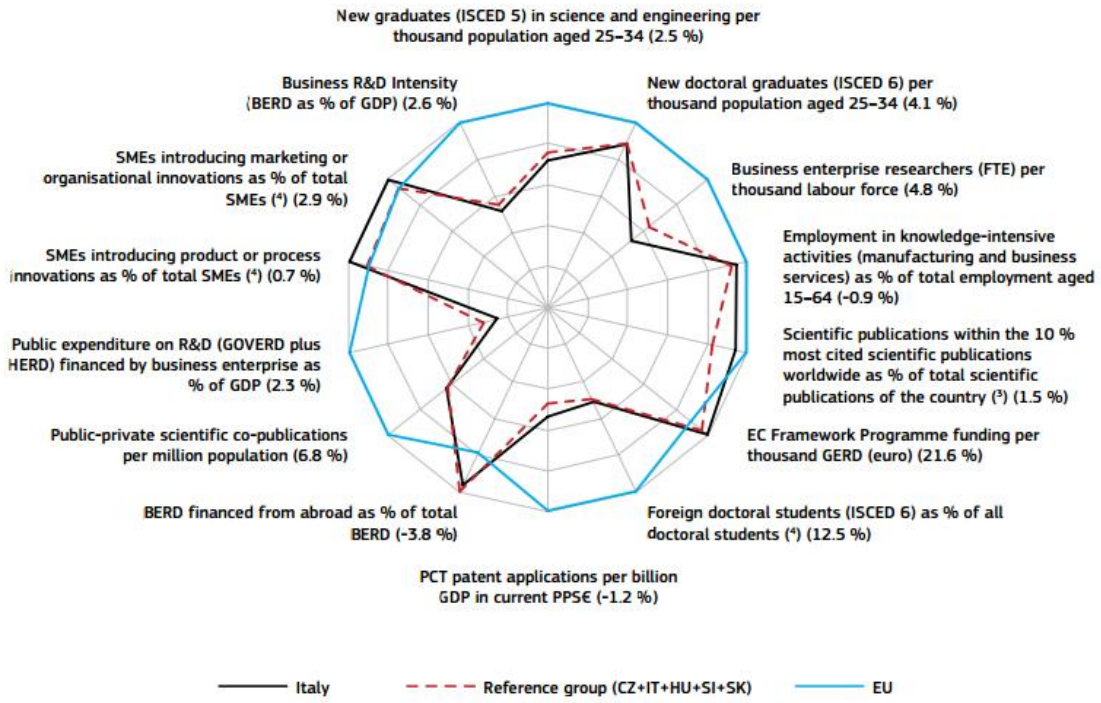
R&D intensity 2012: **1.27 %** (EU: 2.07 %; US: 2.79 %) 2007-2012: **+1.5 %** (EU: 2.4 %; US: 1.2 %)	Excellence in S&T (Composite indicator that includes PCT per population, ERC grants per public R&D, top universities and research institutes per GERD and highly cited publications per total publications.) 2012: **36.5** (EU: 47.8; US: 58.1) 2007-2012: -**0.5 %** (EU: +2.9 %; US: -0.2)
Innovation Output Indicator 2012: **84.3** (EU: 101.6)	Knowledge intensity of the economy (Composite indicator that includes R&D total expenditure, skills, sectorial specialisation, international specialisation and internationalisation

[3] http://ec.europa.eu/research/innovation-union/pdf/state-of-the-union/2014/countries/italy.pdf

	sub-indicators.) 2012: **37.2** (EU: 51.2; US: 59.9) 2007-2012: **+0.9 %** (EU: +1.0 %; US: +0.5 %)
Areas of marked S&T specialisations: Automobiles, food and agriculture, ICT, biotechnology, and new production technologies	HT + MT contribution to the trade balance 2012: **4.8 %** (EU: 4.23 %; US: 1.02 %) 2007-2012: **+2.5 %** (EU: +4.8 %; US: -32.3 %)

The indicator on excellence in Science and Technology (S&T) takes into consideration the quality of scientific production as well as technological development. The Innovation Output Indicator covers technological innovation, skills in knowledge-intensive activities, the competitiveness of knowledge-intensive goods and services, and the innovativeness of fast-growing enterprises, focusing on innovation output. The indicator on knowledge-intensity of the economy focuses on the economy's sectoral composition and specialisation and shows the evolution of the weight of knowledge-intensive sectors and products.

The following figure shows a comparison between EU and Italy stats in R&D and innovation indicators (2012)./ The graph below illustrates the strengths and weakness of the Italian R&I system. Reading clockwise, the graph provides information on human resources, scientific production, technology valorization, and innovation. Average annual growth rates from 2007 to the latest available year are given in brackets.



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: DG Research and Innovation, Eurostat, OECD, Science-Metrix/Scopus (Elsevier), Innovation Union Scoreboard
Notes: (1) The values refer to 2012 or to the latest available year.
(2) Growth rates which do not refer to 2007–2012 refer to growth between the earliest available year and the latest available year for which comparable data are available over the period 2007–2012.
(3) Fractional counting method.
(4) EU does not include EL.

Figure 10. Comparison between EU and Italy stats in R&D and innovation indicators (2012).

2.4.2. SOCIO-ECONOMIC & TECHNOLOGICAL TRENDS

The megatrends process is one of the key ways in which we gain insights that support our project objectives. The process helps us to better understand the challenges and opportunities that Consortium's members face so that we can effectively respond to their needs.

With regards to Maritime Surveillance, taking into account the global trends identified, the megatrends that appear to be most closely are:

- **Digital future**

Naval power will double in 2030, although navies will only maintain and refresh the numbers of platforms and personnel, rather than expanding them. This escalation in naval capability suggests that there are growth opportunities for the naval sector in systems capability rather than platforms or people. The growth of automation, sensor integration, cyber security and related technologies will help to determine the nature of future naval power.

The technological aspect is considered vital for maritime surveillance, since the sector is largely based on electronic systems. Drones, IoT, Cyber-security and Artificial Intelligence are expected to have a large impact in many sectors in the near future, leading the world into a digital future and creating opportunities for many ICT based companies.

- **Global marketplace**

Globally, the volume of seaborne trade will double from nine billion tonnes per annum to somewhere between 19 and 24bn tonnes by 2030. China will play a key role in 2030 as the emerging maritime superpower in shipping. China will see the largest growth in commercial fleet ownership, rivalling Greece and the rest of the European countries combined. China will become the world's primary maritime market, leading in seaborne trade, shipbuilding and vertically integrated ownership and ship management. The economic development of India follows closely behind China, and it is expected to become a giant driver of global trade in an order of magnitude similar to China.

The focus of global growth has shifted to the East and to the South, but international trade will continue to grow unabated. This will create more powerful national economies in different regions with greater resources to protect, and greater resources available to invest in defense and security. That means to adapt and to develop new patterns to manage future security activities in the MED area particularly with north Africa.

- **Urban world**

The number and scale of cities continues to grow across the globe.

The explosion in urbanization will present tremendous challenges for law enforcement, intelligence and internal security. The most of these cities are situated long the sea coast, this also implies implementation of activities which impact at environmental level: increasing of pollution with consequently major risk for the fishing stock and human safety. Not only, the powerful mega-cities continue to proliferate with important consequence on national defence and security.

- **Resourceful planet**

Oil and natural gas is expected to account for 60% of global demand for energy in 2030. Advances in technology, underpinned by innovation, research and development will be the keys to meeting the growing demand for energy from more diverse sources. The number of offshore platforms and renewable energy devices required to meet global demand will grow significantly. This indicates growing challenges and opportunities to produce offshore oil and gas, and offshore renewable energy.

The application of new technologies, as well as the shifting supply environment, will drive business model adaptation and innovation in multiple sectors, as well as impact the geopolitical balance of power. That imply change of international trade related to raw materials, as a consequence new security and safety risks of activities carry out sea.

2.4.3. THE MARITIME SURVEILLANCE KEY SECTORS

All the MS sectors are considered important; however, the most prominent MS sectors are this of **Fisheries Control, Customs, Marine Environment, and Maritime Security & Safety**. An analysis of the state of the art of every sector is presented below. An analysis of the state of the art of every sector is presented below.

BORDER CONTROL

Border security in Italy is particularly critical since most of Italy borders the sea.

In regard to border control at entry points, Italy has not only increased the number of personnel assigned to border control operations in recent years, but also enhanced the technology used in these operations.

The Italian Government launched the operation "Mare Nostrum" in 18 October 2013 as a military and humanitarian operation aimed at tackling the **humanitarian emergency** in the **Strait of Sicily**, due to the dramatic increase in **migration flows**. The Operation ended on **31 October 2014,** coinciding with the start of the new operation called **Triton.** This Operation was an **upgrade of the force for monitoring migration flows** already operating within the **operation Constant Vigilance**, which the Italian Navy has been conducting since dal 2004, permanently deploying a ship in the Strait of Sicily along with maritime patrol aircraft. Operation Mare Nostrum had therefore the two fold purpose of:

- safeguarding human life at sea, and
- bringing to justice human traffickers and migrant smugglers.

The Force included personnel as well as sea and air assets of the Navy, Air Force, Carabinieri, Financial Police, Harbour Masters Corps / Coast Guard, personnel of the Italian Red Cross military corps and of the Ministry of the Interior / State Police, embarked on Italian Navy vessels, with the contribution of all the governmental agencies involved in controlling migration flows by sea.

Maritime patrol is a primary mission of the Italian Navy. The control of migration flows is carried out by means of our naval units and aircraft, driving forces of all maritime activities and protection of human lives at sea.

The first coasts targeted by illegal immigration were in region Puglia; but by now also Calabria, Sicily (especially the islands of Lampedusa, Pantelleria and Lampione) and even Sardinia have become sadly notorious for the countless shipwrecks with thousands of victims.

All these areas at risk are patrolled by our Navy, together with the State Police, Radar Stations and "Atlantic" long-range maritime patrol aircraft. From the Navy Base in Augusta, corvettes and patrollers take turns to control sea trades, assisting ships and boats of all nationalities.

Their activity often involves rescue operations, either because of the bad health conditions of the refugees who are trying to reach Europe, or the precarious boats they are sailing on.

Frontex (European border and coast guard Agency) has finalised all preparations for the launch of Joint **Operation Triton** on November 1st 2014. With a monthly budget of EUR 2,9 million the agency coordinated the deployment of three open sea patrol vessels, two coastal patrol vessels, two coastal patrol boats, two aircraft, and one helicopter in the Central Mediterranean. While the primary focus of the Triton operation is border control and surveillance, search and rescue remains a priority for the agency. Since the beginning of the operation, Frontex vessels and aircrafts have on regularly been redirected by the Italian Coast Guard to assist migrants in distress. The focus of operation Triton has been expanded to also contribute to the detections of drug smuggling, illegal fishing and maritime pollution. A total of 26 EU countries take part in Joint Operation Triton by deploying either equipment or border guards. At the moment, Frontex supports Italy with 350 officers, 11 vessels and five aircraft. Officers deployed by the agency also assist the Italian authorities in the registration of the arriving migrants. They also collect intelligence about people smuggling networks operating in Libya and other African countries on the smuggling routes. The agency shares this information with the Italian authorities and Europol.

All vessels and aircraft deployed within the framework of Triton operate under the command of the Italian Ministry of Interior. In 2016, assets deployed by Frontex were involved in the rescue of **48.800** people as part of operation Triton. So far this year, Frontex vessels and aircraft were involved in the rescue of more than **6.000** people in operation Triton.

External Borders Fund 2007-2013 – Italy

The Commission has adopted the multiannual programme under the External Borders Fund 2007-2013 for the Italian Republic for an estimated amount of € 211 million, together with the 2007 annual programmes. The External Borders Fund is one of the four financial instruments of the General Program on "Solidarity and Management of Migration Flows" which encourages a fair share of responsibilities between Member States arising from the introduction of integrated management of the external borders and from the implementation of common policies on asylum and immigration.

The overall budget of this Fund for 2007-2013 is € 1820 million.

FISHERIES CONTROL

Italy's coastline spans 9136 km, making up 8.75% of the total EU coastline. The surface of the coastal regions (in line with the Eurostat definition) runs to 181.289 km², approximately 10 % of the EU total and 60 % of the national territory.

Six Italian ports feature in the top 20 ports in Europe: Trieste, Genoa, Augusta, Taranto, Venice and Gioia Tauro; in terms of fisheries activity, however, the main ports are Mazara del Vallo, Trapani, Palermo, Chioggia, Ancona, Molfetta and Manfredonia.

The Italian fishing fleet consists in 2015 of 12.414 vessels, with a combined gross tonnage of 164 000 GT.

The activity of monitoring, control and surveillance (MCS) is an integral and essential component of fisheries management. Italian MCS programs generally encompass the gathering of information on fishing effort characteristics and resource yields, the regulatory conditions under which the exploitation of fishery resources is to be conducted and the types of observations required to ensure compliance with regulatory controls imposed on fishing activities.

In Italy no legal or natural persons are allowed to engage in commercial fishing without the preliminary registration in the Fishing Company Register. Crew members are also registered in the Seamen Register and ships are recorded in apposite Vessels Register. This obligatory recording regime came from the Navigation Code, Presidential Decree No. 328/1952 of 1952, Law No. 963/1965 of 1965, and Presidential Decree No. 1639/1968 of 1968. In order to register, professional seamen must satisfy the following statutory requirements:

a. they must show that fishing is their sole or principal source of income; and
b. they must demonstrate that they have acquired adequate professional knowledge and skills to conduct commercial fishing operations (training course).

Currently this regime is confirmed by the context of the new Legislative Decree 153/2004. The registers are kept by the local offices of the Ministry of Transport (*Comando Generale delle Capitanerie di Porto or Coast Guard Authorities*) located along the Italian coastline.

Italy has adhered to the EC provision that governs the implementation of a satellite based monitoring systems ('Blue boxes') on vessels over 12 meters and the AIS (Automatic Identification System) on fishing vessels with a length overall greater than or equal to 15 meters by Regulation (EC) 1224/2009 which established a control system for guaranteeing the observance of Common Fisheries Policy regulations.

Italian Government set up the necessary administrative and technical infrastructure creating, in accordance with Coast Guards Headquarters, two military squads:

1) The National Fishery Control Centre (Centro Controllo Nazionale Pesca - CCNP);

2) The National Unit of Fishery Inspectors.

The latter is responsible for fishery operations in the high seas according to international conventions on Flag State responsibility (UN Convention on the Law of the Seas, 1982 and UN Fish Stocks Agreement, 1995).

The role of the National Fisheries Control Centre (CCNP) is to monitor the fisheries efforts and the economic activities associated with them. Said system of monitoring is directed at fisheries vessels sailing under the Italian flag (irrespective of which waters they may be sailing in or the port they put

into), those of other Member States as well as others belonging to non-EU States when they are operating in EU waters.

With the new Reg. (EU) 404/2011, in addition to the traditional monitoring and control activities against illegal activities across fishing industry, to protect the ecosystem and the consumer, CCNP has been identified as the body responsible for keeping the National Register of Infringements (Article 15 D.lgs 4/2012) which collects all offenses committed against the Common Fisheries Policy (PCP).

Table 2. Comprehensive report of the fisheries control activities undertaken by the Coast Guard from 2011, Jan., 1st - 2011, Nov., 3rd.

	No. of controls	No. of administrative penalties	No. of criminal penalties	Amount in Euro	No. of seizures	kg	Pieces of equipment
At sea	14,150	1,140	232	1,431,162	293	144,766.8	3,087
Landing locations	45,256	935	126	845,365	226	40,972	380
Wholesalers	1,642	118	21	391,664	44	30,932.2	-
Fish markets	2,351	65	27	118,146	40	2,914.1	1
Large-scale retailers	1,572	110	15	244,517	25	8,052.6	-
Catering	3,181	200	47	310,332	114	2,038	-
Airports	4	-	-	-	-	-	-
On the road	5,725	339	273	475,951	404	55,101.7	77
Fishmongers	4,144	349	72	561,685	139	4,963.3	-
Total	**78,025**	**3,256**	**813**	**4,378,822**	**1,285**	**289,740,7**	**3,545**

Source: National Fisheries Control Centre – General Command of the Port Authorities.

In addition the employment in the fisheries sector was estimated around 26.758 in 2013 for Italy, scoring the second place in this aspect among the EU maritime countries (1st Spain with 33.129)

In this sense, the Surveillance and Control of fisheries sector in the country is considered very important.

Fisheries (2013)[1]	
ES	33 129
IT	26 758
EL	24 486
PT	17 875
UK	12 022
FR	10 262
HR	4 872
IE	3 169
PL	2 430
NL	2 123
EE	2 046
FI	1 817
DE	1 647
SE	1 577
DK	1 489
CY[2]	1 290
BG	895
LT	763
LV	680
MT	389
BE	355
RO	304
SI	107

Figure 11. Employment in Fisheries (full-time equivallent)

In the structural European fund field, Italy has adopted an operational programme for € 978.107.682 (€ 537.262.559 EU contribution) covering the six "Union Priorities" defined in the European Maritime and Fisheries Fund 2014-2020 (EMFF), namely:

- promoting environmentally sustainable, resource-efficient, innovative, competitive and knowledge-based fisheries;
- fostering environmentally sustainable, resource-efficient, innovative, competitive and knowledge-based aquaculture;
- implementation of the Common Fisheries Policy (CFP);
- increasing employment and territorial cohesion;
- fostering marketing and processing;
- implementation of the Integrated Maritime Policy (IMP)

Reliable data on fish stocks and effective control of fishing activities are crucial for implementing the revised CFP (Common Fisheries Policy), particularly for the implementation of the discard ban and fisheries management based on MSY (Maximum Sustainable Yield), the budget allocated is € 120.335.674.

The programme supports the implementation of the national data collection plan in line with the existing Data Collection Framework (DCF), which aims at collecting, managing and using biological data on fish stocks, data on fishing activity (capacity, effort, catches and landings) and social and economic data for marine fisheries, aquaculture and processing sectors. The Corpo delle Capitanerie di Porto (the Italian coastguard) is responsible for ensuring proper control and enforcement of the CFP. The programme will support training and operational costs to increase the quality and number of controls, and to ensure that the priorities identified by the national Control Plan are fulfilled.

DEFENCE

Since 1990, the Italian defence market and industry have changed significantly. The post-Cold War decline in defence budgets, both in Italy and across Europe, intensified European efforts at cross-border cooperation, as, e.g., in the Letter of Intent (LOI) process. Since then, Italy has relied mainly on international cooperative efforts for its major defence programs, reinforcing a trend that began in the late 1970s in areas such as combat aircraft.

In 1990 Italy was Europe's fourth-largest defence market, with defense sales of $4.5 billion, 8000 firms (200 principal firms), and some 50,000-80,000 employees. Italy's 1989 aerospace sales were approximately $4.8 billion ($4.6 billion in 1988), also the fourth largest in NATO Europe. Aircraft is the most important sector, accounting for over half (51 percent) of all sales.

Italy today is the one of the largest defence industry spenders in Europe and tenth largest spender in the world is projected to spend US$147.2 billion on its armed forces during the period 2015-2019. In 2014, the Italian government allocated US$27.67 billion for the total defence budget which recorded a CAGR (Compound Annual Growth Rate) of 5.18% during 2010 to 2014.

The Italian MoD (Ministry of Defence) plans to allocate EUR 1.762 billion to investments in equipment in 2016. This amount does not include the funds allocated to technological investments by the Ministry of Economic Development. In 2015, beside EUR 2.171 billion from the MoD, the Ministry of Economic Development dispatched EUR 2.476 billion for investment in defence equipment. In 2015, total defence investments were therefore worth roughly EUR 4.600 billion. The Plurennial Programmatic Document for Defence does not mention future budget allocations for technological investments by the Ministry of Economic Development in the current year. The projection for 2017 defence investments is EUR 1.763 billion, which would confirm the decreasing trend in military expenditure. However, until the Government approves the new Budget Law in late 2016, it is not possible to make any further forecasts. More generally, the figures for 2016 and 2017 are not a final and perfectly defined assumption of the defence budget in real terms, because they do not include the supplement budget from the Ministry of Economic Development.

The following figures present some relevant data about expenditures, personnel and investments of the sector.

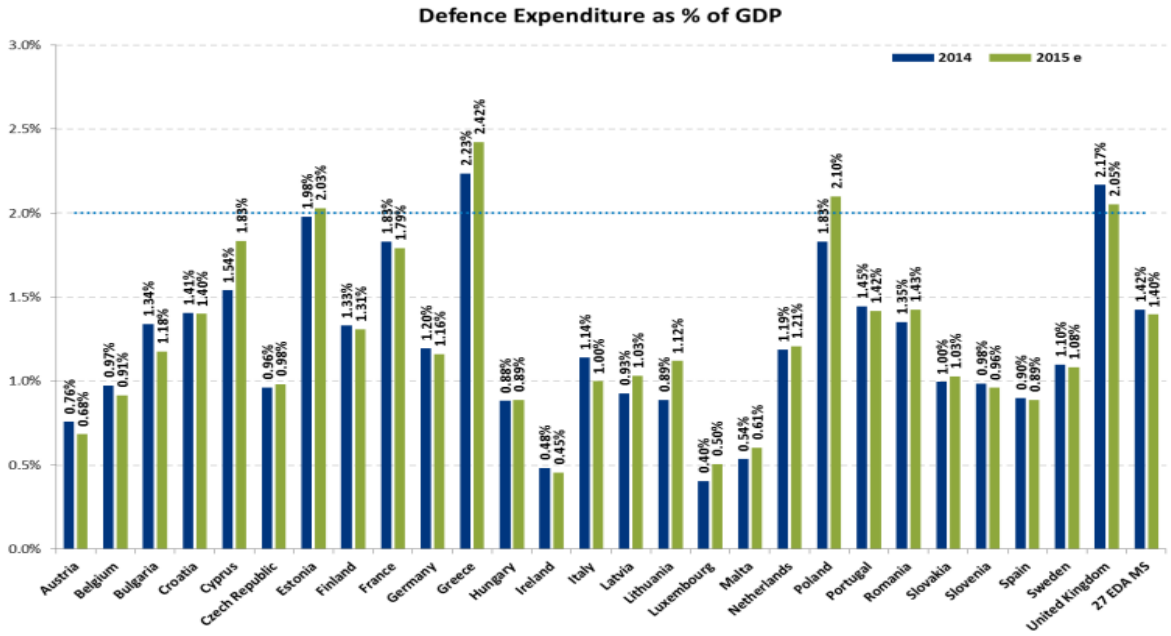


Figure 12. Defense Expenditure as % of GDP

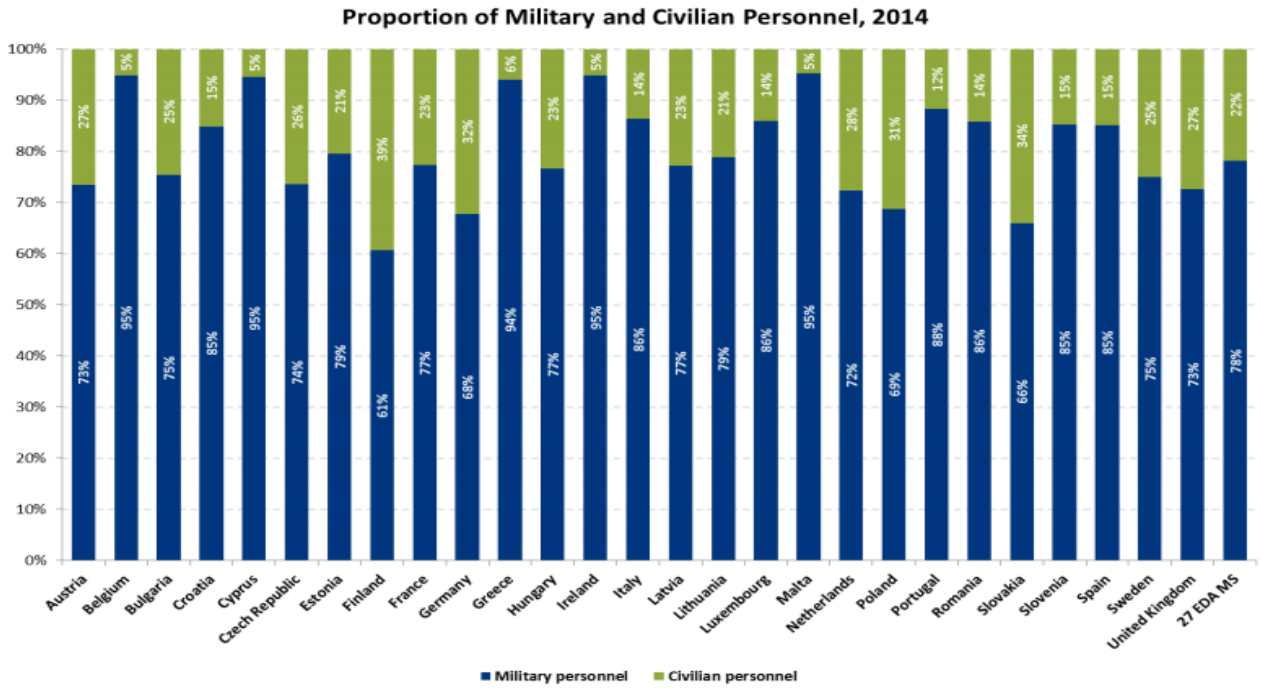


Figure 13. Proportion of Military and Civilian Personnel, 2014

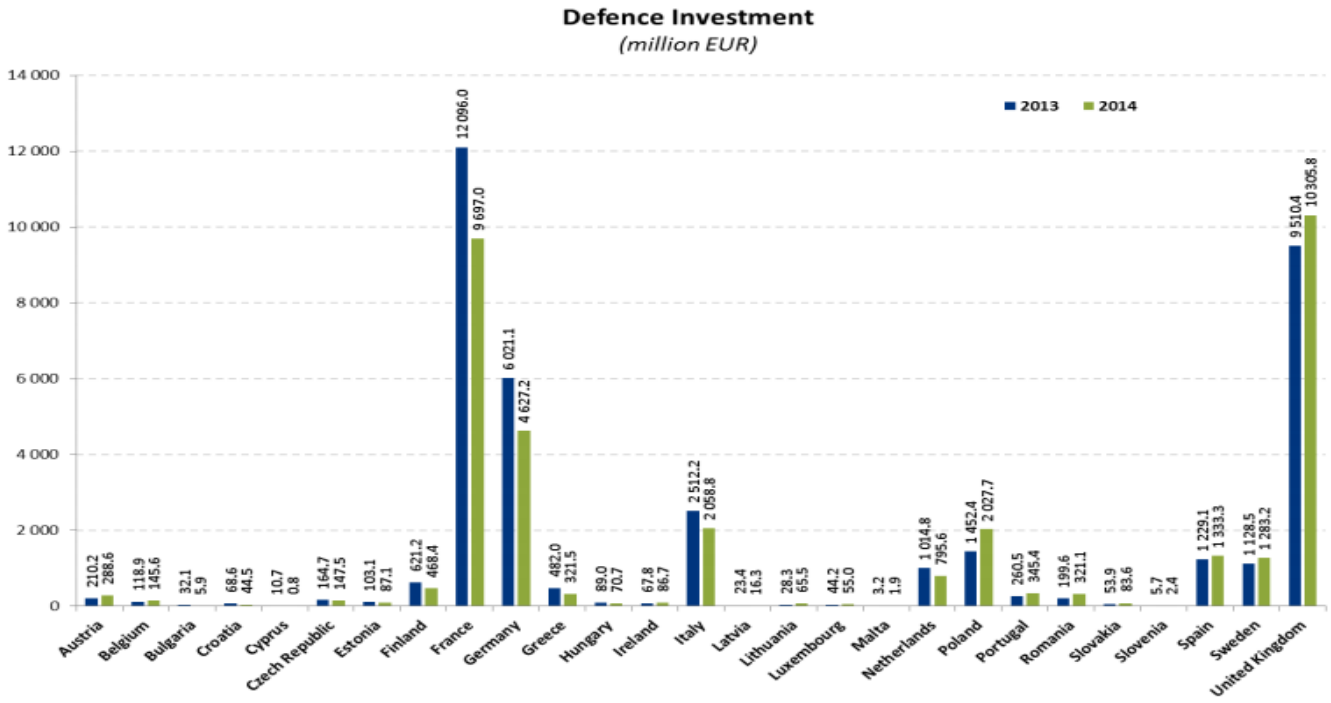


Figure 14. Defence Investment

MARITIME SAFETY & SECURITY

Italian Maritime Safety

The Italian Maritime Safety is guaranteed by Italian Navy and Italian Coast Guard.

The **Italian Navy** provides a relevant contribution to the **marine monitoring** in order to ascertain the quality of national and international waters.

The Navy's work is especially important on the high seas, where for other authorities, scientific institutes and organizations involved in marine conservation, it's more difficult to operate. Besides the special navy units of the Naval Fleet – 6 patrol vessels specialized in anti-pollution operations (units of the Costellazioni class, first and second series of the Patrol Forces Command based in Augusta – COMFORPAT) – all of the Navy units have among their secondary tasks marine conservation especially through the control of hydrocarbons spills in the sea (Legislative Decree: 6 nov 2007 n.202, art. 12), cetaceans monitoring and detecting of macroclastic sediments.

The **Coast Guard** Headquarters ensures the efficient organization of search and rescue services in the entire region of interest on the Italian sea, which overcomes the territorial waters boundaries. The Coast Guard Headquarters in fact is in charge of the I.M.R.C.C. functions - Italian Maritime Rescue Coordination Centre - which all the activities aimed at the search and rescue of human life at sea report to; these activities may be delivered through the use of air and naval components of the Coast

Guard, with the possible use of other military and civilian rescue units. The I.M.R.C.C., functionally identified in the Operational Centre of the Coast Guard Headquarters, keeps contact with the rescue coordination centers in other states to ensure international cooperation as defined by the Hamburg Convention.

The Coast Guard Headquarters is the competent authority in charge for:

- monitoring and controlling maritime traffic – i.e. gathering and exchange of information for increasing traffic safety and efficiency;
- improving response capabilities in S.A.R. activity for protecting human life at sea;
- contributing to a more effective prevention and localization of pollution caused by ships;
- monitoring and controlling activities related to the exploitation of fisheries resources.

The Operation Center monitoring room is arranged with workstations configured for monitoring, controlling and managing maritime traffic; they can interact with the following systems:

- ARES (Search and Rescue Automation)
- LRIT (Long Range Identification and Tracking)
- AIS (Automatic Identification System)
- VTS (Vessel Traffic Service)
- VMS (Vessel Monitoring System)
- SafeSeaNet (SSN)
- CleanSeaNet (CSN)
- IMDATE (Maritime Integrated Data Environment) - experimental
- NAVTEX (Navigational Text Warning)

All the above mentioned systems form the VTMIS platform (Vessel Traffic Management and Information System).

About ship safety a key role is played by 6th Department (Navigation Safety and Security) of the Coast Guard Headquarters is the technical department of the Ministry of Infrastructure and Transport, responsible for both administrative and functional navigation and maritime security.

The safety of navigation requires the Corps to play a twofold role:

- As Flag Administration (Flag State activities), it controls, checks and issues all the security navigation documentation to the domestic mercantile and fishing fleet;
- As Landing Port Administration (Port State Control activities), it has direct control on the compliance with the established international regulations of foreign-registered vessels calling at domestic ports.

Italian Maritime Security

The Italian Maritime Security is guaranteed by Italian Coast Guard and Italian Navy.

Another key technical activity of the **Coast Guard** is the Maritime Security that now involves both port systems and ships management. This topic, identifying preventive measures against the threat of intentional illegal acts on both shipping and port facilities, is ruled by European regulations. This requires a careful and punctilious monitoring activity by the EU Commission in order to ensure full compliance by all the Member States.
In accordance with the descent domestic regulations, the Corps has been titled 'Competent National Authority' and plays a key role in the implementation of cross-border regulations, within domestic regulations. This integrates the exclusive jurisdiction of the Coast Guard in navigation and port activities security, as well as search and rescue on the sea and the protection of fishery resources and food.

The **Italian Navy** through the Combined Maritime Forces (CMF), multi-national naval partnership, aim to promote security, stability and prosperity across approximately 2.5 million square miles of international waters which encompass some of the world's most important shipping lanes.
Combined Maritime Forces Headquarters are co-located with US Naval Central Command and US Navy Fifth Fleet at Naval Support Activity (NSA) Bahrain.

Against **piracy** Italy is involved in different international operations like:

- Operation Active Endeavour began on October 2001 following the invocation of Article 5 of the NATO Treaty, in response to the terrorist attacks against the United States of 11 September 2001, to help detect, deter and protect against international terrorist activity. The operation is under the overall command of Joint Forces Command (JFC), Naples, and is conducted from the Allied Maritime Component Command Naples, Italy (CC-Mar Naples) through a Task Force consisting of a balanced collection of surface units, submarines and maritime patrol aircraft deployed in the Mediterranean.
- Operation Ocean Shield represents NATO's contribution to international efforts to conduct counter-piracy activities off the coasts of Somalia and in the Horn of Africa. The operation was approved by the North Atlantic Council on 17 August 2009 as an evolution of the previous Operation Allied Protector (March-August 2009), whose aim was to contribute to the safety of commercial maritime routes and international navigation, providing maritime security in the region and is helping to reduce the overall pirate attack success rate. In order to respond to new piracy tactics, NATO has created greater synergies with other initiatives and International Organizations, recognized the continued need for regional capacity-building, within means and capabilities, and focused on areas where it provides its support to maintain an acceptable security level.

- ATALANTA is the name given to the EU military operation, also known as European Union Naval Force Somalia (EU- NAVFOR-ATALANTA), a current military operation undertaken to prevent and combat acts of piracy off the coast of Somalia, in support of UN Security Council Resolutions 1814, 1816, 1838 e 1846.

In this context, a crucial tool is represented by the Virtual Regional Maritime Traffic Centre (V-RMTC), an international info-sharing hub successfully implemented to monitor merchant traffic.

An activity between Safety & Security and Marine Environment is the activity of **Port State Control**. That is the inspection of foreign ships in national ports by PSC inspectors to investigate compliance with the requirements of international conventions that regulate the security of Navigation. Inspections can involve checking that the vessel is manned and operated in compliance with applicable international law, and verifying the competency of the ship's master and officers, and the ship's condition and equipment.

Other important actors active in the safety and security fields are **the Port Authorities** which guide, plan, co-ordinate, promote and monitor port operations. They ensures that the port's facilities are monitored at all times through a video surveillance system and checks on people and vehicles accessing the area.

On 21st January 2016, the Italian Cabinet gave the green light for the "Reorganization, rationalization and simplification of Port Authorities" decree (the "Ports Decree"), which reviews a system which has been in place for over 20 years. The Ports Decree is part of the re-launch of ports and logistics in Italy promoted by the Ministry for Infrastructure and Transport ("MIT"). The Ports Decree focuses on the competitiveness of our ports and supports the role of Italy - crossed by four of the TEN-T rail corridors - as a hub in the Mediterranean and European logistics platform.

Italian ports will be reorganized into 15 Port System Authorities ("PSA") based in strategic decision-making centers based in the Italian "core" ports as set out by the EU. These are Genova, La Spezia, Livorno, Civitavecchia, Cagliari, Napoli, Palermo, Augusta, Gioia Tauro, Taranto, Bari, Ancona, Ravenna, Venezia and Trieste. The new PSA will be in charge of 54 national ports. The local regional authorities can ask that additional ports of regional importance be included in the PSA.

MARINE ENVIRONMENT

The European Community, as per the regulation 2008/56/CE, entrusted the EU countries with creating national strategies involving all the main naval institutions, aimed at marine conservation.

Italy applied this regulation with the D.Lgs 190/2010 which gives the Ministry of the Environment and Protection of Land and Sea of Italy (MATTM) the role of coordinator of the strategy through the Technical Committee for the Environmental Marine Strategy (c.d. Marine Strategy).

On a technological-operative basis, the national Marine Strategy is achieved in five steps:

- Evaluation of the current state of the national waters (completed);
- Targeting: the Good Environmental Status – GES (completed);
- Targeting the "marine environmental goals" (TARGET) which allow to reach the GES (completed);
- Elaboration of the monitoring programs, evaluating the quality of the marine environment (in progress);
- Elaboration of the actions needed to reach the reach the GES and maintain it. (To be established).

The initial evaluation of the state of the waters and the establishing f the parameters that earn a GES (indicating the good environmental status) have been defined on the basis of eleven specific parameters, given by the European Commission and named 'Descriptors'. The systematic monitoring of these descriptors will constitute the National Plan for Environmental Monitoring and will allow to target environmental goals which in turn will earn a GES.

The **Italian Navy** collaborated to the establishing of the GES, the marine environmental goals and the monitoring plans in different fields of the marine conservation. Among these:

- seabed and biodiversity habitat;
- environmental and hydrographic evaluation;
- underwater noise.

As for the marine monitoring, the Navy's contribution will provide logistic support with ships and other means operative in both coastal waters and offshore, and the specific skills of technical departments such as the Italian Navy Hydrographic Office in Genoa and the Naval Experimentation and Support Centre (CSSN) in La Spezia.

All of this within the dual connotation of the Italian Navy's work for Defence and Maritime Safety in the Mediterranean Sea.

In particular, the Italian Navy can contribute to the monitoring with:

- the employ of naval units for the Descriptors' monitoring, in cooperation with the institutional activities;
- the use of the data acquired during the Hydro-Oceanographic Campaigns and data from the collaborations with the research institutes;
- provision of the hydro-oceanographic data from the Italian Navy Hydrographic Institute (IIM);
- the monitoring of the Biogenic Habitat – Cold Water Corals;

- the employ of the Hydrographic Units and the Minehunters for the control of specific parameters through the use of multibeam echo sounding, side scan sonars, grabs, ROVs and AUVs;
- specific expeditions and hydrographic research;
- acquisition of acoustic data concerning the merchant navy.

The protection of marine and coastal environment is guaranteed also by **Coast Guard Marine Environment Department**.

The Coast Guard Headquarters exerts - through its Operations center, the peripheral commands and the Air Stations - the services related to the actions for fighting marine pollution. This system is integrated by a satellite surveillance service, as part of a specific collaboration with EMSA (European Maritime Safety Agency).

A National Operation Plan is set for fighting marine pollution, based on two types of emergencies (Local and National) along with three operating conditions: at the first stage the local emergency operational plans arranged by each Harbour Master Office; at the second stage the operational emergency plan against pollution by hydrocarbons and other harmful substances defined by the Ministry for the Environment; at the third stage, only for pollution leading to the declaration of national emergency, the emergency response plan for national defense against pollution of hydrocarbons or other harmful substances caused by marine accidents, established by the Department of Civil Protection.

The Coast Guard has two mobile environmental laboratories (LAM) equipped for environmental sampling and immediate analysis on the physicochemical properties determining the pollutant behavior at sea and in fresh water; they are land mobile technical/scientific structures for supporting the operational capabilities of the periphery and can be sent easily over the territory.

CUSTOMS

The fight against contraband, smuggling of weapons, drug, cigarettes, radioactive materials, hazardous waste, illegal or expired drugs is guaranteed by different bodies: Italian Customs Administration and Finance Guard.

Each year the operational offices of the Customs Agency have to deal with the rapid and constant flow of trade within the world widest single market made up of 370 million of consumers. 115 million tons of products (worth 255,000 million Euros) transit through the points of exit at the Italian border, representing also the EU border towards the Mediterranean sea and the Slavic countries. 327 million tons of goods worth 254,00 million Euros, have in the same period arrived in Italy from Third Countries and the EU.

The Customs laboratories were set up with the aim of performing controls and tests necessary for the classification of important products and their corresponding taxation according to the relevant

category within merceology (sugar was the first product) and represent today a modern structure able to perform analysis and certifications for any kind of goods and products, ranging from foodstuff, hydrocarbons, drugs, clothes and spirits. They may be considered as specialized structures of reference not only for the tax administration, but also for all the institutions which are involved in the safeguard of the natural environment and health matters, as well as fighting against counterfeiting and repressing frauds.

Recently, the Custom Agency's laboratories added some new services. First of all gemmology, a field previously lacking an effective State certification body, and in which the need for countering fraudulent imports and guaranteeing traders about the objective quality and value of the products were strongly felt.

Still recent is Agency expertise in controlling transgenic food. In fact, the strict Community legislation on this matter prescribes very precise rules on the information to be provided and the labeling of food with a content of modified DNA higher than 1%.

Fake products – some european figures

- The global volume of trade in fake goods stands at over €200 billion per year;
- Between 2010 and 2011, the volume of fake articles detained by European customs grew by 11%;
- In 2009, the value of the top 10 brands in EU countries amounted to almost 9% of GDP;
- Fashion and high-end personal products encompass 54% of the total value of goods detained at EU borders;
- In 2011 alone, 115 million fake goods were detained at the EU borders, with an overall value of over €1.2 billion;
- Almost one third of the articles detained by EU customs in 2011 were found to be potentially dangerous to the health and safety of consumers.

The Finance Guard is particularly focused on the investigative activities to reconstruct the illicit supply chains and the production of illegal goods.

GENERAL LAW ENFORCEMENT

Law enforcement in Italy is carried out by numerous organizations, not all of which operate in the same areas.

The present organization of Public Security in Italy was introduced by Law N. 121 of 1981. The National Authority for Public Security is the Minister of the Interior, responsible for public order and security, and the coordination of police forces. In Italy there are five police forces: Polizia di Stato, Arma dei Carabinieri, Guardia di Finanza, Polizia Penitenziaria and Corpo Forestale dello Stato.

The *State Police* is the civil national police of Italy and is the principal Italian police force for the maintenance of public security and as such it is run directly from the Department of Public security and the keeping of public order.

The *Financial Guard* is a military corps under the authority of the Minister of Economy and Finance, with a role as police forces. They are responsible for regulating national and international financial dealings and combating fraud, counterfeiting, tax evasion and smuggling, money laundering, international illegal drug trafficking, illegal immigration, customs and borders checks, copyright violations, anti – Mafia operations, cybercrime, terrorist financing, maintaining public order and safety, political and military defense of the Italian borders.

The *Carabinieri* is a special branch of the army with similar function to the police, particularly concerning criminal investigation.

The *Polizia Penitenziaria* (Prison Guards) operate the Italian prison system and handle the transportation of inmates. They guarantees the safety and the conditions of legality inside the penitentiary institutes, they collaborates for the social admission activities of the condemned people, for the realization of the constitutional goal of the punishment, enacted in the art. 27 of the Constitution.

The *Corpo Forestale dello Stato* is responsible for law enforcement in Italian national park and forests. Their duties include enforcing poaching laws, safeguarding protected animal species and preventing forest fires. The Corpo Forestale was founded in 1822 and is a civilian police force specialized on the environmental protection. They are specialized for the prevention and repression of the crimes in environmental subject and food farming.

The multiplicity of tasks entrusted to Forestry is rooted in a professional forestry history that has evolved over time to include all the activities of safeguarding agri-environmental resources, national fauna and natural resources.

2.5. SPAIN

2.5.1. AREA OF REFERENCE

Spain is located in southwestern Europe. The Spanish mainland is bordered to the south and east almost entirely by the Mediterranean Sea (a small land boundary with Gibraltar excluded); to the north by France, Andorra, and the Bay of Biscay; and to the west by the Atlantic Ocean and Portugal. It is the fourth largest country in Western Europe covering 504,030 km² (156 000 km^2 of which refer to coastal regions).

Spain, based on its geographical location as well as its political strategic positioning, is an eminently maritime nation. The country's maritime profile is considered an ambivalent space that offers many opportunities for prosperity and development, but the difficulty of controlling it is conducive to the emergence of risks and threats to its security. This difficulty, coupled with the strategic and economic importance of the present and future uses of the sea, entail a growing need for security, as is

recognized by the recently adopted National Security Strategy, 2013 (IMG. National Interests of Spain for Maritime Security), which establishes maritime security as one of its areas of action.
With regards to the economic performance, the Spanish economy is the fifth-largest in the European Union, and the fourth-largest in the Eurozone, based on nominal GDP statistics.
The economic importance of Mediterranean coastal area for Spain accounted to 39% of the national Gross value added (GVA).

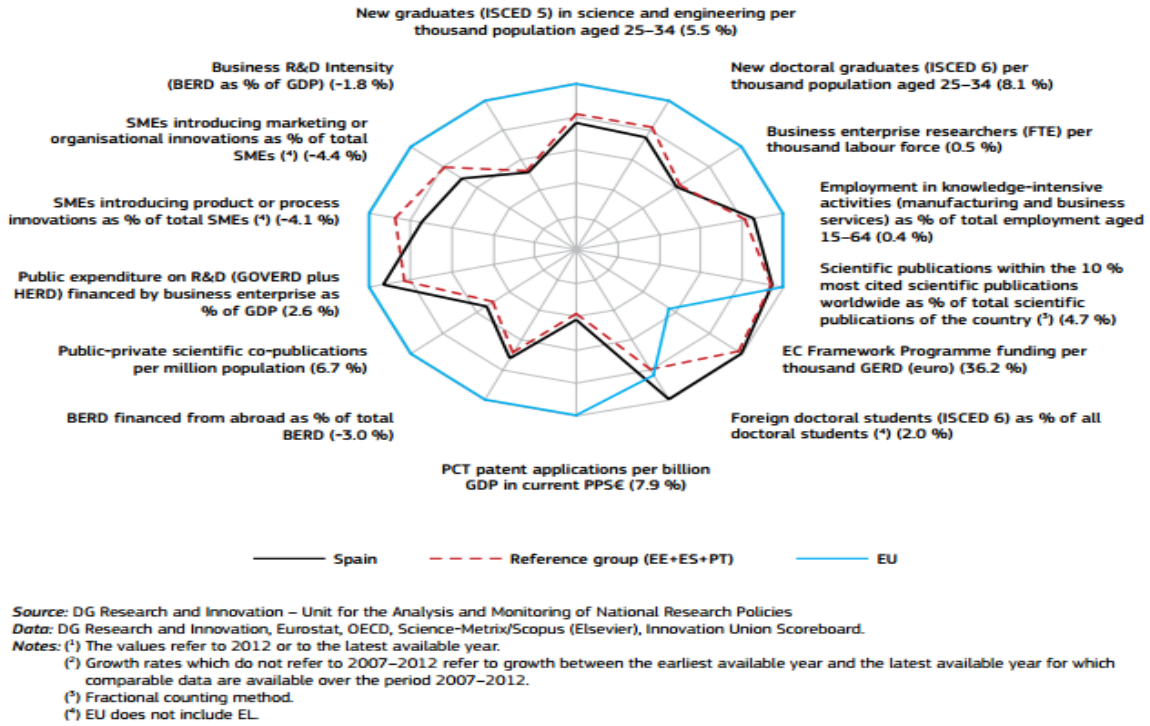
The indicators in the table below present a synthesis of research and innovation (R&I) performance in Spain for 2012, in relation to the EU and US averages. They relate knowledge investment and input to performance and economic output throughout the innovation cycle.

Table 3. Synthesis of research and innovation (R&I) performance in Spain for 2012

Key indicators of research and innovation performance

R&D intensity 2012: 1.30% (EU:2.07%; US:2.79%) 2007-2012: +0.5% (EU:2,4%; US:1.2%)	***Excellence in S&T*** *(Composite indicator that includes PCT per population, ERC grants per public R&D, top universities and research institutes per GERD and highly cited publications per total publications.)* 2012: 33.2 (EU:47.8; US:58.1) 2007-2012: +0.4 (EU:+2.9%; US: -0.2%)
Innovation Output Indicator 2012: 80.8 (EU:101.6)	***Knowledge intensity of the economy*** *(Composite indicator that includes R&D total expenditure, skills, sectorial specialisation, international specialisation and internationalisation sub-indicators.)* 2012: 38.0 (EU:51,2; US: 59.9) 2007-2012: +2.1% (EU:+1.0%; US:-32.3%)
Areas of marked S&T specialisations: Food, agriculture and fisheries, transport technologies, construction technologies, environment and biotechnologies	***HT + MT contribution to the trade balance*** 2012: 3.3% (EU:4.23%; US:1.02%) 2007-2012: +15.9% (EU:+4.8%, US:-32.3%)

Thematic strengths in key technologies and also the high-tech and medium-tech contribution to the trade balance are depicted. The indicator on excellence in science and technology takes into consideration the quality of scientific production as well as technological development. The Innovation Output Indicator covers technological innovation, skills in knowledge-intensive activities, the competitiveness of knowledge-intensive goods and services, and the innovativeness of fast-growing enterprises, focusing on innovation output. The indicator on knowledge-intensity of the economy focuses on the economy's sectoral composition and specialization and shows the evolution of the weight of knowledge-intensive sectors and products. The following figure shows a comparison between EU and Spain stats in R&D and innovation indicators (2012).



Source: DG Research and Innovation – Unit for the Analysis and Monitoring of National Research Policies
Data: DG Research and Innovation, Eurostat, OECD, Science-Metrix/Scopus (Elsevier), Innovation Union Scoreboard.
Notes: (1) The values refer to 2012 or to the latest available year.
(2) Growth rates which do not refer to 2007–2012 refer to growth between the earliest available year and the latest available year for which comparable data are available over the period 2007–2012.
(3) Fractional counting method.
(4) EU does not include EL.

Figure 15. Comparison between EU and Spain stats in R&D and innovation indicators (2012)

2.5.2. SOCIO-ECONOMIC & TECHNOLOGICAL TRENDS

With regards to Maritime Surveillance, taking into account the global trends identified, the technological megatrends appear to be most closely related and more specifically the following trends:

- Digital Transformation and Proliferation of Data
- Cyber Threats and Data Security
- Digital and Robotic Technologies
- Artificial intelligence (AI)
- Augmented Reality and Virtual Reality
- Drones
- Internet of Things (IoT)
- 3D printing

The technological aspect is considered vital for maritime surveillance, since the sector is largely based on electronic systems. Drones, IoT, Cyber-security and Artificial Intelligence are expected to have a large impact in many sectors in the near future, leading the world into a digital future and creating opportunities for many ICT based companies. At the same time, those opportunities constitute challenges for the companies to adapt and follow the global trends before they will be already considered outdated and enter first-to-market competitive added-value products.

2.5.3. THE MARITIME SURVEILLANCE KEY SECTOR

All the MS sectors are considered important; however, the most prominent MS sector is this of **Defense**. An analysis of the state of the art of every sector is presented below.

BORDER CONTROL

Border security in Spain is particularly critical since most of Spain borders the sea. Control strategies are not limited to monitoring arrivals at a linear border, but also include reaching out beyond Spanish territory to coordinate with the migratory policies of the immigrants' countries of origin.
In regard to border control at entry points, Spain has not only increased the number of personnel assigned to border control operations in recent years, but also enhanced the technology used in these operations (Advance Passenger Information System & electronic data interchange system). Spain has also fortified the border surrounding the cities of Ceuta and Melilla on the border with Morocco, through the use of American fence construction technology.
In addition to border controls that are carried out by Frontex (EU border control agency), an advance surveillance system (Sistema de Vigilancia Exterior) SIVE – budget 130 million euros, developed by a Spanish company and used by the Spanish Civil Guard to monitor the Spanish coast - has also been installed in the coastal areas of Gibraltar and the Canary Islands. SIVE was created at the end of the '90s to provide information obtained through sensor stations that detect seacraft from a long distance, and transmit a televised signal to two Central Commands, currently located in Algeciras in Gibraltar and Fuerteventura in the Canary Islands. The control of Spain's borders is relevant not only for Spain but also for many European countries in the north because of the elimination of the internal borders within the EU.
In addition, at EU level, a proposed European System of Border Surveillance (EUROSUR) to help prevent illegal border crossings and reduce irregular migration has been developed.
Immigration became part of the Spanish government's agenda in 1985, but it was not until the mid-1990s that it became a matter of vital importance to political elites and in the eyes of the public. The sharp increase in the number of foreign residents in the last years, the recent polemical debate surrounding the reform the immigration law, the establishment of a political immigration framework known as the Plan Greco, and the shortcomings of the 2002 labor quota program have made immigration one of the most hotly contested issues in the media, and the second most important "national" issue for Spaniards after terrorism.
The illegal immigration issue has become fairly significant in the recent years, especially in Spain, Italy and Greece. According to the Spanish government, 5,312 illegal immigrants arrived on Spanish coasts by sea in 2015 compared with 4,552 in 2014, an increase of 16.7%, in other words, 760 more than in the previous year.
The border control task also benefits from improved maritime surveillance and security. According to UNODC estimates, in 2008, some 55,000 migrants were smuggled from Africa into Europe for a sum

of about €73.4 million. Europol reported two years later, in 2010, a sharp reduction in the use of sea routes for this activity, thanks to the celebration of international agreements and European coordination of law enforcement activities along the maritime border. This shows the potential and benefits of stronger cooperation and coordination initiatives in this surveillance and security function. Illegal immigration leads also to direct costs to the EU budget, such as the €676 million of the return fund, which was established with the 2008 Return Directive to support and assist the return of immigrants. Such costs could be further reduced through an improved cooperation and coordination in the maritime surveillance system.

It should be noted that in Spain the competences to manage different aspects of immigration are distributed between various ministries and between the central government and the autonomous communities. That is why at the beginning of this decade two organisations were created to coordinate the actions of these different administrations: the Comisión Interministerial de Extranjería [Interministerial Commission on Alien Affairs], made up of representatives from the different ministries and the Consejo Superior de Política de Inmigración [Superior Council on Immigration Policy], which also includes representatives of the different Spanish regions and local governments.

In this sense, immigration issues have also broadened the Spanish foreign policy agenda due the growing importance of the development-migration nexus. As a consequence, the topic of immigration had an impact on Spain's foreign policy, promoting closer relationships with non-priority countries or those "diplomatically forgotten".

External Borders Fund 2007-2013 – Spain

The Commission has adopted the multiannual programme under the External Borders Fund 2007-2013 for Spain (the biggest beneficiary of the Fund) for an estimated amount of € 356 million, together with the 2007 annual programme. The External Borders Fund is one of the four financial instruments of the General Program on "Solidarity and Management of Migration Flows" which encourages a fair share of responsibilities between Member States arising from the introduction of integrated management of the external borders and from the implementation of common policies on asylum and immigration.

The overall budget of this Fund for 2007-2013 is € 1820 million.

FISHERIES CONTROL

The Spanish fishing fleet consists of approximately 13.400 vessels, classifying it to the first place of fleets in the European Union in terms of tonnage (480,000 GT). This tonnage constitutes 25 % of the EU-25 total. During the period 2000-2005, the country presented remarkable growth in short sea shipping (8,3%), compared to the average rate of EU-15 that had an increase of 3,5%.

In addition the employment in the fisheries sector was estimated around 33.129 in 2013 for Spain, scoring the first place in this aspect among the EU maritime countries (2nd. Italy with 26.758)

In this sense, the Surveillance and Control of fisheries sector in the country is considered very important. Overall, it is estimated that by 2020 illegal, unregulated and unreported (IUU) fishing in

selected fish groups and in five large marine ecosystems will cost to the EU €10 billion of lost catches, €8 billion of lost stock value and 27,000 lost jobs in the fishing and processing industries. In reaction to this prediction the EU Fisheries Control System was overhauled, through, inter alia, more harmonisation in information and inspection procedures of Member States, the use of modern data-processing and more communications technologies, and the introduction of new more effective systems for sharing of control data. The impact assessment conducted in 2008 for this new system estimated that through its implementation, enforcement costs at land would be reduced from €146.1 million to €63.7 million from 2010 to 2019 and marine enforcement costs from €88.2 million to €52 million from 2008 to 2017. This example shows that a more integrated surveillance system entailing, as in the new fisheries control system, more harmonisation, sharing of information, and the use of new technologies can reduce the administrative costs of enforcement of this and other functions, while decreasing the losses resulting from illegal activities such as IUU fishing.

In 2010, the European Commission detected several deficiencies in the Spanish fisheries control system, and therefore initiated an audit of the system during the years 2010 and 2011.

Given this situation, an action plan was established in July 2012 to correct deficiencies in fisheries management. After more than four years of intense work, the Ministry of Agriculture and Fisheries, Food and Environment managed to take a 180-degree turn in the organization and management of the fishery control and inspection system in Spain, which today stands at a high position, as it is recognized at Community and international level.

According to the Spanish Government, at the moment, Spain has achieved excellence in fisheries control and is a world reference in the field, which is proven by the achievement of ISO 9001:2015 certification in March 2016 for all the activities developed by the General Sub-directorate of Control and Inspection.

Spain also applies a VMS programme, to monitor compliance with European Union (EU), third countries, regional fisheries organizations and Spanish fisheries regulations around the world.

In addition, Spain has adopted an operational programme for €1.558.280.753 (75% EU contribution) covering the six “Union Priorities” defined in the EMFF, namely:

- promoting environmentally sustainable, resource-efficient, innovative, competitive and knowledge-based fisheries;
- fostering environmentally sustainable, resource-efficient, innovative, competitive and knowledge-based aquaculture;
- implementation of the Common Fisheries Policy (CFP);
- increasing employment and territorial cohesion;
- fostering marketing and processing;
- implementation of the Integrated Maritime Policy (IMP)

Specifically for the implementation of CFP, which sets rules for managing European fishing fleets and conserving fish stocks, the budget allocated is €155 954 705. The Spanish OP addresses structural weaknesses in the Spanish scientific data collection system through an action plan. In terms of control, the main measures aim to reinforce the control and inspection schemes, support the development of specific programmes, increase the control of products from third countries and

boost the fight against illegal fishing or the control of discards and fishing effort. Control in the Atlantic basin will concentrate on monitoring compliance with total allowable catches (TACs) and quotas, while in the Mediterranean, it will focus on control of fishing gears and the size of the captures. As a key result, EMFF funding will support the collection, management and use of data required by the CFP, as well as implementation of the control, inspection and enforcement system, likewise required by the CFP.

DEFENCE

The aerospace and defense sector is widely developed in Spain. The Spanish defense industry accounted for about 850 companies in 2010, generating over 18,000 direct jobs and a joint turnover of €3.6 billion (40% is exports). The four leaders of the local industry (Navantia, GDSBS, EADS and Indra) account for nearly 80% of the sector turnover, and approximately other 50 companies are considered large in terms of employees.

The sector is characterized by its high growth and its significant investment in R&D, which in 2015 amounted to 11% of the turnover of the sector.

Back in the 1990s, the Spanish defense industry underwent profound transformations. These changes created new relationships between governments and industries. There were many opportunities arising from both public and private sector projects in which Spanish firms would welcome partnerships with U.S. high-technology defense companies. For example, Spain's heavy investment in infrastructure projects presented major opportunities for U.S. defense electronics manufacturers. In the past, public firms dominated the defense sector, but private firms now have the upper hand.

Spain uses offsets on defense orders to support and develop its defense industry. Spanish industry has manufactured a significant share of the material requirements of the armed forces, notably light arms, vehicles, ships, and light transport aircraft. As a member of NATO, Spain had joined in the planning of several coproduction projects with other West European countries.

The General State budget approved for 2016 included an allocation of resources to the Ministry of Defence around € 5.787,89 Million (decrease of 8.36% of 2012).

Spain's navy (Armada Española) is critical to its defense. Spain's population and industry are concentrated along her coasts, which also form 83 percent of her international boundaries. Trade continues to be dependent on sea routes. More than 90 percent of Spain's exports go by sea, and a majority of imports - particularly raw materials and hydrocarbons - reach Spain by sea.

As regards the defence function, improved maritime security and surveillance can also enhance the effectiveness of operations and more cost-efficient CSDP maritime missions, as in the EU NAVFOR Operation to combat piracy. The problem of piracy, which has direct effects in the European economy, is estimated to have cost globally in 2010, between €7 and 12 million. According to recent reports the rate of success of piracy attacks has decreased substantially in the last two years, as a result of deployment of wider deployment of Western Navies and a greater coordination among them. This demonstrates again how better coordination leads to significant better results. An

integrated maritime surveillance and security system can foster such coordination and therefore influence positively the outcome of activities under the DEFENCE function.

MARITIME SAFETY AND SECURITY

Maritime transport enables trade and contacts between all the European nations and provides the main vehicle for European imports and exports to the rest of the world. Almost 90% of the EU external freight trade is seaborne, while short sea shipping represents 40% of intra-EU exchanges in terms of ton-kilometers. Overall, maritime industries are an important source of employment and income for the European economy. The EU focuses its efforts to improve maritime safety and security by developing systems to improve maritime surveillance capabilities and to collect information about maritime accidents. The research focuses on investigating the value and usage of raw data on the movement of containers, previously not systematically used by customs authorities.
While 90% of the world's cargo is transported in maritime containers, only 2% is physically inspected by customs authorities, opening the possibility for illicit activities.
Member States are organised differently in safeguarding national and the EU's strategic maritime security interests and protecting against maritime security risks and threats. Some Member States use civilian authorities for surveillance and law enforcement, such as Coast Guards; others use Navies or other maritime forces; others share responsibility between civilian and military administrations. Cooperation at sea between all actors involved has a positive spill-over in other policy areas.
According to the Spanish National Maritime Security Strategy 2013, several risks and threats are connected to Maritime Security for Spain. Those are depicted in the following figure.

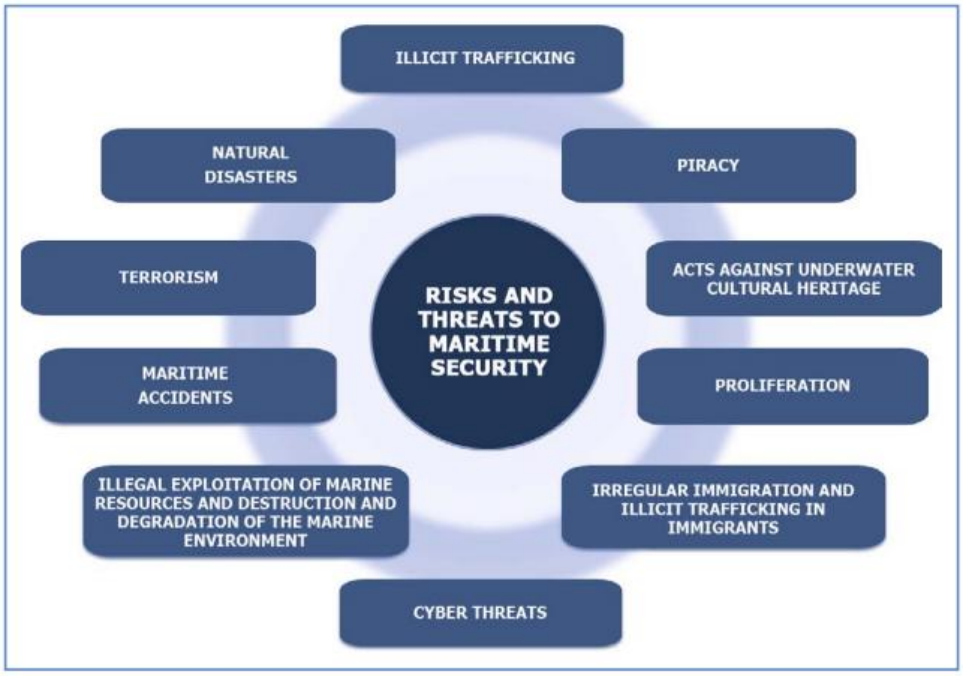


Figure 16. Risks and Threats to Maritime Security

MARITIME ENVIRONMENT

Marine environment is particularly sensitive and fragile, even more for ecosystems of special vulnerability towards pollution.

These areas require continuous and precise surveillance to preserve the natural environment.

The impact of industrial operations at sea has always been a strategic and demanding issue on operating companies, governments and general public. Marine environmental surveillance existing technologies depend in most cases on an expert operator, since they are non-automated systems. New developments in early detection are required as complementary to prevention technologies that allow achieving the minimum response time to any incident. Detailed and swift information is crucial from the tactical point of view for an efficient management of resources in monitoring,

Spain, in the framework of it operational programme, covers the Union Priority of EMFF with regards to the implementation of the Integrated Maritime Policy.

More specifically, funds under the IMP will be used to ensure appropriate mapping of marine ecosystems, run a programme to explore the continental shelf and slope (through surveys), and other measures contributing to increased marine knowledge (seabed data, mapping, bathymetric analyses, etc.). The key result will be the preservation and protection of the marine environment and its resources, and enhancing the spatial planning and implementing policies and guidelines and the MSFD.

CUSTOMS

In the customs function, a further integration of maritime surveillance and security has potential to tackle more effectively with illegal activities and avert thereby economic losses to the EU and its Member States. For instance, through customs fraud and smuggling, counterfeit products are introduced into the European economy evading therefore import duties. According to UNODC estimates, in 2008, the European seizures from all counterfeit sources were worth roughly €606 million, taking as a reference the 7% rate of interception of counterfeit goods this study proposes, this leaves counterfeit goods for a value of €8.7 billion going unaccounted. Other illegal activities (partly) undertaken through maritime trade such as cigarette smuggling entail as well great losses for the EU Member States, Europol estimates that the losses to national and EU budgets resulting from the smuggling of this type of products amount to €10 billion per year.

GENERAL LAW ENFORCEMENT

Law enforcement in Spain is carried out by numerous organizations, not all of which operate in the same areas.
The Guardia Civil patrols rural areas (including highways and ports) and investigate crimes there. They operate from garrison posts and fully equipped Police Stations.
The Policia Nacional or Cuerpo Nacional de Policía (CNP) deals with criminal offences and public order in big towns and cities. It includes special anti-riot units.
Policia Local exist in most cities and important towns in order to concentrate on preventing crime, settling minor incidents, traffic control, and, crucially, intelligence gathering.
There are also several specialist forces also with the powers of arrest for dealing with areas such as tax avoidance, smuggling and international crime.
Locally, all enforcement agencies work together closely, and in serious matters, usually under the guidance of an Examining magistrate. Operational policy and major interventions are nationally coordinated under the direction of the Ministry of the Interior. The Ministry of the Interior of Spain is the executive branch responsible for policing, national security, immigration matters, prisons and road traffic safety.
At the EU level, the European body Europol contributes to the function of general law enforcement in the sea. In general, it serves as a support centre for law enforcement operations, criminal information hub, and centre for law enforcement expertise. Its role as a facilitator in the exchange of information among Member States is particularly relevant for surveillance activities in this function Among others, Europol supports certain law enforcement activities of Member States part of their maritime surveillance and security, such as the fight against illicit drug trafficking, illicit immigration networks, terrorism, trafficking of human beings and illicit vehicle trafficking.

2.6. PORTUGAL

2.6.1. AREA OF REFERENCE

Algarve has a strong sense of regional belonging, rooted in a common identity. This derives from the process of historical construction of the region since the territory has remained the same since the birth of Portugal as a nation in the early 12th century. In addition, the peripheral character of the Algarve in relation to the rest of the country and the fact that the government units correspond to the spatial limits, which is rare in Portugal.

The Algarve region has only a single department (Faro), which leads to a territorial coincidence between the NUTS II and the NUTSIII. It has only 16 municipalities and 67 parishes.

The Algarve is located in the south of the country, bordered to the south and west by the Atlantic Ocean, to the east by the Guadiana River (which borders the Spanish border) and to the north by a mountainous morphology before Alentejo. The region is spread over 5.000 km ^{2}, representing little more than 4% of the national territory and is home to about 440.000 inhabitants, which accounts for 4.3% of the Portuguese population.

The regional GDP per capita expressed in purchasing power standards (PPS) has decreased in the last few years but is still the second highest amongst the Portuguese regions, reaching 78.7% of the EU28 average (2014).

The Algarve is assumed, historically and currently, as a territory with a strong maritime tradition and where development has been strongly coupled to the direct use of coastal and marine resources. Tourist activities, fishing, aquaculture and marine-recreational are the main driver of the current economic development in the Algarve. Its continuity, as well as looking for new ways of economic development within a high standard of environmental respect, are fundamental to achieve sustained growth. The areas of potential development incorporate biotechnological exploration, exploration of energy resources (mainly renewable sources), increased marine tourism activity, increase on the supply of tourism with nature, diversity in the types of coastal tourism, with greater maritime connections, sustainable exploitation of fishery resources and the valuation of the offer in aquaculture. In terms of Maritime Surveillance Sectors there is potential development for technologies for protecting and monitoring Tourism, Fishing & Aquaculture activities, and Maritime Environment (for instance preventing pollution). As a transversal sector ICT will support MS sectors. According to the regional S3 for Algarve[4] Tourism and Sea are consolidated sectors and interconnections between sectors - for instance Tourism, Sea and Environment – are encouraged, and the use of ICT in these sectorial interconnections should also stimulate new business opportunities, new products and technologies.

The coastal area includes the most important economic value of the Algarve region - the beaches, where environmental quality has a leading role in its recovery. The knowledge of the marine biodiversity in areas of high biological value aimed at the enhancement of underwater biodiversity, such as marine hazardous areas, has implications not only for sustainability of resources but also for

[4] CCDR Algarve (2013). *RIS3 – Algarve 2014 – 2020, CRESC Algarve 2020*

development environmental and underwater tourism. In biotechnology, the development of marine high-yield strains for biofuels and processing of biomass show a high potential for incorporation of knowledge produced for global applications, as well as for identifying active compounds and industrial gene applications. But this also represents a potential danger for tourism activities and because of this, it is important to develop monitoring activities, as far as Maritime Surveillance is concerned.

Description of the Innovation eco-system, main business models and markets of reference

According to the Regional Innovation Scoreboard 2016, Algarve is a Moderate Innovator.

“Innovation performance has increased over time with a large increase in 2014. Performance relative to the EU declined until 2013. In 2014 and 2015, performance relative to the EU has increased to 80% of the EU average.” In addition, the Algarve has a GDP per capita, which places it as a region of phasing out. The growth was mainly due to public and semi-public investments in infrastructures designed to meet the needs of population growth in the high season, in order to provide quality services to the population. However, there was no similar evolution in productivity and competitiveness indicators and region did not overcome all its structural, socioeconomic and demographic asymmetries.

The business structure of the Algarve is essentially composed of micro-enterprises with less than 10 employees. This is related to the fact that a significant number of companies are individual in nature, in a higher proportion in the Algarve than in the rest of the country. The concentration of companies in "Agriculture, livestock, hunting and forestry" is also above the country level. On the negative side the Manufacturing Industries are less representative in the Algarve, compared to the rest of the country.

The over-specialization of Algarve's economic structure in tourism has been an obstacle to innovation because the sector is not connoted with a perspective of technological innovation and because most economic agents in this sector are from outside the region.

The negative evolution of R&D spending shows that the Algarve starts from a level well below the national baseline and very far from the 3% EU ambitions. At the same time, the low level of R&D is accompanied by a lower growth rate compared to the national average in recent years. In addition, the concentration of R&D expenditure is at the University of Algarve, a public entity, which reflects the almost inexistence of production of knowledge and innovation in the private sector.

According to data from the Web of Science, in terms of knowledge production the Algarve's regional specialization is linked to existing natural resources. The scientific knowledge of the Algarve is mainly in the areas related to the sea: marine and freshwater biology, fisheries, environmental sciences, biochemistry and molecular biology, oceanography, ecology, plant science, geosciences, chemistry, electrical and electronic engineering and zoology.

The indicators of the Regional Innovation Scoreboard reveal that the region presents deficits of innovation in terms of: private expenditure on R&D, low levels of employment in industry and services of medium-high and high technology, knowledge intensive, EPO patents and public-private partnerships. Positive aspects include the relevant increase in the technological product and process innovation, in SMEs to innovate at home, and in the sales of new products to the market or to the company.

In short, the Algarve is a region in progress at the level of innovation, in the national and European context, but with high deficits in: R & D with a focus on the market and results; Investment in R & D compared to other Portuguese and European regions; Support conditions to stimulate innovation and entrepreneurship.

2.6.2. SOCIO-ECONOMIC AND TECHNOLOGICAL TRENDS

Demographic Shifts

Megatrend: **Immigration/diversity**

Trends: capacity to fill gaps in workforce

Megatrend: **Population growth** – Specifically large population oscillations between winter and summer

Trends: demands and effects on land, climate, water, government resources. The population of the Algarve triples in the high season (tourists), causing impact on the environment, water, construction, etc.

Megatrend: **Suburbanization/sprawl**

Trends: demands and effects on land, climate, water supply, small business, entrepreneurship, government resources.

Science and Technology Developments

Science and technology developments are advancements in both scientific research and applications of that research.

Megatrend: **Energy sources**

Trends: development of alternative energy sources

Megatrend: **Privacy & security issues**

Trends: wireless tracking, identity theft, cyber terrorism

Megatrend: **Electronic delivery of goods/services**

Trends: e-commerce, e-government

Economic Dynamics

Economic dynamics are changes in the production and exchange of goods and services both within and between nations as well as movements in the overall economy such as prices, output, unemployment, banking, capital and wealth.

Megatrend: **Globalization of trade**

Trends: outsourcing, offshoring, free trade agreements, prescription drug reimportation

Megatrend: **Energy supply**

Trends: price increases, availability

Megatrend: **Intellectual property**

Trends: standardization of local, state, national and international regulation.

2.6.3. THE MARITIME SURVEILLANCE KEY SECTOR

The ocean is a development vector, through the numerous and diverse uses and activities it supports, such as marine transport, tourism, shipbuilding and repair, recreational boating and other traditional or emerging activities. The ocean also represents risks and threats which social and economic impact is high and negative. The ocean is more and more subject to pressures that arise out of human action and in particular due to the fast growing population in some regions of the planet. For instance: excessive urbanisation of the coastal areas, increasing its impacts as pollution, unsustainable fast consumption of living marine resources, over-exploitation , illegal, unregulated and unreported fishing, and maritime traffic. In addition, the growing global trade done by sea extend significantly the risk of accidents and environmental catastrophe.

Moreover, the ocean is still a platform being used for illicit and criminal activities such as: piracy, armed robbery, unregulated or unreported fishing, illegal immigration, trafficking of human beings and weaponry, drug trafficking, biological and chemical nuclear proliferation and terrorism. In Algarve, the main problems are unregulated or unreported fishing; drug trafficking; illegal immigration; robbery, unregulated and over-exploitation of marine resources; sea discharges of ships

passing by the coast - The Algarve is a crossing zone between the Mediterranean Sea and the Atlantic Ocean, and large ships pass relatively close to the coast where they take advantage to clean the tanks; pollution from the leisure boats during the high season (June – September).

Nevertheless the Surveillance Maritime Sector is not yet well developed. Included in the main Sea Challenges for 2020 are few projects:

- Training projects in maritime safety;
- Creation of a centre of maritime safety (training centre);
- Creation of an observatory for Logistics and Intelligence for collecting and monitoring relevant data for decision making (Key performance indicators);
- Project to increase and raise awareness of maritime culture, maritime safety and all marine sciences;
- Acoustic and environmental monitoring projects.

Resulting from the projects MARSUNO, BlueMassMed and Cooperação, some priority domains for transnational cooperation were identified, for instance: real-time communication of positions of ships and patrol aircraft to ensure a faster response to rescue operations or other situations of risk at sea; consolidation of data and exchange of information on suspect vessels navigating in EU waters; collaborative tools for cross-border crisis management.

According to Algarve Regional Innovation Strategy the sea is "*a strategic resource for Portugal and decisive for the Algarve. Its importance is highlighted in the various national strategies developed over the years, is transversal to the whole of society and encompasses a complex set of activities ranging from tourism and leisure, to energy and minerals, to logistics and transportation, fishing, aquaculture, Fish processing and related support services, or for R&D-based activities, in a structured relationship in the so-called hypercluster concept of the sea* ".

The strategic priorities are therefore to develop a cluster of maritime activities, promoting the connection between sectors such as: Ports, Maritime Equipment, Shipbuilding, Leisure Fishing, Maritime Services, Fishing, Dredging, Offshores Activities, River Transport, Transports.

The strategic priorities for the fisheries and aquaculture subsectors in the National Strategic Plan for Fisheries include:

- Promoting the competitiveness of the fisheries sector in the context of adapting to available and exploitable resources;
- Reinforcement of innovation and diversification of aquaculture production;
- Creation of more value and diversification in the manufacturing industry;
- Sustainable development of coastal areas most dependent on fisheries.

According to the Regional Agenda for the Sea (CCDR Algarve 2008), it will be anchored in five main areas: "**Fisheries, Tourism, Research and Development, Infrastructures and Culture**".

By taking into consideration the above facts, 2 key sector were indertified as prominent: **Maritime Security & Safety** and **Fisheries Control**.

MARITIME SECURITY IN TOURISM

Being tourism the most important economic sector in the Algarve and the coastal area and beaches its most valuable economic asset, necessarily the MS sectors crucial for the region are the ones that affects maritime and nautical tourism and related recreational activities, providing safety and security for tourists, but also preventing risks of accidents and environmental catastrophes.

MARITIME SECURITY IN FISHERIES AND AQUACULTURE

As previously mentioned Algarve has a strong maritime tradition where fishing activities and the direct use of coastal and marine resources has provided for many years the way of living of population. More recently Aquaculture is gaining importance and being developed in a serious and sustainable way in order to cope with the overexploitation of fisheries and to respond to the food needs of local people and tourists who, by consumption habits (in the case of the population Local) or by brand image associated with the territory (Mediterranean Diet), consume fish and seafood in large quantity. Therefore, the main issues are the following:

- Unsustainable fast consumption of living marine resources,
- Over-exploitation , illegal, unregulated and unreported fishing,
- Robbery in Offshore and Onshore Aquacultures
- Preservation of marine biodiversity

MARINE ENERGIES (additional sector)

- Renewable energies are energy efficiency are contemplated in the Algarve RIS 3 and should be a sector to be developed. Taking into account the importance of the sea for Portugal and particularly for Algarve, marine energies will also a sector to be included in a near future in the regional policies and with connections to MS sectors as well.

2.7. CHAPTER'S KEY POINTS

Table 4 presents the key points of the chapter based on the data collected by del. 3.2.1 for each area.

Table 4. Identified MS Sectors and RDI performance per area of reference

Country	Identified prominent MS Sectors	Other identified MS Sectors	RDI Performance
France	▪ Maritime Security & Safety ▪ Maritime Environment		High
Greece	▪ Maritime Security & Safety	▪ Defence ▪ Border Control	Moderate
Italy	▪ Maritime Security & Safety		Moderate

	▪ Fisheries Control ▪ Marine Environment ▪ Customs		
Spain	▪ Defence		Moderate
Portugal	▪ Maritime Security & Safety (focused in tourism) ▪ Fisheries Control	▪ Marine Energies	Moderate
Cyprus	*pending*	*pending*	*pending*

3. IDENTIFICATION OF THE INVOLVED STAKEHOLDERS

The chapter presents the identified key stakeholders per country that will host the national nodes.

3.1. EU LEVEL

Table 5 presents the key involved stakeholders in from the EU.

Table 5. Involved Stakeholders in EU

EU Actors (Public and Private)	
Name	**Primary MS Sector**
Joint Research Centre – EC, EU Science Hub	Maritime Security
Combined Maritime Forces	Maritime Security
EUROPOL	General Law Enforcement
Directorate-General for Maritime Affairs and Fisheries (MARE)	Fisheries Control
SatCen - European Union Satellite Centre	Defence
European Border and Coast Guard Agency (Frontex)	Border Control
European Defence Agency (EDA)	Defence
European Fisheries Control Agency (EFCA)	Fisheries Control
European Maritime Safety Agency (EMSA)	Maritime Security
European Space Agency (ESA)	Defence
OSCE: Organization for Security and Co-operation in Europe	Border Control
International Maritime Organization (IMO)	Maritime Security

3.2. FRANCE

The main public actors involved in MS are national actors. There are 2 regions in France where the MS public actors are concentrated with Brittany and PACA. In PACA, presence of the naval base of Toulon brings together all the MS public actors. Table 6 presents the key involved stakeholders in the area of interest of France.

Table 6. Involved Stakeholders in France

A/A	Stakeholder	Area of Interest / Key features	Status
1	**DGA TN** (French ministry of Defence) is a key actor of Defence in Toulon	- Naval surface and submarine platforms (including weapons integration) - Naval combat systems - Telecommunications and naval command aids - Submarine and surface drones - Expertise in naval interoperability - Measurement and analysis of acoustic and electromagnetic signatures of surface vessels and submarines	Public / Local
2	**CROSSMED** (Maritime Affairs) is a key actor of Search And Rescue in Toulon	- Search and Rescue - Surveillance of maritime navigation - Pollution monitoring - Dissemination of Maritime Safety Information	Public / Local
3	**MARINE NATIONALE** (Ministry of Defence) is a key actor of Defence in Toulon	- The main French naval base. - Host most of the naval force, including the aircraft carrier Charles de Gaulle, the projection and command buildings (BPC) Mistral, Tonnerre and Dixmude, as well as the 6 nuclear attack marines, Ruby class.	Public / Local

A/A	Stakeholder	Area of Interest / Key features	Status
		- More than 60% of the tonnage of the French Navy is docked in the harbour of Toulon.	
4	**SSF** (Ministry of Defence) is a key actor of Defence in Toulon	- Provides, in a single structure, the MCO (project management in operational condition) of surface vessels and submarines of the French Navy. - Responsible for managing naval replacement stocks and is responsible for the implementation of facilities related to the maintenance of nuclear powered vessels and submarines and the dismantling of buildings at the end of their life, except nuclear-powered vessels.	Public / Local
5	**SATT-SE** is a key actor of Technology Transfer between university and private sector in PACA	- Acts as an interface between companies and public research in the south-east of France. - Brings inventions developed by its shareholder research bodies to readiness on legal (intellectual property), economic (market) and technical (proof of concept) levels. - Aims at transferring innovative technologies stemming from its shareholders to the economic fabric while granting operating licenses to companies.	Public / Research and Technology Transfer Institutions
6	**Chamber of Commerce and Industry VAR** is a key actor of creation, recovery development and assignment of a business in the region.	- Start a business - Takeover of a company - Financing a training - Appropriation of apprenticeship tax - Support the establishment of new companies in the department	Public / Intermediaries
7	**The Regional Agency for Innovation and**	- implements economic development, innovation and internationalization strategies (Regional Scheme for Economic	Public / Intermediaries

A/A	Stakeholder	Area of Interest / Key features	Status
	Internationalization of Companies (ARII)	Development, innovation and internationalization, SRDEII in French, Regional Innovation Strategies, Regional Plan for Internationalization of Companies and so on) as well as various European, national and regional operational schemes. - Is the favored interface between public and corporate stakeholders thanks to governance combining elected representatives, partners, economic stakeholders and entrepreneurs. - Its role is to catalyze funding. - Focuses on 3 development leverages: o Regional Major Structuring Programs o Business growth acceleration among high-potential SMEs o International attractiveness in the region	
8	**Toulon Provence Méditerranée (TPM)** is a key actor of in the region	- It is a community of agglomeration located in the department of Var and the region Provence-Alpes-Côte d'Azur around the city of Toulon	Public / Others institutions
9	**BRGM**	- Marine mining and energy resources - Marine environment and coastal planning Harbours - infrastructures and shipping - Marine Environment - Hydrodynamic Engineering - Modeling NICT	Public
10	**CEFREM** - Université de Perpignan	- Expertise in coastline evolution, water availability, ecological restoration by artificial reef and post-larvae use.	Public University

A/A	Stakeholder	Area of Interest / Key features	Status
		- Transfer of materials and energy at coastal zone level including coastline evolution. - Ecological restoration including marine protected areas and artificial reefs function.	
11	Centre de Droit Maritime et des Transports	- Research and teaching in Maritime and transport law - Consultancy Training	Public
12	Centre de recherche sur les Risques et les Crises / Ecole des Mines de Paris	- Ship building and ship repair Energy - Equipment - Hydrodynamic - Material - Simulation - Innovative and Complex systems	Public / Research
13	CEREGE	- Disciplines: Geology, Mineralogy, Géophysics, Solid state Physics, Geochemistry, paleobiology, Mass spectrometry. - Studies topics: planetology and Deep Earth Interiors; Geodynamics and morphodynamics; Climate and Climatic cycles; Environmental variability and Ecosystems, Hydrosystems and water cycle; Soils sciences; Nanomaterials and waste treatment. - Services: Acoustic, Sensors Marine Environment, Hydrodynamic Engineering, Oceanography, Green technologies	Public
14	GEOSCIENCES AZUR	- Geosciences research : dynamics of crust and lithosphere, fault	Public

A/A	Stakeholder	Area of Interest / Key features	Status
		and earthquake mechanics, fracture processes, marine geosciences and integrated on-shore and off-shore approaches, Natural hazards (seismic, landslide, tsunami), geochronology, geomechanicsnn space geodesy, metrology of the close universe - Numerical and analogical modelisations. Research and Development in métrology (GPS, OBS, satellite positioning), geophysical tomography, datation, geological cartography, analysis of mineral	
15	INPP	- Commercial Diving Hyperbaric Centre (SS Top-up - M/G Closed Bell) - ROV Operator and submersible pilot training - IMCA quali cation courses - Surface support quali cations - Commercial Diving and Hyperbaric activities (Training - Certi cation - Advisory - Expert) in the eld of underwater works	Public
16	Institut Méditerranéen d'Océanographie - MI0 (CNRS 7294)	- Research, oceanography, observation, marione, chemistry and physics, marine biology and microbiology, modeling. - Observation of marine waters, in situ equipement for marine observation, satellite imagery; sensors for marine waters, modeling, oceanic circulation.	Public
17	LABORATOIRE LMA	- Research Laboratory Research training - Materials and Structures:homogenization, multi-scale approaches, composite materials, elastomers, contact and friction phenomena, interfaces, dynamics of non-linear systems, multiphysics coupling. - Waves and Imaging: wave propagation and non-destructive	Public

A/A	Stakeholder	Area of Interest / Key features	Status
		characterization of complex media : porous media, biological media, marine environment, geological media, materials, ultrasound imaging. - Sounds: structural acoustics, active noise control, psychacoustics, auditory perception, sound eld analysis and synthesis, virtual reality, musical instruments.	
18	LABORATOIRE LSIS	- Naval architecture - Software - Maintenance - Subsea robotics - Simulation - Innovative and complex systems	Public
19	OOV – Laboratoire LOV	- Research, Education, Observation on marine environments, plankton: biodiversity and role in biogeochemical cycles. Instrumental developments for laboratory and in situ observation. Predictive modeling of invasive or harmful species. Effects of global change on ecosystem services	Public
20	SHOM	- Measurement, description and forecast of the HOM environment for the security of navigation, defence, maritime limits and boundaries, integrated management and sustainable development of coastal zones, risk prevention. Web services. International cooperation. Digital Models - Marine Data acquisition, modelisation, DTM, charts, marine boundaries, expertises for blue economy development, web services	Public

A/A	Stakeholder	Area of Interest / Key features	Status
21	Université de Toulon	- Training Research Technology transfer - Training: Sciences & technology, economics, management, language and literature, law, sciences & technology of sport and physical activity, information communication	Public
22	UNS - LABORATOIRE I3S	- Maritime safety and security Naval and yachting - Marine biological resources - Engineering Software Modeling - Subsea robotics Signal processing	Public
23	UTLN - LABORATOIRE CPT	- Mathematical physics, geometry, non linear phenomena, ergodic theory, nanophysics, complex systems, statistical physics, condensed matter physics, fundamental interactions, symmetry and physics, cosmology, particle physics.	Public
24	UTLN - LABORATOIRE IM2NP	- Research in Materials, - Microelectronics and Nanoscience - Functional Materials - Sensors - Signal processing Target Motion Analysis	Public
25	UTLN - LABORATOIRE MAPIEM	- Material chemistry and physico-chemistry - Organic chemistry and biology	Public
26	DCNS - The European leader in naval defence and a major player in marine renewable energies.	- Naval architecture - Energy - Engineering - Maintenance - Innovative and complex systems	Large Group of Companies

A/A	Stakeholder	Area of Interest / Key features	Status
27	THALES SERVICES	- Software Engineering and Services - IT Consulting - Cyber security - Prime project contractor for Defense industry and especially for the French Navy. - Sensors - Marine Environment Oceanograph - Simulation - Innovative and Complex systems - Acoustic - Sensors - Equipment - Maintenance - Subsea robotics - Innovative & complex systems Signal processing	Large Group of Companies
28	SIGNALIS	- Designs, develops, supplies and implements Maritime Surveillance systems, for Port Traffic control (Vessel Traffic Services systems), Coastal Surveillance, and Homeland Security. - Address Maritime Safety, Security, and Environment Protection challenges. - Provides a complete range of strong added value services and follows the customers throughout the life cycle of the equipment until operational support.	Large Group of Companies
29	DEGREANE HORIZON	- Designs and manufactures electronic systems for remote sensing and remote monitoring.	Large Group of Companies

A/A	Stakeholder	Area of Interest / Key features	Status
		- know how of the radar and sonar technology and in meteorological measures.	
30	CIEL SNEF	- Maritime safety and security - Marine mining and energy resources - Marine biological resources	Large Group of Companies
31	CMR Group	- Develops and commercializes a wide range of products from the temperature & pressure sensors to the most sophisticated alarm monitoring and control systems to meet specific requirements of Marine, engine builders, and industrial users in the fields of measurement and automation, as well remote condition based maintenance.	Large Group of Companies
32	DIGINEXT	Provides: - Cutting edge and reliable Operational systems - Sensors - Modeling - Simulation systems for design or testing - E-learning & Training solutions	Large Group of Companies
33	ECA	- sectors of defence, maritime, aerospace, simulation, energy and industrial equipment. - Naval architecture - Engineering Oceanography - Subsea robotics - Simulation - Innovative and complex systems	Large Group of Companies
34	CNIM	-Designs and produces turnkey industrial facilities with high technological content - Provides expertise, services and operations in the areas of Environment, Energy, Defense and Industry.	Large Group of Companies

A/A	Stakeholder	Area of Interest / Key features	Status
35	GAZOCEAN	- Naval architecture - Consultancy - Shipbuilding and ship repair Training Maintenance - Simulation - Propulsion systems	Large Group of Companies
36	ALSEAMAR	- Acoustic, Shipbuilding and ship repair Marine Environment - Material - NICT - Subsea robotics - Innovative and Complex systems	Large Group of Companies
37	Total Développement Régional	Specializing in: - Private equity fund management, - ACE Management, - Investment funds (450 M€) in aerospace, - Marine and maritime industries and, - Defense/security sectors - Maritime industry.	
38	NEXEYA Systems	- Iintervenes in the Naval Defense by creating making and maintaining complex electronic systems. - Shipbuilding and ship repair - Equipment - Engineering - Software - Maintenance - Simulation - Innovative and Complex systems	Large Group of Companies

A/A	Stakeholder	Area of Interest / Key features	Status
39	BNP Paribas	- Maritime safety and security - Naval and yachting - Marine mining and energy resources - Marine biological resources - Marine environment and coastal planning - Harbors, Infrastructures and shipping	Large Group of Companies
40	ACTIMAR	- Maritime and coastal activities - Sensors - Energy - Marine Environment - Modeling Oceanography Simulation - Signal processing	Large Group of Companies
41	ASCOMA Maritime	- Naval architecture - Energy Engineering - Subsea robotics - Subsea Works	Large Group of Companies
42	Assystem Pacifique	- Architecture Consultancy - Engineering - Software - NICT - Innovative and complex systems	Large Group of Companies
43	DCI NAVFCO	- Consultancy Trials - Training - Maintenance - Simulation - Subsea Works	Large Group of Companies

A/A	Stakeholder	Area of Interest / Key features	Status
44	SCALIAN	- Consultancy - Training - Engineering - Software - NICT - Simulation - Innovative and Complex systems Signal processing	Large Group of Companies
45	Louis Dreyfus Travocean	- Energy - Marine Environment - Engineering - Subsea robotics - Subsea Works	Large Group of Companies

3.3. GREECE

Table 7 presents the key involved stakeholders in the area of interest of Greece.

Table 7. Involved Stakeholders in Greece

A/A	Stakeholder	Status
1	Ministry of National Defence	National Public Authorities
2	Ministry of Public Order and Citizen Protection	National Public Authorities
3	Hellenic Coast Guard	National Public Authorities
4	Ministry of Shipping and Island Policy	National Public Authorities
5	Hellenic Armed Forces, Hellenic Navy	National Public Authorities
6	Hellenic Chamber of Shipping	National Public Authorities
7	Ministry of Environment, Energy and Climate Change	National Public Authorities
8	Ministry of Foreign Affairs	National Public Authorities
9	Greek Customs – Ministry of Finance	National Public Authorities
10	Institute of Communication and Computer Systems	Public Research and Technology Transfer Institutions
11	National Center for Scientific Research "Demokritos" - Institute of Informatics and Telecommunications	Public Research and Technology Transfer Institutions
12	Centre for Security Studies (KEMEA)	Public Research and Technology Transfer Institutions
13	Hellenic Centre for Marine Research (HCMR)	Public Research and Technology Transfer Institutions
14	Ce.R.T.H. CERTH - Centre for Research and Technology Hellas	Public Research and Technology Transfer Institutions
15	NOA - National Observatory of Athens	Public Research and

A/A	Stakeholder	Status
		Technology Transfer Institutions
16	FORTH - Foundation for Research & Technology - Hellas (Greece) - Institute of Applied and Computational Mathematics	Public Research and Technology Transfer Institutions
17	National Technical University of Athens; School of Naval Architecture and Marine Engineering	Public Research and Technology Transfer Institutions
18	University of the Aegean – Department of Shipping, Trade and Transport - Research Unit	Public Research and Technology Transfer Institutions
19	Hellenic Association of Space Industry (H	Business Support Organisations
20	Hellenic Space Technologies and Applications Cluster (si-Cluster)	Business Support Organisations
21	EKBY - The Goulandris Natural History Museum	Private Actor
22	Hellenic Eco Marine Synergy, CoopLtd - ECOMASYN	Private Actor
23	Port of Piraeus SA (PPA)	Private Actor
24	Telesto	Business
25	SATWAYS	Business
26	POSEIDON Group	Business
27	MARAC Electronics (ME)	Business
28	Hellenic Aerospace Industry S.A.	Business
29	Attisat	Business
30	SPACE HELLAS	Business
31	Advanced Microwave Systems (ams)	Business
32	AeroPhoto Co Ltd	Business
33	Aratos Technologies	Business
34	ELFON LTD	Business
35	Geoapikonisis S.A. Projects & Geo-Informatics	Business
36	Geotopos	Business
37	Hellenic Technology of Robotics (HTR)	Business
38	iKnowHow (IKH)	Business
39	Innora Robotics and Automation	Business
40	Integrated Systems Development (ISD)	Business
41	Interoperability Systems International (ISI)	Business
42	Intracom Defense Electronics (IDE)	Business
43	Noesis Technologies	Business
44	Novocaptis Cognitive Systems & Robotics	Business

A/A	Stakeholder	Status
45	Planetek Hellas	Business
46	Prisma Electronics	Business
47	ICOM SECURITY	Business
48	Teletel – Telecommunications and Information Technology	Business
49	Terra Spatium SA	Business
50	EPE (Environmental Protection Engineering S.A.)	Business
51	INTERNATIONAL ARMOUR GR	Business
52	Aspida	Business
53	ZEFYROS	Business
54	GMSO GROUP – Greek Maritime Security Operations	Business
55	PATRIOT Risk Management	Business
56	Forte Maritime Security (FMS)	Business

The following figures (figure 17- 20) present the distribution of the actors by main sector

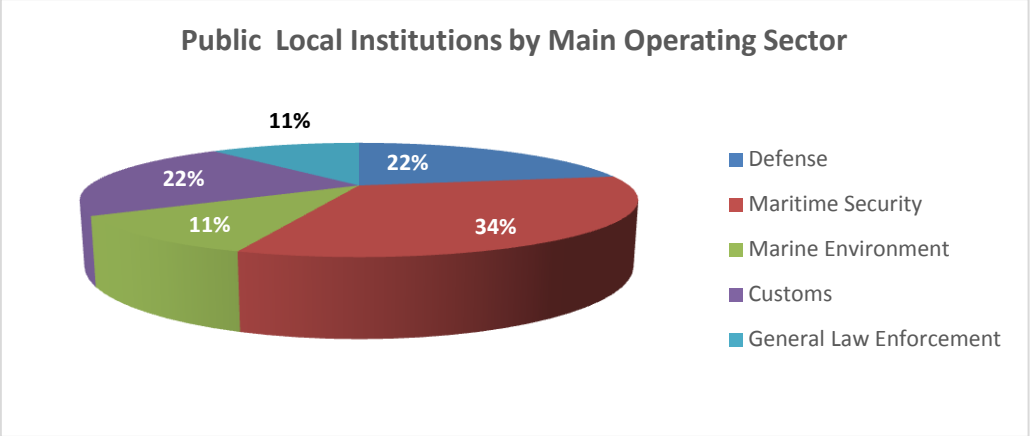


Figure 17. Public Local Institutions by Main MS Sector (Greece)

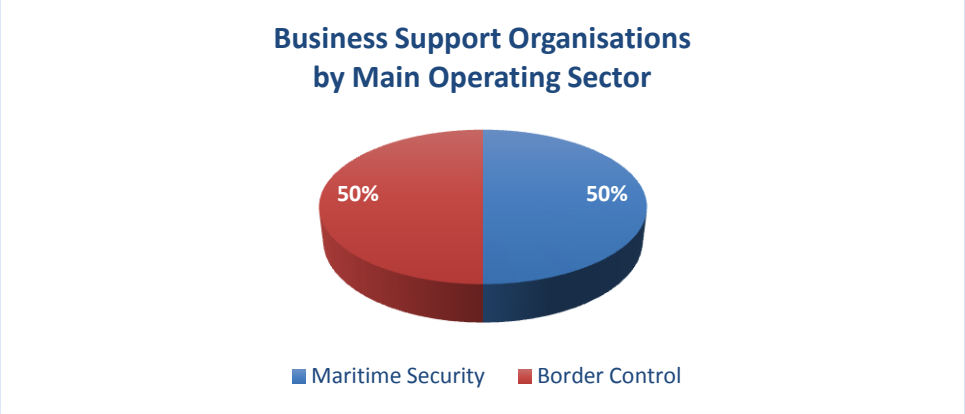


Figure 18. Business Support Organisations per Main MS Sectors (Greece)

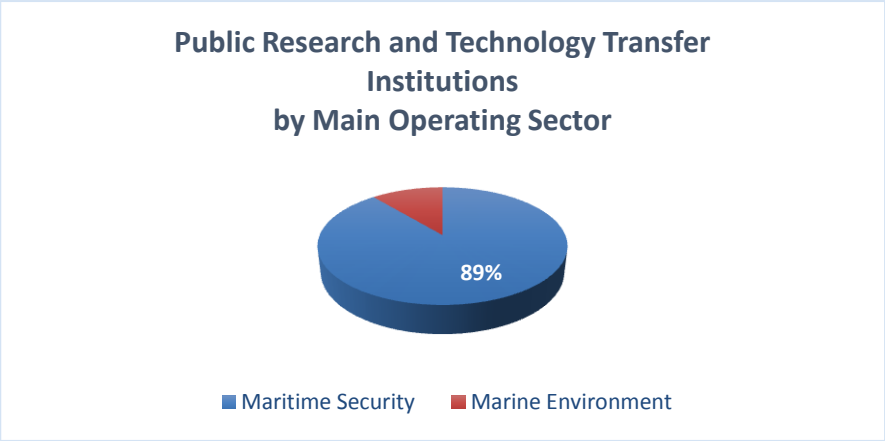


Figure 19. Public Research & Technology Transfer Institutions by Main MS Sector (Greece)

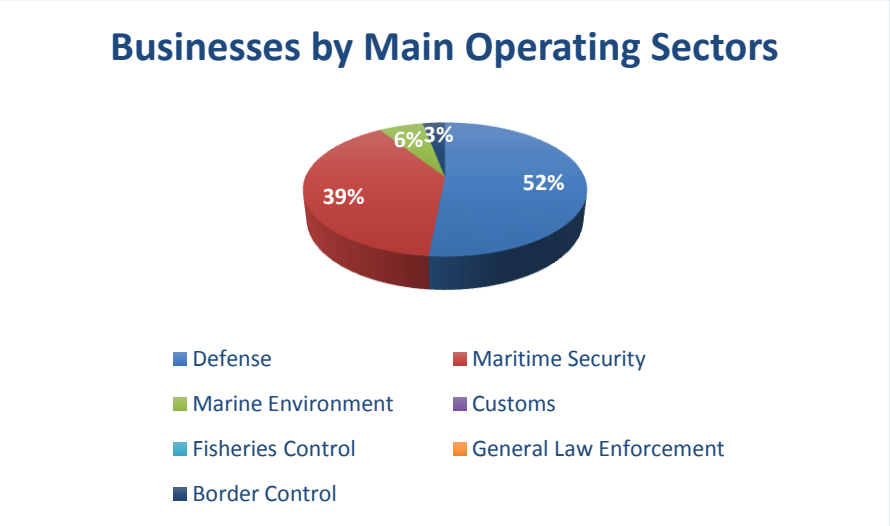


Figure 20. Business by Main Operating Sectors

3.4. ITALY

Table 8 presents the key involved stakeholders in the area of interest of Italy.

Table 8. Involved Main Stakeholders (public & private) in Italy

No.	Name	Area of Interest / Key features	Status
1	ASSOPORTI	Carry out shipyard activities	

No.	Name	Area of Interest / Key features	Status
		Port operations and services	
2	CONFITARMA - Italian Shipowners'Association	Marine transport	private
3	FEDERAGENTI	Sales representatives	
4	FEDERALINEA - Association of Cabotage Companies	Cabotage	
5	ASSITERINAL - The Italian Terminalists Port Association	Port operations and services	
6	ITALIAN SHIPS AGENT'S ASSOCIATION	Port operations and services	
7	SHIPPER	Port operations and services	
8	Legacoop pesca (fish employer associations)	Fishing	
9	Federcoop pesca (fish employer associations)	Fishing	
10	AGCI Pesca (fish employer associations)	Fishing	
11	Specially Protected Areas of Mediterranean Importance (ASPIM, n. 10)	Environment	
12	Established Marine Areas (27 plus 2 overgrown parks)	Environment	
13	A.S.Po.	Maritime environment & pollution	public
14	North Adriatic Sea Port Authority	Maritime environment & pollution	public
15	Harbourmaster and Coast Guard's Office	Maritime safety & security	public
16	Fisheries Monitoring Centre (Centro di controllo Pesca)	Fisheries control, Maritime safety, Maritime environment & pollution	public
17	Venice Customs Office – Security (Distretto di Venezia)	Customs	public

No.	Name	Area of Interest / Key features	Status
18	Marine Biological Chioggia	Maritime environment & pollution	public
19	Umberto d'Ancona Hydrobiological Station	Maritime environment & pollution	public
20	Maritime Traffic – Vessel Traffic Service (VTS)	Maritime safety & security	public
21	Port State Control –PSC	Border control	public
22	Trieste Customs Service – Distretto di Trieste	Customs	public
23	Genova Customs Service – Distretto di Genova	Customs	public
24	Ancona Customs Service – Distretto di Ancona	Customs	public
25	Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS	Maritime environment & pollution	public
26	Centro Controllo Nazionale Pesca (CCNP) Capitaneria di porto con Ministero delle politiche agricole alimentari e forestali,	Fisheries control	public
27	STATO MAGGIORE MARINA, III° Reparto Piani Operazioni e Strategia Marittima	Maritime defence & safety	public
28	ANTONINI GROUP S.P.A.	Maritime safety & security	private
29	GILARDONI S.P.A.	Maritime safety & security	private
30	FINCANTIERI S.P.A.	Maritime safety & security	private
31	ENGINEERING - INGEGNERIA INFORMATICA S.P.A.	Maritime safety & security	private
32	ENEA DTE-SEN-APIC	Maritime environment &pollution	private
33	COIBESA THERMOSOUND S.P.A.	Maritime safety & security	private
34	EUROCONTROL S.P.A.	Maritime safety & security	private
35	GRUPPO SIGLA S.R.L.	Maritime safety & security, Maritime environment &	private

No.	Name	Area of Interest / Key features	Status
		pollution	
36	IB S.R.L.	Maritime safety & security	private
37	ISSELNORD S.R.L.	Maritime safety & security, Defence	private
38	JOBSON ITALIA S.R.L.	Maritime safety & security	private
39	LEONARDO COMPANY S.P.A.	Border Control, Maritime safety & security	private
40	SOFTECO SISMAT SOCIETA' A RESPONSABILITA' LIMITATA CON UNICO SOCIO	Maritime safety & security, Maritime environment & pollution	private
41	RINA SERVICES S.p.A.	Maritime environment & pollution	private

3.5. SPAIN

Table 9 presents the key involved stakeholders in the area of interest of Italy.

Table 9. Involved Stakeholders in Spain

A/A	Stakeholder	Area of Interest / Key features	Status
1	Ministry of Defence / Ministerio de Defensa	The Defense Department determines and oversees: ▪ The policies of defense. ▪ Military alliances. ▪ The conduction of war. ▪ The expenses and budget of the military.	Public / Ministry
2	Civil Guard (Spain) / Guardia Civil	▪ General Law Enforcement ▪ Civil's Naval Service ▪ Tasked with seashore surveillance and fisheries inspections.	Public
3	Ministry of Agriculture, Food and Environment	▪ Fisheries Control ▪ Making the state legislation in	Public / Ministry

A/A	Stakeholder	Area of Interest / Key features	Status
	(Spain) / Ministerio de Agricultura y Pesca, Alimentación y Medio Ambiente	water, shores, environment, hills, meteorology and climatology affairs. ▪ Suggesting and carrying out the general guidelines of the Government about the agricultural, fishing and food policy. ▪ Managing the hydraulic, maritime and terrestrial public property.	
4	Ministry of the Interior (Spain) / Ministerio del Interior	▪ Defense	Public / Ministry
5	Ministry of Public Works and Transport (Spain) / Ministerio de Fomento	▪ Responsible for preparation and implementation of government policy on land transport infrastructure, air and maritime jurisdiction of state and control.	Public / Ministry
6	ISDEFE	The main areas in which it carries out its activity are: ▪ Defense and Security ▪ Space ▪ Transport ▪ Government Agencies ▪ Information and Communications Technologies (ICT) ▪ Energy It also operates and maintains NASA, ESA and INTA space facilities in Spain.	State-owned company, property of the Ministry of Defense
7	Salvamento Maritimo (Spanish Maritime Safety Agency)	▪ Maritime Security ▪ Preserve & defend maritime environment, control maritime traffic	Public
8	Cuerpo Nacional de Policía (National Police Corps)	▪ General Law Enforcement ▪ Citizen Security, judicial Police, Scientific Police, Aliens / borders and information	Public
9	Servicio de Vigilancia Aduanera (Customs Surveillance Service)	▪ General Law Enforcement ▪ Investigation, discovery and prosecution of contraband violations	Public

A/A	Stakeholder	Area of Interest / Key features	Status
		throughout the nation, territorial waters and airspace. ▪ The force also has powers conferred by the Spanish internal revenue agency (Agencia Tributaria) regarding economic crimes, including the fight against corruption, fraud investigation in foreign trade and money laundering, among other roles.	
10	Navantia	▪ Design and execution of competitive naval programs, serving to National Security. ▪ Design and construction of hi-tech military vessels and civil vessels. ▪ Design and manufacturing of control and combat systems. ▪ Technology transfer. ▪ Overhauls and alterations of military and civil vessels. ▪ Support to the Service Life of its vessels and systems. ▪ Diesel engine manufacturing. ▪ Turbine manufacturing.	state-owned company which belongs to the Sociedad Estatal de Participaciones Industriales (SEPI)
11	Oceanic Platform of the Canary Islands (PLOCAN)	▪ Provides support for research, technological development and innovation in the marine and maritime sectors, available to public and private users.	Multipurpose technical-scientific service infrastructure co-funded by State
12	Instituto Español de Oceanografía (IEO)	▪ Devoted exclusively to marine related studies including fisheries, aquaculture and marine environment studies. It is the advisory body to the government in marine affairs, on its oceanographic and fisheries policies.	Public Research Institute
13	INTA – National Institute For Aerospace Technology	▪ Aerospace research and technology development.	Public Research Organization

A/A	Stakeholder	Area of Interest / Key features	Status
14	INDRA SISTEMAS S.A	Provides: ▪ Customers comprehensive management solutions, from consultancy, to project development, integration and implementation, to IT outsourcing and BPO. ▪ SIVE – Spanish Border Control System. ▪ MRI - an advanced aerial radar system for search operations.	Private Company / Large
15	ITP - Industria Turbo Propulso	Provides: ▪ Aeronautical and industrial engines over the entire product life cycle through its technology ▪ Fighter ▪ Transport ▪ Helicopter	Private / Large
16	Applus+ Laboratories (LGAI Technological Center S.A.)	Supplier of: ▪ Testing, quality control, and certification services for the leading manufacturers and integrators in the aerospace, ▪ Defense, and transport industries.	Private
17	AERLYPER S.A.	▪ Safety equipments (radars, cameras and communication) in civilian and military planes (80% military production in 2009).	Private
18	AICOX Soluciones	▪ Production systems, electronics and industrial computer for EADS, Indra, INTA, Eurocopter Spain, etc. (15% military production). ▪ Integrated systems and rugged solutions for Defense and Security Forces ▪ Land Terminals ▪ Network Terminals/VSAT ▪ RF ▪ Tactical Communications Systems	Private

A/A	Stakeholder	Area of Interest / Key features	Status
19	Altran ES	▪ Creative and successful partnerships to address current concerns in Aeronautics, Space and Defense	Private
20	DAS Photonics	▪ Develop innovative products for the fields of defense, avionics and space mainly for application areas such as electronic intelligence (ELINT / COMINT), antennas alignment, advanced instrumentation or optical cabling.	Private
21	CT INGENIEROS	▪ Improvements in security as an essential element of maritime transport is a key area of its focus on innovative potential ▪ Development of vessels with no environmental impact ▪ Innovation in safety technology based on the prediction of accident scenarios	Private
22	Praesentis	▪ Develop a line of high-tech products for the nautical sector in both their professional and recreational slopes worldwide.	Private
23	Meteosim	▪ Committed to environmental, technological and economic progress for the society.	Private
24	Aeromarine	▪ Integrated Systems of Navigation ▪ Data and Voice Communication Systems, both Internal and External ▪ Maritime Traffic Management Systems, Sensor Integration - Defense Systems	Private
25	SGS Española de Control S.A	▪ Border Control ▪ Marine Environment, ▪ Customs, ▪ Maritime Safety	Private
26	SENER INGENIERIA Y	▪ Supplier of electromechanical	Private

A/A	Stakeholder	Area of Interest / Key features	Status
	SISTEMAS S.A.	systems, systems for submarines and helicopter modernization services.	
27	Wake Engineering	▪ Design, manufacturing, and marketing of Unmanned Air Vehicles (UAVs) for Defense industries. ▪ Control of traffic operations ▪ Border control ▪ Monitoring of marine operations: fishing banks, marine pollution, drug trafficking ... ▪ Critical Infrastructure Surveillance	Private
28	GMV Aerospace and Defence, S.A	Provides integrated systems, specialized products and services covering the whole life cycle: ▪ C4ISTAR command and control systems ▪ Data and signal processing, intelligence systems ▪ Cyber-defense ▪ Simulation ▪ Military space applications, GPS, EGNOS and Galileo applications ▪ Integrated access- and presence-control and surveillance and security systems ▪ Border surveillance systems ▪ Emergency and crisis management centers, 112 centers ▪ Tracking and management systems for security forces' vehicles and personnel	Private
29	TTI Norte	▪ Develops communication systems for security and defense applications, designing system level solutions based on commercial equipment or new developments for specific applications.	Private
30	Airbus Defence and	▪ Cutting-edge and peerlessly reliable	Private

A/A	Stakeholder	Area of Interest / Key features	Status
	Space	products in the fields of defense and space. ▪ Provides cutting-edge defence and space technology enabling governments and institutions to protect natural resources, societies, and individual freedom. ▪ Provides aircraft, satellites and services help to monitor climate, crops, and to secure borders. ▪ Provide solutions guarantee sovereignty in foreign affairs and defence matters.	
31	Segur Maritime	▪ Delivers maritime security services continuously from 2009 in the HRA with 100% efficiency	Private
32	SQUADRON International Security Solutions	▪ Provides International Security Solutions offering a wide range of Maritime Protection Services deploying Vessel Protection Teams (armed and unarmed) for commercial ships and super yachts.	Private

The following figures (figure 21 and 22) present the distribution of the actors by main sector.

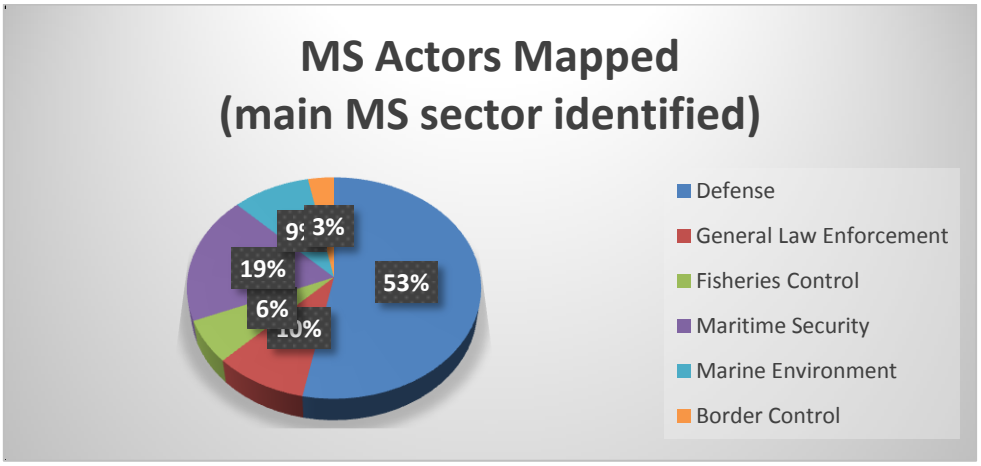


Figure 21. MS Actors Mapped by MS sector (Spain)

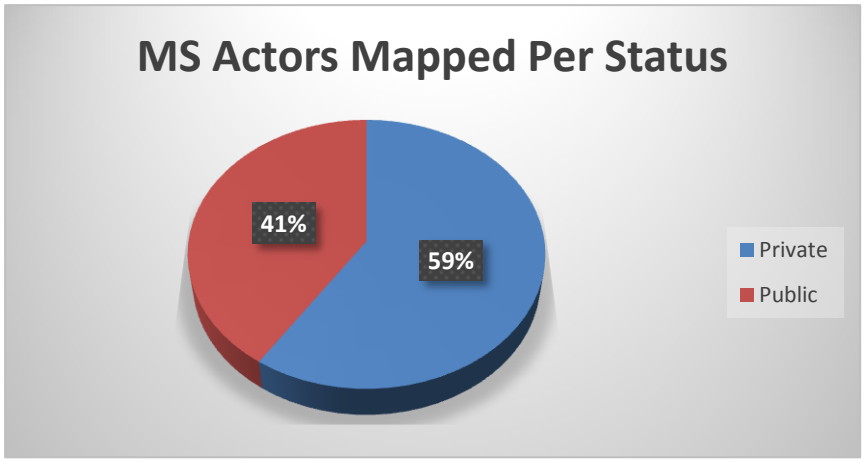


Figure 22. MS Actors Mapped per status (Spain)

3.6. PORTUGAL

Table 10 presents the key involved stakeholders in the area of interest of Italy.

Table 10. Involved Stakeholders in Portugal

A/A	Stakeholder	Area of Interest / Key features	Status
1	DGPM	- Sea Policy Directorate General	Public
2	GAMA	- Accident Investigation Bureau Maritime and Authority Meteorology Aeronautics	Public
3	DGRM	- Directorate General for Natural Resources, Security and Maritime Services	Public
4	IH-Instituto Hidrográfico	- Hydrographic research	Public
5	IPMA	- The Portuguese Institute for Sea and Atmosphere	Public
6	University of Algarve		Research and Technology Transfer Institutions
7	CIMA, The Centre for Marine and	- Marine and Environmental Research	Research and Technology

	Environmental Research		Transfer Institutions
8	LARSyS, Laboratory of Robotics and Engineering Systems / ISR-Institute for Systems and Robotics	- Robotics and Engineering Systems / ISR-Institute for Systems and Robotics	Research and Technology Transfer Institutions
9	CCMAR – Centre for Marine Sciences	- Marine Sciences / research	Research and Technology Transfer Institutions
10	CINTAL – Centro de Investigação Tecnológica do Algarve / SiPLABoratory		Research and Technology Transfer Institutions
11	INESCTEC Technology & science associate laboratory / CROB Robotics and intelligent systems	- Robotics and intelligent systems	Research and Technology Transfer Institutions
12	Abyssal S.A.		Private
13	MarSensing – Marine Sensing & Acoustic Technologies, Lda.	- Marine Sensing & Acoustic Technologies, Lda.	Private
14	OceanScan – Marine Systems & Technology, Lda.	- Marine Systems & Technology, Lda.	Private
15	TEKEVER Autonomous Systems	- Autonomous Systems	Private
16	EDISOFT Defense and Aerospace Technologies	- Defense and Aerospace Technologies	Private
17	CRITICAL software	- Software	Private
18	TEC4SEA		Private

3.7. CHAPTER'S KEY POINTS

Table 11 presents the identified the number of key stakeholder's for each area of reference. A classification public/private is given while the number of the key stakeholders involved in each MS sector is also presented.

Abbreviations of MS Sectors:

- Border Control (BC)
- Maritime Safety and security (MSS)
- Fisheries Control (FC)
- Customs (C)
- Maritime Environment & pollution (ME)
- Defense (D)
- General Law Enforcement (GLE)

Table 11. Identified key stakeholders related to MS sectors per area of reference

Country	Number of Identified Stakeholders[5]	Public	Private	Number of Involved Stakeholders per MS Sector[6]						
				BC	MSS	FC	C	ME	D	GLE
France	41	25	19	3	9	4	2	15	9	1
Greece	56	18	38	5	31	3	2	10	23	3
Italy	41			5	17	2	4	10	2	1
Spain	32	13	19	7	13	4	3	9	20	4
Portugal	18	11	7	1	3	4	1	12	2	1
Cyprus *(pending)*										

[5] Only the key actors/key stakeholders related to MS are presented, based on the reports of Del 3.2.1 per area of reference.

[6] Some Actors/Stakeholders are involved in more than one MS sector.

4. IDENTIFICATION OF CHALLENGES, THREATS AND WEAKNESSES PER COUNTRY OF REFERENCE

Table 12. Challenges, threats and weaknesses related to MS per country that will host the national nodes.

	France	Greece	Italy	Spain	Portugal
challenges	• Big Data: Cybersecurity, Data protection, Data Integration and Data Quality, Self-learning algorithm, change of business models and emergence of services, predictive maintenance. • Sensors: Robust and Wireless, low energy, Remote Sensing, Connectivity, Data transfer, Data quality and Cybersecurity, efficiency. • Communications: Spectrum congestion, bandwidth challenge, numerous communication networks, reliability, security and cost. • Drones: Regulation and legislation, Social Acceptance, New operator skills, Integration, Testing and evaluation. • HCI: Enhancing user experience, improving situation awareness, crew performance, increasing efficiency of operation, and decision making and deployment.		• Foster synergy between public and private actors involved in same sectors • Strong public sector influence in the market of new technologies • Strong competitors at european and world level • High-intensity research and innovation applied to the Sea and MS • Increasing of the maritime commerce, including cabotage and containerization • Prevention of risks of accidents and environmental catastrophes • Interoperability of Data Systems applied by each sector • Use of predictive analytics and behavioral models and increased availability of data advances in Big Data analytics		• Fishing and over-exploitation of marine resources - In this regard, it is essential to balance the control of economic variables associated with fishing activity by monitoring the impacts of fishing on natural resources. • Aquaculture / farmfishing - here the strategic priority is to strengthen innovation and diversify aquaculture production. The experimental initiatives carried out in offshore areas have provided a model of high aquaculture potential and a better integration with the surrounding environment. • Tourism and leisure boats during the High Season cause water pollution.

Threats	• The cost of vessels incorporating new technologies increase. The need of high level of specialist to operate and maintain this technology increase. However the value of the vessels on the second-hand market will be higher also. • Investment are needed to provide new sensors, ships, satellites and infrastructures. The French state must have an incentive policy to enable this investment to be done by the SME's and also large enterprises.	• Illegal Immigration and illicit trafficking growing trends. • Global rise in maritime security threats. • Without a secure environment on the seas maritime activities are being compromised. • Increased competition by players from Germany, United Kingdom, Italy, Israel, China, and Taiwan. .	• Overall economic situation. • Dependence on a few strong global players. • Lack of well-defined structures and mandates for maritime clusters facilitation may inhibit development and obstruct much needed engagement from private actors. • Illegal Immigration and illicit trafficking growing trends. • Global rise in maritime security threats. • Without a secure environment on the seas maritime activities are being compromised. • Increased competition by players from Germany, United Kingdom, Israel, China, and Taiwan. • Increased cost for disruptive innovative technologies in the near future. • High level of inter-port competition in the Mediterranean area. • Mono sector companies too dependent from the state orders.	• Geographical location considered vulnerable to illegal entries – increased need for border control. • Inadequate infrastructure and traffic management (maritime security). • High ICT costs for developing MS Surveillance systems. • Exchange information between states is limited due to the sensitivity and importance of the data collected.	• Outdated fishing fleet. • Illegal fishing - Maritime surveillance technologies (eg acoustics) could help to counter this. There are a number of such projects (eg SUB-ECO) and a collaboration with CCMAR for the monitoring of the fishing fleet by AIS. • Preponderance of micro-mollusc companies. • Poor dissemination and absorption of codified knowledge resulting from applied research by companies.

Weaknesses	• National preference in Maritime security and Safety system: redoing existing technological blocks instead of simply buying them to the community is a real weakness of all these activities. • Training and formation of future engineers, are not well organized.	• Market of security and surveillance products is fragmented because of sectoral, institutional and legal differences within and between EU Member States. • Sharing of information between sectors and institutions is limited. • Legal framework that is not compatible or complementary to the other sectors. • Europe's internal maritime borders are much less defined and easy to cross. • Industry lacks clarity about demand which restricts investment. • Limited standards and certification to facilitate the global market. • Limited national budget. • Public procurement and bureaucracy due to the public nature of the sector.	• No national maritime cluster strategy. • Limited political interest in the cluster. • Limited private and public networking. • Undeveloped port network. • Strongly related to public duties and other sub-functions, thus creating a basic demand or political drive. • Market of security and surveillance products is fragmented because of sectoral, institutional and legal differences within and between national and international Public Authorities. • Sharing of information between sectors and institutions is limited. • Legal framework that is not compatible or complementary to the other sectors. • Italian maritime borders are much less defined and easy to cross. • Limited standards and certification to facilitate the global market. • Limited public awareness of the importance of maritime sectors. • Public procurement and bureaucracy due to the public nature of the sector.	• Data Systems applied by each sector/system are not harmonized (all). • Information is not shared and thus is being duplicated (all). • High flow of immigrants due to the economic recession and the political advances (border control). • Interconnectivity at port level and harmonisation of procedures between different port authorities is still not achieved (maritime security). • Piracy (maritime security).	• Pollution and depletion of marine resources. • Restrictions on fishing reduce the attractiveness of the sector. • Sensitive coastline (eg. erosion). • A low proportion of the value created is appropriated by fishermen. • Aging of the population in the fisheries sector makes it difficult to renew the activity. • Competition from countries with more favourable climatic conditions for aquaculture (Greece). • Aquaculture is still considered as "dangerous for the environment". • Difficulty in attracting and securing foreign.

5. GAP ANALYSIS: CLUSTERS, BEST PRACTICES & INITIATIVES RELATED TO MS

The chapter analyses the ongoing clusters best practices and initiatives related to MS that take place in the areas of reference, in order to identify the existing gaps.

5.1. EU LEVEL

The Common Information Sharing Environment (CISE)

European Commission in order to improve maritime safety and security develops, through JRC, systems to improve maritime surveillance capabilities and to collect information about maritime accidents. One of these systems is CISE (Common Information System Environment). Integrated maritime surveillance is about providing authorities interested or active in maritime surveillance with ways to exchange information and data. Sharing data will make surveillance cheaper and more effective. Currently, EU and national authorities responsible for different aspects of surveillance, e.g. border control, safety and security, fisheries control, customs, environment or defence, collect data separately and often do not share them. As a result, the same data may be collected more than once. The CISE will integrate existing surveillance systems and networks and give all those authorities concerned access to the information they need for their missions at sea. The CISE will make different systems interoperable so that data and other information can be exchanged easily through the use of modern technologies.

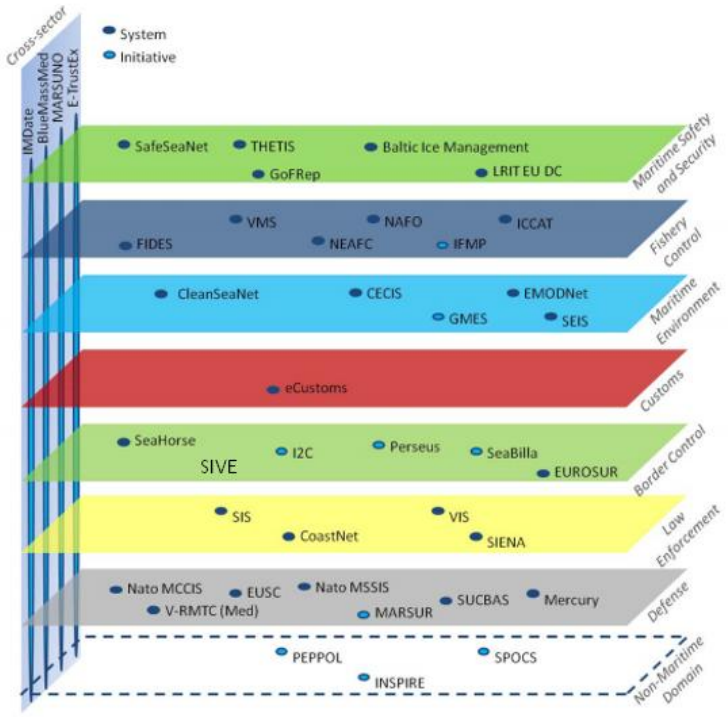


Figure 23. Common Information Sharing Environment (CISE)
Source: Deloitte 2012

Regional Fisheries Management Organisations (RFMOs)

RFMOs are international bodies formed by countries with fishing interests in a same area or a same species or group of species. Within these bodies, countries collectively set catch and/or

fishing effort limits, technical measures and control obligations to encourage fair and sustainable management of the shared marine resources.

Today, the majority of the world's waters are covered by RFMOs that deal with a specific region or species. There are RFMOs that only manage highly migratory fish stocks, like tuna, and RFMOs that manage other fish stocks. In the case of tuna, stocks have improved significantly over the past few years and this is mainly thanks to the dedication and hard work of RFMOs.

Out of the 16 main tuna stocks for the EU, 13 were fished sustainably in 2014. Six years before, in 2008, the figure was 6. RFMOs are open to both the coastal states of the region and the countries which fish or have other fisheries-related interests in the region. Represented by the European Commission, the European Union plays an active role in six tuna RFMOs (including the Agreement on the International Dolphin Conservation Program, sister organization to the IATTC) and in 9 non-tuna RFMOs.

The EU is also a member of two Regional Fisheries Management Organisations that have a purely advisory role: the Western Central Atlantic Fishery Commission and the Fishery Committee for the Eastern Central Atlantic.

Sustainable Fisheries Partnership Agreements (SFPAs) and Northern Agreements

The SFPAs that the EU signs with third countries allow EU vessels to fish in the third countries exclusive economic zone (EEZ). Tuna agreements allow EU vessels to target and catch highly migratory fish stocks; mixed agreements give them access to a wide range of fish stocks, especially ground fish species (mainly shrimps and cephalopods) and/or pelagic species. To ensure sustainable fishing, EU vessels have access only to surplus resources that the partner country is not willing or capable of fishing. In exchange, the EU pays a financial contribution: an access fee for the right of access into the partner country's EEZ, and a sectorial support.

The sectorial support is tailored to the needs of the partner country, with the main view of reinforcing fisheries governance, strengthening administrative and scientific capacities, fostering monitoring and control activities and supporting small-scale fisheries. In addition, EU vessel operators pay a license fee for access. The burden of payment is shared between the EU and the industry, with the latter sustaining a higher share.

Today, SFPAs set the standard for international fishing policy. They are all centred on resource conservation and environmental sustainability, with EU vessels subject to strict supervision and transparency rules. All protocols contain a clause concerning the respect for human rights in the hosting country. The agreements are negotiated and concluded between the European Commission on behalf of the European Union and the partner country; transparency and accountability are the driving principles of the negotiation

process. The texts of the agreements are public and open to the scrutiny of other public institutions and civil society.

Fleet Capacity Management (FCM)

FCM is an essential tool for the sustainable exploitation of fisheries resources, which is one of the main objectives of the Common Fisheries Policy. The EU fishing fleet is very diverse, with vessels ranging from under 6m to over 75m. Under EU law the total capacity of the fishing fleet may not be increased and any decommissioning of vessels or reduction of fleet capacity obtained through public support must be permanent. For the last 20 years, the EU fishing fleet capacity has declined in terms of both tonnage and engine power. Despite enlargements to the EU, the number of EU vessels in 2015 was 85.154 – 18.693 fewer than in 1996. Healthier stocks contribute to a more sustainable industry. Overall, the EU fleet was profitable in 2013, consolidating the gradual recovery of recent years, when both gross profit and net profit margin of the fleet have shown an upward trend.

Source: https://webgate.ec.europa.eu/maritimeforum/en

	Number of vessels		Gross tonnage		Engine power in kW	
MS		%		%		%
BE	78	0.1%	14 535	0.9%	46 289	0.7%
BG	1 989	2.3%	6 541	0.4%	58 043	0.9%
DK	2 396	2.8%	69 607	4.3%	224 769	3.5%
DE	1 465	1.7%	64 221	4.0%	141 679	2.2%
EE	1 534	1.8%	13 225	0.8%	43 714	0.7%
IE	2 156	2.5%	62 331	3.8%	189 442	2.9%
EL	15 638	18.4%	76 573	4.7%	449 534	6.9%
ES	9 572	11.2%	354 186	21.8%	815 872	12.6%
FR	6 964	8.2%	171 544	10.6%	1 001 603	15.5%
HR	7 540	8.9%	52 341	3.2%	414 618	6.4%
IT	12 414	14.6%	162 749	10.0%	1 003 301	15.5%
CY	893	1.0%	3 502	0.2%	40 209	0.6%
LV	688	0.8%	24 671	1.5%	43 114	0.7%
LT	144	0.2%	41 403	2.6%	46 484	0.7%
MT	1 005	1.2%	7 106	0.4%	73 106	1.1%
NL	832	1.0%	133 995	8.3%	312 548	4.8%
PL	874	1.0%	26 293	1.6%	76 256	1.2%
PT	8 136	9.6%	96 596	5.9%	359 633	5.6%
RO	152	0.2%	870	0.1%	6 146	0.1%
SI	169	0.2%	597	0.0%	8 540	0.1%
FI	2 839	3.3%	15 613	1.0%	160 475	2.5%
SE	1 357	1.6%	30 398	1.9%	167 214	2.6%
UK	6 319	7.4%	194 683	12.0%	787 592	12.2%
EU-28	85 154	100.0%	1 623 581	100.0%	6 470 180	100.0%

Figure 24. The fishing fleet of the Member States (2015)
Source: EU Fishing Fleet Register (Sept. 2015)

5.2. FRANCE

5.2.1. IDENTIFIED CLUSTERS

Pôle Mer Méditerranée (Best Practice)

Website: www.polemermediterranee.com
Year of Establishment: 2005
Members: 410

Created in 2005, Pôle Mer Méditerranée-Toulon Var Technologies (PMM-TVT) is a sea innovation and business cluster located in the south of France. Its ambition is to contribute to the sustainable development of the maritime and coastal economy in the Mediterranean basin, in Europe and across the globe. It stimulates and encourages innovation trough collaboration around 6 Strategic Business Areas:

- Maritime safety and security;
- Ship and nautical industry;
- Marine energy resources;
- Marine biological resources;
- Environment and coastal planning;
- Ports, Infrastructures and shipping.

In 2017, its network involves 400 members including majors companies, SMEs, research institutes and academic actors. PMM-TVT provides a wide range of services to its members related to access to funding, international activities, business growth, collaborative R&D projects.

After Twelve years of activities, the Pôle Mer Méditerranée has operational results:

- A sustained programme with 248 labelled projects shared innovative for a total amount of 656M€ R&D and 185 are granted projects for a total amount of 485M€;
- 12 structural projects (Shared innovative platforms, ITE, IRT, Labex, Equipex...) for an amount of 695M€;
- Several thousand jobs to be created or secured;
- Expansion in Occitanie realized in 2016.

SAFE Cluster

SAFE Cluster is a recent created cluster focusing on global security*. Its network includes customers and suppliers of security solutions.

Born in December 2015, from the merging of Pegase and Risks clusters, SAFE Cluster reunites almost 600 affiliates, including: companies, and training and research organizations related to security, environment protection and aerospace sectors; together with insurance companies, banks, and, most important, customers (civil and cities security services, etc.). They all grant SAFE Cluster:

- The opportunity of developing new business models to boost companies' competitiveness;
- A complete value chain that associates technology suppliers, integrators, and most important, existing and future clients of security solutions.

With a 7% of annual growth rate estimated, the security sector represents a remarkable development opportunity for SAFE Cluster's members, who are largely implanted in PACA Region, a leading French region in this sector, thanks to the strong presence of OEMs and SMEs in civil security and defense.

To support our affiliates' development, SAFE Cluster provides services of "networking", "business" and "growth", with actions going from a project idea to finding technology partners, financers and international development.

Secured Communication Solutions Cluster

World Competitiveness Cluster SCS (Secure Communicating Solutions) has a genuine ambition: to become the leading and recognized player in the field of Secured Communicating Solutions by covering the entire ICTs value chain, from silicon to end uses.

- Microelectronics;
- Telecommunications;
- Software.

It will do this based on focused, differentiating Smart Specialization Areas (SSAs): contactless technology; networks, M2M & mobile services; digital security & identities

For the benefit of high-growth markets: Health, Pharmaceutical, Trade, Mass-market retailing, Transport & Logistics, Banking, Insurance, Financial institutions, Environment, Recycling, Consumer Electronics, Administration, Energy, Smart Grids, Smart Meters, and so on.

OPTITEC Cluster

OPTITEC is a widely recognized photonics cluster and the driver of the photonics sector in the south of France. Bringing together highly innovative SMEs, major photonics-integrating industrial groups and leading academic partners, the Cluster has generated a strong dynamic of joint R&D projects and the development of new services and innovative products.

In the coming years, the Cluster's aim is to provide essential leverage for the creation of value in the photonics sector, via the transformation of R&D into business and industrial opportunities for companies

Taking into consideration the benefits that arise from the installation of the business clusters and the features of the area of reference, the installation of a cluster dedicated to the Blue Economy near the largest French military port "Toulon" allows it to benefit from the entire ecosystem historically present in the region whose activity affects the fields of maritime safety and security:

- Three major international systems integrators, DCNS, THALES and AIRBUS DS / SIGNALIS, are present in the cluster and guarantee the dynamism of innovation and the potential for the marketing of solutions throughout the Mediterranean Sea;
- The presence of their main subcontractors in complex software development (ATOS, SOPRA, THALES SERVICE, EUROGICIEL, AKKA TECHNOLOGIE, SII, etc.).

It should also be noted that the presence in the ecosystem of the French Navy, and the Ministry of Defence, and all the entities mentioned above, that are used as actors in the framework of the action of the State at Sea on the various Missions of maritime safety and security, promotes the emergence of innovation by brewing ideas between needs and solutions.

A considerable industrial base across PACA and Occitanie including these purchasers and large international defence groups enables cross fertilisation between SMEs and laboratories which promotes the creation of innovative solutions.

5.2.2. IDENTIFIED BEST PRACTICES

Two best practices and several initiatives related to Marine Surveillance have been identified in the examined areas.

The **Technopole de la Mer**, created and developed by TPM, is the first science park in Europe focused on maritime safety and security and the sustainable development of the sea and coastal areas based on high-tech from « System Factory » project. It is divided between the principal site at Ollioules dedicated to the underlying cross sector digital core and a marine base at La Seyne-sur-Mer for experiments.

The « **S.E.A.Lab Innovation Center** », at the heart of the Technopole de la Mer, will represent the physical aspect of the « System Factory » project, with the implementation of an accelerator for innovative industrial projects with 200 - 400 m2 of modular space which will lead to the creation of sustainable employment. The « S.E.A.Lab Innovation Center » is an open innovation platform enabling the promotion of global solutions for monitoring and management of crisis situations (civilian, military, maritime and coastal sanitation) based on cyber-secure technology, big data, connected smart objects and interaction between man

and machine to explore new usage inspired by other sectors not just naval. It will host the shared digital core of the System Factory, dedicated to the industry of the future.

5.2.3. IDENTIFIED INITIATIVES & PROJECTS

This chapter presents projects and initiatives related to MS that have been take place in the area:

1. **AIRMES** - Heterogeneous drones cooperating in fleet

2. **AMARYLLIS** - Asset management system for navigational safety in and around offshore wind farms

The AMARYLLIS project aims to offer a competitive mobile asset management system for craft (vessels, aircraft, personnel) moving within and around an offshore wind farm by providing an effective response to the problems of security and safety which arise during each phase of the life cycle of the field (design, installation, operation, development, decommissioning). Thus, the project proposes the development of a comprehensive control and management system for these new maritime spaces:

- Specific marker buoys
- Specific maritime traffic controls
- Specific supervision
- Specific surveillance
- Specific method for action procedures
- This will also take into account:
- current and potential future constraints relating to international regulations
- technological challenges in coping with the difficulties inherent in the use of existing facilities (accessibility, environmental conditions, MCO, radio frequency and hyper frequency interference (radar), the impact on other maritime traffic).

The project would also include a full-scale, 9 month trial in a wind farm.

3. **ATOS -** Acoustic Antenna using only Optical Technology

The ATOS project aims to develop an underwater acoustic antenna for maritime surveillance using only optical technology.

This development is a technological breakthrough for passive underwater acoustic monitoring systems. This breakthrough is founded on the use of optical sensors based on fibre laser optical cavities which are multiplexable and easily interrogated from great distances via a single fibre optic cable without the need for on-board electrical power. This self-supporting system can also be used in conjunction with more complete maritime protection systems such as those developed within the framework of Pôle Mer Méditerranée.

4. **BIMAC**

The BIMAC project proposes to carry out Industrial Research into the concept of acoustic barriers for the protection of marine and coastal infrastructure.
It focuses on the issue of vulnerability to underwater attacks of marine or coastal infrastructure such as offshore platforms, ports or boats at anchor; issues which are currently addressed either very little or not at all.
The objective is to introduce the concept of an acoustic barrier for the detection and 3D imaging of an underwater intrusion. The innovative nature of the system comes from the combination of two identical multibeam sonars which use a fully active “Mills Cross” array.

5. **BORA**

The BORA project aims to develop a new generation dive computer.
Each year around the world, thousands of divers are victims of diving accidents, the best known and the most serious is called decompression sickness. This occurs when a diver has moved from deep water towards the surface in too short a time: it is a result of nitrogen bubbles from dissolved gas which are accumulated in the tissues of divers during the dive. The symptoms of decompression sickness should be taken seriously: the spectrum ranges from simple joint pain ("bends") to paralysis or even death. The BORA project aims to develop a new generation of "customized" dive computer for the prevention of decompression accidents. The goal is to create a benchmark of excellence in the field of dive computers and take its place among the world leaders in this market.

6. **CAP NG -** New Generation Passive Acoustic Sensor

This project aims to develop a new type of new generation, broadband, passive acoustic sensor (CAP-NG) which can be integrated into current standard equipment (e.g. acoustic buoys for naval aviation), or allowing, thanks to its increased performance, the development of new listening functions (e.g. acoustic barriers, protection of marine mammals).
It is an intelligent sensor which combines the power of physics and electronics and whose performance aims are to achieve a minimum of 20 dB improvement in signal to noise ratio compared with the same range of current sensors, commonly used in passive omnidirectional listening.
This improvement is particularly exceptional and sensors currently on the market and manufactured by foreign companies (U.S., UK), do not reach this level.

7. **CAVIAR** - CAtadioptric Vision for Aerial Robots

The CAVIAR project aims to study the contribution of omnidirectional vision in the context of aerial robotics.
UAVs or captive balloon type systems can be very useful for surveillance of coastlines, maritime traffic and marine protected areas.
But this type of remotely operated vehicle raises the question of then being able to remotely

operate from associated observation platforms.
The CAVIAR project aims to study what omnidirectional vision can contribute in the context of aerial robotics.
The aerial craft, remotely controlled by an operator on the ground is equipped with an omnidirectional camera.
While standard vision is usually used for this type of mission, the project examines omnidirectional vision working in association with the benefits of a catadioptric optical system which avoids the need to use panoramic fields.
Studied algorithms will be tested on platforms provided by the project partners.

8. **DRORAS -** Rapid Surface Drone

The DRORAS project aims to develop a fast, radar equipped surface drone. It will allow monitoring missions without exposing personnel to risk. Its main characteristics are: length: 9 metres, maximum speed: 35 knots, battery life: 12 hours.

9. **GAMBITS** - Game-Based Strategic Intelligence

The GAMBITS project aims to train human participants in the management of complex situations through the use of a "serious game" for realistic adaptive simulations.
The project instigates simulation modules with autonomous behaviour allowing them to evolve into a rich and dynamic storyline, adapting itself to the decisions of human participants and looking for flaws in their strategies. An integrated learning system will improve the responses of the simulation system based on how the player behaves and the impact of its actions on the simulated environment. This aspect also allows the evaluation of the human player on his ability to evolve within a changing environment.
In order to demonstrate the relevance of the underlying technology, the chosen field is maritime defence. Human participants should be able to deal with malicious acts or terrorism (such as piracy at sea, for example) or major accidents (such as oil spills or the sinking of a ferry).

10. **GREENAR** - OPTIMAL ENERGY BALANCING NAVIGATION AND RANGING

The GREENAR project is based on an observation: acoustic sensor networks deployed in underwater or aerial domains are complex, heavy and expensive and have a very narrow potential range of uses.
The GREENAR project objective is to completely rethink sensor network technology working in parallel on two issues: the lack of communication standards and the overall optimization of energy consumption. We therefore propose two innovations that complement each other perfectly to achieve a model of sensor networks which are more economical, autonomous, with a wide range of uses with immediate application potential in the field of underwater surveillance and in the census of mammal species on the Red List of threatened species: marine mammals and bats. We expect a reduction in energy consumption by a factor of 10 compared to current state of the art technology and at the same time we offer an innovative

standard for sonar network communications.

11. **I2C** - Global monitoring system for regional maritime areas and detection of offenders

The I2C integration project recommends, by 2015, the creation of a new generation of integrated monitoring system for maritime boundaries in order to monitor movement of ships and identify suspicious behaviour and associated threats.
The system is made up of:

- A land based platform merging new technologies such as FMCW radar sensors to monitor small vessels (two prototypes are being tested), AIS stations and coastal radars. This permanent platform will continuously monitor maritime traffic up to 200 nautical miles;
- Embedded sensors on mobile platforms. Four equipped platforms are deployed: aircraft, ship patrols, USV and Zeppelin;
- A capacity to detect abnormal behaviour of ships;
- A capacity to identify a threat quickly and give information to the authorities allowing decisions to be made.

12. **MWPS** - Maritime Warning and Protection System

The project aims to develop a system to equip civilian or military ports with warning, intimidation and neutralization systems when faced with suspect vessels entering a restricted area.
The objective of the system is to provide a graded level of reaction proportionate to the threat, without mortal danger and most importantly, one that can be implemented in a few seconds over an area of 1km², thus making it particularly effective.

The project includes innovative developments in the automation of the detection / warning / reaction chain that simplifies operational management of the system. In many cases its implementation is easily possible, contrary to conventional protection which requires a large number of qualified personnel. Finally, the system can initiate a non-fatal reaction without exposing the operator.

This system has four main functions:

- Day and night detection of craft moving in restricted areas;
- Warning by ultra-directional audio message and ultra-directional nocturnal lighting;
- Intimidation by launching non-lethal pyrotechnics.
- Physical blocking of the threat by non-lethal means.

The project has been the object of an actual demonstration under extreme weather conditions on the site of St. Elmo in La Seyne sur Mer which was made available to the consortium by the Navy. The entire chain has been successfully tested: the detection of

moving targets with incremental responses: in the form of focused lighting, audio messages and pyrotechnic effects (e.g. deafening effects).

13. **PARAMILLS -** Underwater communication using Mills Cross parameters

The PARAMILLS project is intended to model, specify, design, build and test on a full-scale an innovative and efficient underwater acoustic communication modem. The aim is to transmit data between two mobile underwater devices, one of which is an AUV.
The project focuses in particular:

- On the creation of a "pointable" and stabilized antenna
- On the creation of a modem incorporating spatial dimension into its operation (management of beams, acoustics, Mills Cross theory)
- On the testing of this modem in a realistic configuration
- On the establishment of its performance (target: doubling the throughput of COTS modem models)

14. **PERSEUS -** Protection of European boRders and SEas through intelligent Use of Surveillance

PERSEUS is a demonstration project as part of the EU FP7 initiative which aims to anticipate the EUROSUR European organisation of monitoring systems for maritime borders coordinated by FRONTEX.
This project proposes the creation of a network of existing systems Spationav (France), Sive (Spain), Sivicc (Portugal) & Sia (Italy) and includes innovative capabilities such as intelligent holding position, detection of suspect vessels and / or small ones, as well as tools for identifying threats. The project will also integrate the use of space technology as a means of detection.
The ultimate goal of the project is to demonstrate the added value of information sharing and capacity utilization in decision support through the creation of multi-national exercises at sea.

15. **PROPAGATION** - Radar Tracking and Passive Optronics for the preservation and protection of coastal infrastructure

The PROPAGATION project proposes the deployment of passive means of detection (passive radar, AIS station and network of high resolution cameras), on sites of specific interest to conduct an experiment in fully discrete merged maritime holding positions for all types of vessels and mobile craft.
This "technical platform" will allow the development and evaluation of new generations of plotting extraction algorithms (ships and mobile) and tracking (trajectories) from a combination of actual multi-sensor data, and make cross-calibrations between these sensors and develop a maritime holding position for a permanent coastal base which is completely unobtrusive (i.e. the detection methods used are completely undetectable by technical means available to criminals to carry out acts of malice: sabotage, bombings, hostage taking,

etc.).

16. **RAPACE** - Assisted recovery by on-board sensors

The project concerns a feasibility study into the concept of an airborne craft linked to land through an umbilical cable, equipped with sensors to assist naval and land based parties in the location of or intervention in environmental accidents such as marine hydrocarbon pollution.

Visibility of scattered slicks on the surface of the water from the bridge of a ship is very limited. On-going location of slicks in the area around the support vessel can greatly increase the effectiveness of recovery operations and treatment, by assessing the amount of pollutant, locating it, and organizing work across the affected area: allocating resources, planning operations, positioning boats and recovery or treatment procedures. These are the aims of concept of this feasibility study.

17. **SARGOS** - Graduated Warning and Response System

The SARGOS project aims to respond to emerging needs for strong security for offshore civil infrastructures which are vulnerable to malicious acts of piracy or terrorism from the sea.

The project aims to develop a global warning system and system of graduated response, covering the whole process of infrastructure protection, from the moment of detection of a potential threat to the implementation of the reaction.

18. **SCANMARIS** - Monitoring and control of ship activity at sea

The SCANMARIS project aims to create a support system for safeguarding maritime borders which uses learning modules and rules of investigation in order to detect suspicious behaviour of ships.

As such the project will study, evaluate and develop methods and a software tool to:

Analyse weaknesses related to traffic density (large number of vessels) and their diversity (merchant ships, tankers, ferries, fishing, boating, etc.) across a regulated maritime zone.

Process, cross reference, merge and make use of varied data from the different sensors and databases available to establish an informed and constant state of maritime traffic.

Monitor and identify the routes (itineraries) for trade (corridor, marine highways, passenger transport, coastal shipping, fishing, etc.). The flow of goods (hydrocarbon, gas, containers, chemicals, freight, passengers, etc.) and illegal activities (abnormal behaviour of suspect vessels). The project should permit the evaluation and testing of innovative methods and technology such as:

- Learning vessels movements (itineraries and behaviour)
- The development of flow modelling for goods and passengers
- The development of anomaly modelling (accidental and suspicious events such as the trafficking of illicit products)

19. **SECMAR** - Security systems for goods, people and facilities present in a sensitive

marine area

The SECMAR project aims to provide a practical response to the detection of a terrorist threat that would make use of either the sea's surface or underwater as the preferred medium for an attack on a sensitive coastal site.

In order to achieve this, the industrial and research laboratories of the PACA region have grouped together to create a prototype of an intrusion detection system across a sensitive marine area in the PACA region.

This project has two phases. Work for Phase 1 led the participants to select one of the tanker terminals at the Grand Port Maritime de Marseille in the Gulf of FOS for the deployment of detection equipment. After classification of specific terrorist threats to this site, experiments were conducted. These experiments and the following analysis helped define a prototype monitoring system adapted to sensitive marine areas combining various and complementary means of detection and taking into account the restrictions inherent in this type of environment. The SECMAR monitoring system defined from this includes, hardware and software open architecture, modular and generic detection means such as Sonar, Radar and Optronics which were developed in Phase 2 by the partners. In addition to these high-tech sensors, the Earth Centre is responsible for applying the data received from these sensors and sensors in service at the port (VTS, AIS) innovative merging processes for the detection of abnormal behaviour. Consistent with the objective of providing an effective response to irregular threats the SECMAR prototype developed in Phase 2 was used by operators of the Grand Port Maritime de Marseille for a long experimental period of 6 months to allow a real environment with 24/7 operations for validation tests and promotion of the system.

20. **SISMARIS** - Information and monitoring system

The SISMARIS project is a system integrating key technical capabilities to monitor maritime traffic up to 200 nautical miles offshore. This project combines the results from the SCANMARIS and TAMARIS projects.

It aims to develop and test a coastal platform installed on the Saint Mandrier peninsula. It merges conventional sensors and also second generation sensors still under development: HF radar, frequency modulated radar, an AIS network and conventional radar.

The purpose of the project is to develop an "integrated system" comprised of networked monitoring of an extended maritime area (EEZ) for the development, in a real environment, of key technology, new sensors, new incremental algorithms, in association with users.

System capabilities are as follows:

- Develop, in real time, a multiple sensor evaluation of the maritime traffic situation (AIS, VMS, conventional radar, high frequency long range radar, continuous frequency modulated radar, processed satellite imagery, camera optronics, etc.).
- Develop, at a later point, a more informed evaluation of the maritime traffic situation and information on the activities of vessels (types, destinations, cargo, history, etc..), navigational conditions (weather / oceanography), geographic data ,

regulations
- Detect abnormal events (in travel and in activity) and generate alerts
- Analyse, interpret and document suspicious behaviour (accidents, criminal activity, illegal fishing, pollution, regulation violations) associated with the alerts.

21. **STRADIVARIUS** – Transhorizon Decametric System

The STRADIVARIUS project aims to support the development of French industry in the niche sector of over-the-horizon radar (High Frequency Surface Wave Radar – HFSWR) which is the only fixed sensor capable of monitoring up to 200 nautical miles offshore.

Based on technological breakthroughs which have been the subject of patents, the consortium aims to develop a high performance product both in terms of detection of small targets such as "trawlers" and in terms of environmental impact.
The resulting product from these developments will aim to integrate into a maritime surveillance system such as those developed under the framework of the Pôle Mer Méditerranée.

5.3. GREECE

5.3.1. IDENTIFIED CLUSTERS

Hellenic Space Technologies and Applications Cluster (si-Cluster)

Si-Cluster is a business Cluster focusing in the area of Marine Environment and Maritime Security. The Cluster aims to a fully exploitation of the services provided today by the modern space technology, emphasizing on the security and safety of the citizens. The provided services include **disaster monitor, border surveillance and control, weather forecast, environmental disaster monitoring, smart citizen's transportation,** electric power transfer, services for the reduction of the digital divide as well as high bandwidth internet services. The Cluster has 50 members, including both large businesses and SMEs.

ECOMASYN

Website: http://www.ecomasyn.gr
Year of Establishment: 2015
Members: 13

The Hellenic Eco Marine Synergy, CoopLtd, with distinctive title “ECOMARINESYNERGY” and trademark “ECOMASYN” was founded as an Urban Limited association aiming to actively contribute in the next 3-5 years to the creation of a world known Green Marine Center in Greece, which will provide the “green” added value to its clients.

The strategy to be followed is the «one stop shop» concept, where the customer will have the opportunity to find all services (research, development, advisory, education, certification, project execution, etc.) provided together in one place, selecting from a variety of service providers and products, which will match the required quality/cost/time criteria.

The aim of the cooperative is to provide integrated solutions including study, supply and installation of equipment, as well as the provision of supportive advisory and educational services in combination with the above in the whole range of the so-called Green Marine, indicatively mentioning Energy Efficiency, Scrubber Systems, Ballast Water Treatment Systems, Use of Liquefied Natural Gas (LNG) as a fuel.

For the realization of its aim, the cooperative looks not only at interconnecting the network of its members (professionals, enterprises and agencies), but also providing counseling or organizational assistance, education and training for their collective development, improvement of their business value and upgrading the quality of their services.

STRATEGIS

Website: https://strategis-cluster.com/
Year of Establishment:
Members: 9

Maritime Center of Excellence is a non-for-profit organization with the vision to become a global Consulting and R&D center in advanced technologies, strategy and entrepreneurship for the Blue Economy & the Digital Shipping of the future. Drawing on the global leadership of Greek Shipping, STRATEGIS aims to facilitate further development of the maritime sector in Greece augmenting its role as a key growth engine of the Greek economy, and, to help establish Greece among the world's leading powers in Blue-Growth and the Blue Economy.

The main activity of Strategis focuses on the creation, development, and management of collaborative innovation networks and commercial clusters in the shipping industry, with emphasis on the application of advanced ICT technologies in digital shipping.

The Cluster's vision is to become a world-class Maritime Cluster & Technology Flagship of the Greek Shipping Industry in the Digital Age and its mission is summarized as follows: "To offer 21st century maritime services and synergies for growth enabling Smart Sea – sustainable business opportunities in the greater SEE region".

To achieve the strategic objective of consolidating shipping as a key factor of regional development, STRATEGIS focuses on:

- Research & Development of frontier Maritime & Smart-Sea ICT Technologies
- Strategy & innovative Business Models for the Blue Economy

- Raising the region's Creative Capital (Intellectual & Human Capital)l
- Development of infrastructures supporting smart, sustainable regional growth (smart sea, smart ship, smart port and smart city technologies)
- International standardization activities, policies and regulations facilitating efficient collaboration of stakeholders in the innovation ecosystem.

5.3.2. IDENTIFIED INITIATIVES & PROJECTS

1. **PERSEUS** - Protection of European seas and borders through the intelligent use of surveillance
2. **SUPPORT** - Security UPgrade for PORTs
3. **TALOS** - Transportable autonomous patrol for land border surveillance system
4. **BLUEMASSMED** – Blue Maritime Surveillance System MED
5. **DOLPHIN** - Development of Pre-operational Services for Highly Innovative Maritime Surveillance Capabilities
6. **NEREIDS** - New Service Capabilities for Integrated and Advanced Maritime Surveillance
7. **MERSEA** - Marine Environment and Security for the European Area
8. **MEMO** - Mediterranean Electronic Marine Highways Observatory
9. **MEDESS-4MS**: Mediterranean decision support system for marine safety
10. **RANGER** - RAdars for loNG distance maritime surveillancE and SaR opeRations
11. **TASS** - Total Airport Security System
12. **Blue Hub** - in-house platform to perform research in the fields of maritime surveillance and Maritime Situational Awareness
13. **ConTraffic** - provides information on container routes as well as risk assessment services to users from customs and security authorities.
14. **MELISSA –** Radar system for innovative maritime surveillance
15. **LIMES** - Land and sea integrated monitoring for European security
16. **INTAROS** - Integrated Arctic Observation System
17. **COFASP** - Cooperation in Fisheries, Aquaculture and Seafood Processing
18. **SFS** - How to benefit from the ocean whilst preserving its environmental integrity
19. **NetBiome** - Sustainable management of biodiversity in Europe´s overseas areas
20. **RISC-KIT** - Improving tools for managing coastal hazards
21. **ESONET** - European Seas Observatory NETwork
22. **EFIMAS** - Operational evaluation tools for fisheries management options
23. **NETMARIMED** - Network for supporting Marine Affairs in the Mediterranean
24. **Marine-EO** - Bridging Innovative Downstream Earth Observation and Copernicus enabled Services for Integrated maritime environment, surveillance and security
25. **CoRINThos** - Maritime Clusters supporting Research & Innovation to enhance Blue Economy Entrepreneurship

26. **MED-PCS** - PROMOTION OF "PORT COMMUNITY SYSTEM" IN MEDITERRANEAN TRAFFIC OUTLINE OF MED-PCS
27. **eFreight** - European e-Freight capabilities for Co-modal transport: RFID and semantic web technologies for secure, integrated freight transport services
28. **e-Shipping** - Development of e-learning platform for knowledge exchange in marine and maritime education
29. **PORTOPIA** - Ports Observatory for Performance Indicator Analysis.

5.4. ITALY

5.4.1. IDENTIFIED CLUSTERS

Federazione del Mare

Website: http://www.federazionedelmare.it/
Year of Establishment: 1994
Members: 17 associations

Established in May 1994, Federazione del Mare acts as the Italian maritime cluster, with the aim to jointly represent the country to the international maritime markets.

The cluster works extensively to allow the appreciation as a factor of development and affirm the commonality of values, culture and interests, which also stems by constant comparison with the international experience. The maritime activities of Federazione del Mare annually produce goods and services for a value of 33 billion euros (2% of GDP), out of which 6.2 billion exported, providing directly employment to 170.000 workers and indirectly to another 310.000 in the manufacturing and tertiary activities induced.

The cluster is a European leader in several of its activities:

- First place as cruise embarkation and landing country (6.2 million pax; 4,600 landings)
- First country for many years in goods import-export by sea, in 2015 third (210 million tons)

The cluster is also a World leader in several of its activities:
- 1st Ro-Ro fleet (250 ships, 5 million GT)
- 3rd G20 countries fleet (17 million GT)
- Cruise shipbuilding (Fincantieri)
- Motor-yachts building (Azimut-Benetti)
- Maritime Intensity Regional Ranking in Italy (All Regions, first six places):
    - 1st. Liguria: first in port activity and yachting, second in shipping and shipbuilding
    - 2nd.Campania: first in shipping
    - 3rd. Friuli – Venezia Giulia: first in shipbuilding

- 4th. Veneto: second in port activity and fishing
- 5th. Sicilia: first in fishing
- 6th. Toscana: second in yachting

Maritime Technology Cluster FVG S.c.ar.l. (Best Practice)

Website: http://www.marefvg.it
Year of Establishment: 2012
Members: 42

The vision of the mareTC FVG is to create a regional synergic system that enhances a sustainable and inclusive value creation chain in the blue economy by leveraging scientific knowledge and industrial skills of the territory. Its mission is to link industries and scientific institutions within a network of organized relationships finalized to develop Research, Innovation and Education projects with the aim to enhance the competitiveness of the industrial basis of the FVG region.It offers the following support services:

- Networking and R&D: to manage the relationships between the regional demand and supply of research in order to activate synergies through the development of specific projects.

- Innovation: to set up initiatives encouraging cross-fertilization processes, technology transfer and the growth of proactive business.

- Cooperation: to develop clusters at national and international level, through the territorial cooperation and the participation in international projects.

- Training: to realize activities to meet the market needs of qualification and upgrading for managerial and technical profiles.

- PR: to organize or participate at sectoral events, fairs, workshops to advertise the cluster activity, the cluster members results and attract new associates.

- Internationalisation: to support with contacts and new opportunities the SMEs aiming at going international and widely to support the territory to achieve a major role at macro-regional and international level.

Maritime Technology Cluster FVG S.c.a.r.l. is awarded a Silver Label Cluster Management Excellence Certificate.

5.4.2. INDETIFIED BEST PRACTICES

Contribution of Italian Navy to the marine Monitoring

The **Italian Navy** provides a relevant contribution to the **marine monitoring** in order to ascertain the quality of national and international waters.

The Navy's work is especially important on the high seas, where for other authorities, scientific institutes and organizations involved in marine conservation, it's more difficult to operate. Besides the special navy units of the Naval Fleet – 6 patrol vessels specialized in anti-pollution operations (units of the Costellazioni class, first and second series of the Patrol Forces Command based in Augusta – COMFORPAT) – all of the Navy units have among their secondary tasks marine conservation especially through the control of hydrocarbons spills in the sea (Legislative Decree: 6 nov 2007 n.202, art. 12), cetaceans monitoring and detecting of macroclastic sediments.

Vessel Traffic Management and Information System

The Operation Center monitoring room of the Italian Coast Guard Headquarters is arranged with workstations configured for monitoring, controlling and managing maritime traffic; they can interact with the following systems:

- ARES (Search and Rescue Automation)
- LRIT (Long Range Identification and Tracking)
- AIS (Automatic Identification System)
- VTS (Vessel Traffic Service)
- VMS (Vessel Monitoring System)
- SafeSeaNet (SSN)
- CleanSeaNet (CSN)
- IMDATE (Maritime Integrated Data Environment) - experimental
- NAVTEX (Navigational Text Warning)

All the above mentioned systems form the VTMIS platform (Vessel Traffic Management and Information System)

Virtual Regional Maritime Traffic Centre (V- RMTC)

V-RMTC is a crucial tool which is used against **Piracy**. It constitues an international info-sharing hub successfully implemented to monitor merchant traffic.

Port State Control

An activity between Safety & Security and Marine Environment is the activity of **Port State Control**. That is the inspection of foreign ships in national ports by PSC inspectors to investigate compliance with the requirements of international conventions that regulate the security of Navigation. Inspections can involve checking that the vessel is manned and operated in compliance with applicable international law, and verifying the competency of the ship's master and officers, and the ship's condition and equipment.

Reorganization, rationalization and simplification of Port Authorities

On 21st January 2016, the Italian Cabinet gave the green light for the "Reorganization, rationalization and simplification of Port Authorities" decree (the "Ports Decree"), which reviews a system which has been in place for over 20 years. The Ports Decree is part of the re-launch of ports and logistics in Italy promoted by the Ministry for Infrastructure and Transport ("MIT"). The Ports Decree focuses on the competitiveness of our ports and supports the role of Italy - crossed by four of the TEN-T rail corridors - as a hub in the Mediterranean and European logistics platform.

Italian ports will be reorganized into 15 Port System Authorities ("PSA") based in strategic decision-making centers based in the Italian "core" ports as set out by the EU. These are Genova, La Spezia, Livorno, Civitavecchia, Cagliari, Napoli, Palermo, Augusta, Gioia Tauro, Taranto, Bari, Ancona, Ravenna, Venezia and Trieste. The new PSA will be in charge of 54 national ports. The local regional authorities can ask that additional ports of regional importance be included in the PSA.

Monitoring Marine Environment through Italian Navy

Italy applied the EU regulation 2008/56/CE regarding the creation of national strategies involving all the main naval institutions, aimed at marine conservation. The regulation with the D.Lgs 190/2010 which gives the Ministry of the Environment and Protection of Land and Sea of Italy (MATTM) the role of coordinator of the strategy through the Technical Committee for the Environmental Marine Strategy (c.d. Marine Strategy).

On a technological-operative basis, the national Marine Strategy is achieved in 5 steps:

- Evaluation of the current state of the national waters (completed);
- Targeting: the Good Environmental Status – GES (completed);
- Targeting the "marine environmental goals" (TARGET) which allow to reach the GES (completed);
- Elaboration of the monitoring programs, evaluating the quality of the marine environment (in progress);
- Elaboration of the actions needed to reach the reach the GES and maintain it. (To be established).

The initial evaluation of the state of the waters and the establishing the parameters that earn a GES (indicating the good environmental status) have been defined on the basis of eleven specific parameters, given by the European Commission and named 'Descriptors'. The systematic monitoring of these descriptors will constitute the National Plan for

Environmental Monitoring and will allow to target environmental goals which in turn will earn a GES.

The **Italian Navy** collaborated to the establishing of the GES, the marine environmental goals and the monitoring plans in different fields of the marine conservation. Among these:

- seabed and biodiversity habitat;
- environmental and hydrographic evaluation;
- underwater noise.

As for the marine monitoring, the Navy's contribution will provide logistic support with ships and other means operative in both coastal waters and offshore, and the specific skills of technical departments such as the Italian Navy Hydrographic Office in Genoa and the Naval Experimentation and Support Centre (CSSN) in La Spezia.

All of this within the dual connotation of the Italian Navy's work for Defence and Maritime Safety in the Mediterranean Sea.

In particular, the Italian Navy can contribute to the monitoring with:

- the employ of naval units for the Descriptors' monitoring, in cooperation with the institutional activities;
- the use of the data acquired during the Hydro-Oceanographic Campaigns and data from the collaborations with the research institutes;
- provision of the hydro-oceanographic data from the Italian Navy Hydrographic Institute (IIM);
- the monitoring of the Biogenic Habitat – Cold Water Corals;
- the employ of the Hydrographic Units and the Minehunters for the control of specific parameters through the use of multibeam echo sounding, side scan sonars, grabs, ROVs and AUVs;
- specific expeditions and hydrographic research;
- acquisition of acoustic data concerning the merchant navy.

5.4.3. IDENTIFIED INITIATIVES & PROJECTS

Italy has by far the most cooperation projects related to marine and maritime issues around the Mediterranean basin. Out of 149 projects identified, Italy is involved in 117. Even outside the Adriatic and Ionian region, where cooperation may have been intensified by the EUSAIR, Italy remains involved in 70% of the projects. The three other large EU Member States - Greece, Spain and France - come next with 75, 51 and 48 projects respectively.

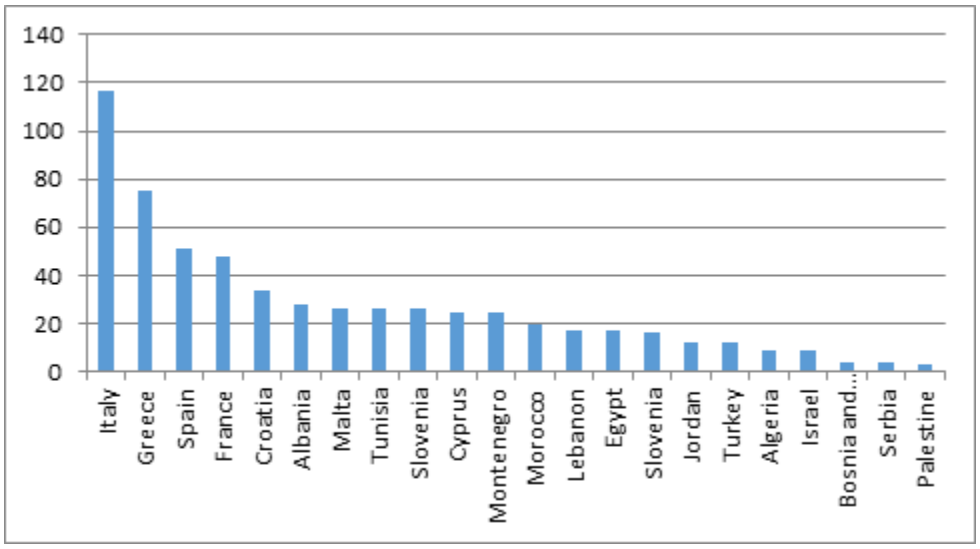


FIGURE 25. NUMBER OF PROJECTS BY COUNTRY

Cooperation is particularly significant in the Adriatic and Ionian basin, with 50 projects exclusively in this area. This contributes to the good ranking of Adriatic and Ionian countries in terms of the number of projects implemented, even for small countries.

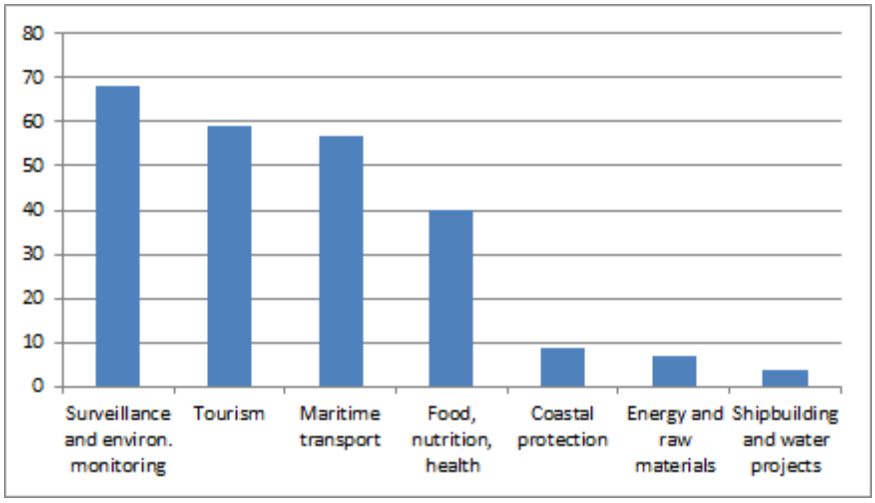


FIGURE 26. NUMBER OF PROJECTS BY TYPE OF MARITIME ACTIVITY

The classes below refer to the standard classification used across the different reports of this study. The four most important sectors for cooperation are:

- Maritime surveillance and environmental monitoring (68 projects);
- Tourism (60 projects): coastal tourism, yachting and marinas, cruise tourism;
- Maritime transport (57 projects): deep-sea shipping, short-sea shipping, passenger ferry services and inland waterway transport;
- Food, nutrition and health (40 projects): fishing for human consumption, fishing for animal feeding, marine aquaculture, blue biotechnology, agriculture on saline soils.

The geographic coverage varies depending on the activities. For instance, half of the projects involving maritime transport take place in the Adriatic and Ionian Region (including the Adriatic Motorways of the Sea). On the contrary, environmental monitoring projects tend to be implemented at the Mediterranean sea basin level (e.g. the Med Partnership).

Analyses on specific MEAs show that projects under **surveillance and environmental monitoring** tend to focus on the latter. Environmental monitoring activities are understood here as the interdisciplinary study of the marine environment (ecosystem approach), integrating networks of observing systems with the implementation and development of physical and biogeochemical numerical models. For about half of them, environmental conservation is the primary objective. This is the case for instance for projects such as the PERSEUS[7] project aiming to identify the interacting patterns of natural and human-derived pressures on the Mediterranean and Black Seas, or projects related to the management of Natura 2000 sites (e.g. the ADRIAWET 2000[8] project). A few projects combine maritime surveillance and environmental monitoring, such as the MEMO project[9] (Mediterranean Electronic Marine Highways Observatory). Other projects focus on the sustainable growth of maritime activities. Some of them do focus on environmental monitoring, as for the MEDFISIS project[10] (Fishery Statistics and Information System in the Mediterranean), but for others, environmental monitoring is involved more as a pre-requisite to improve sustainability. Projects related to maritime surveillance mainly concern the monitoring and prevention of maritime risks (e.g. oil spills). With a global budget of EUR 9.5 Million over the period 2006-2012, SAFEMED[11], which encompasses EU and non-EU countries, is by far the largest project in this field and among the largest ones in general.

Coastal tourism is the second most important MEA in cooperation projects and initiatives, after environmental monitoring. It is worth highlighting that most projects also have an environmental dimension[12] (e.g. SALTWORKS[13] - Eco-touristic valorisation of the Salt-pans between Italy and Slovenia). About a third of the projects focus on both coastal and maritime tourism and include yachting and marinas or cruise tourism activities (e.g. PARA - MARE TOURISM[14] - Promotion and Digital Support of Maritime Tourism in the South East Mediterranean Sea). The integration of management and information systems is also significant in coastal tourism related projects (e.g. MED-ROUTE[15], which tends to reinforce an integrated approach for the preservation and promotion of cultural, natural and other resources through the use of information and communication technologies).

[7] http://www.perseus-net.eu
[8] http://www.adriawet2000.eu/
[9] http://www.adriawet2000.eu/
[10] http://www.faomedfisis.org
[11] http://www.safemedproject.org
[12] This includes projects involving environmental monitoring and sustainable tourism
[13] http://www.ita-slo.eu/projects/projects_2007_2013/2012110811544976
[14] http://www.greece-cyprus.eu/index.php?option=com_projects&view=item&id=29&Itemid=3
[15] http://www.med-route.net

Maritime transport projects mainly focus on short-sea shipping and deep-sea shipping. However these activities are commonly associated with passenger ferry services or maritime surveillance since traffic information systems, port sustainability, maritime safety and preventing pollution from ships are major topics in this field. As for tourism, cooperation projects often focus on environmental issues or on integrated approaches (e.g. CUSTOM MED[16], which aims to develop shared procedures and technologies between the Middle East and the EU or FUTUREMED[17] in the Adriatic and Ionian).

The projects under the category **'Food, nutrition and health'** focus on fishing for human consumption and marine aquaculture. Projects related to fishing tend to involve a large number of countries, especially those implemented by the GFCM and concern mainly fishery sustainability and small-scale coastal fisheries. Marine aquaculture projects focus on sustainability issues and innovation (e.g. the AQUAMED project for the development of a cross-functional strategy for sustainable aquaculture research).

Other MEAs tend to be covered mostly by cross-sectoral projects and are generally not the primary focus[18].

5.5. SPAIN

5.5.1. IDENTIFIED CLUSTERS

The Basque Maritime Forum

Website: www.foromaritimovasco.com
Year of Establishment: 1993
Members: 24

The Basque Maritime Forum was established as a non-profit-making organisation, which includes companies, associations, banks, research centres and universities, in 1993 and was officially recognised as a Priority Cluster by the Basque Government in 1999. The BMF's mission is to represent, defend, consolidate, promote and improve the competitiveness of the companies in the Basque maritime sector by means of the services it offers in line with its Core Strategic Areas (Internationalisation, Technology, Management Excellence, Finance and Taxes, Training and People and Communication, Information and Representation). As a whole, the maritime sector plays a very important role in the economy of the Basque Country, roughly representing 1.74% of its GNP. The Basque Maritime Forum has consolidated itself as the sector's main reference point within the region and one of the most highly regarded clusters in the sector on a national and international level. The BMF has helped set up the Cluster Maritimo Español (the Spanish Maritime Cluster), as well as a

[16] http://www.custommed.eu
[17] http://www.futuremedproject.eu/
[18] https://webgate.ec.europa.eu/maritimeforum/sites/maritimeforum/files/Task%205-Report4.pdf

significant number of regional clusters, and often works and cooperates with other European organisations on projects that have an international scope.

The members of the Basque Maritime Forum are businesses, associations and institutions. Its mission is to render services to the Basque maritime industry and in order to achieve this mission; the BMF offers the following services for associated companies:

- Promotion to assist Associates achieve excellence in their management, to improve their position in international markets, to encourage innovations in their strategies, to contribute to the development of the talents of their personnel and help them carry out their activities with the utmost respect for the best of social and environmental guidelines.
- Provide Representation of Associates' interests before the relevant decision-making bodies.
- Provide Information services to help understand fully the situation, evolution and prospects for their sector in both the Basque Country and on a worldwide scale.
- Communication services to assist a broadening of the presence and image of the Basque maritime sector throughout the world.

Asociación Cluster del Naval Gallego - ACLUNAGA

Website: www.aclunaga.es
Year of Establishment: 1999
Members: 113

The mission of the Cluster of the Galician Naval Sector (ACLUNAGA), created by initiative of the Ministry of Innovation and Industry of the Galician Government, is to improve the competitiveness and to promote the development of the group of companies that integrate the Galician naval sector, establishing an agreement among the protagonists on:

- The challenges they face
- The objectives and strategies to overcome said challenges
- The high-priority actions to be accomplished by the companies and the Cluster itself, with the essential support and involvement of the rest of the agents that influence the sector (Administration, University, Unions, Sectorial Associations, etc)

At the present time 113 companies participate in the Cluster. Their products and services cover all the segments of the value chain of the naval construction (from shipyards and engineering companies to classification and certification societies, from capital goods and supplying companies, to equipment companies, installers or metal companies. This way the first goal of ACLUNAGA, consistent in becoming the institution that more faithfully reflects and represents the Galician naval sector has been accomplished. AREAS

With the purpose of formulating collaboration strategies that allow to increase the productivity of the Galician naval sector and their capacity to innovate, the main working lines of Aclunaga are focused on:

- Promoting horizontal and traversal dialogue among companies through forums, committees and working meetings that approach all those high-priority topics that affect the sector
- Participating in all those initiatives and debate forums that approach issues concerning the Galician naval sector
- Identifying common and complementary needs of the companies of the Galician naval sector and to coordinate the search of the necessary resources to carry out the projects or necessary investments to cover them. These needs can embrace all the areas of the management:

Human resources and training

- Information technologies
- Quality, environmental issues and labour protection
- International trade and promotion
- Excellence and industrial operations
- Logistics
- R+D and Innovation

- Being the centre of strategic information of the sector and contributing to a better structuring of it through the elaboration of strategic plans and the continuous revision of its management model; facilitating the creation of new companies and the integration, transformation and collaboration among the existing ones.

- Exchanging information and collaborating with other sectors and institutions.

CTN - Marine Tecnology Centre (Best Practice)

Website: www.ctnaval.com
Year of Establishment: 2003
Members: 15

CTN is a nonprofit private association of companies that aims to improve the competitiveness of the overall marine and maritime sector through the development of new technological solutions and technology transfer. The main activities of our companies are shipbuilding and ship repair both defence and civil, maritime transport, aquaculture and marine and coastal tourism. Most of these companies are SMEs of the industrial sector. CTN is a cofounder member of the Spanish Maritime Cluster which is made up of more than 100 entities.

CTN encourages the integration of all the actors of the sector with the aim to improve the cooperation and collaboration among them, the search of new business opportunities, the

preparation of new innovative solutions and the development of R&D projects. CTN has a wide experience in the development of R&D projects related to the improvement of product and processes at local, national and European levels.

Since the creation of our European projects office, OPEUMAR, CTN has successfully participated in several European projects with partners all over Europe. These projects are co-funded by the European Social Fund and the programmes include Horizon 2020, Life, CBC MED and Interreg (Sudoe, MED and Europe). The results of these partnerships proved to be successful and contributed to the boost of this centre's recognition in both Spain and Europe.

It has been awarded a Bronze Certificate of Cluster Management Excellence.

NYM AEI Naval y del Mar

Website: www.navalydelmar.com
Year of Establishment: 2007
Members: 26

The Innovative Business Association of Naval and Marine (Naval y del Mar - NYM) is defined as a network that fosters the integration of all members of the naval industry and the sea, with the aim to foster cooperation and collaboration among them, search of new business opportunities, foster dialogue with the various social agents, institutions, agencies and different administrations, as well as promote the culture and maritime tradition of the Region of Murcia.

The initiative of NYM Agrupación Empresarial Innovadora Naval y del Mar emerged to create a differentiated value among its members, enhancing its ability to operate in the existing market and access new business opportunities, through value solutions and the realization of key projects In hand "that foster business cooperation and cooperation.

The cluster values the quality and good work, commitment to innovation, the creation of wealth and well-being in the naval and maritime sectors, professionalism, teamwork through collaboration, respect and transparent communication are the values that make NYM a solid initiative to foster the development of the business fabric of the naval and sea sector of the Region of Murcia.

There are five main strategic objectives on which NYM's development is based:

- The creation of a climate of cooperation among its members.
- Provide the sector with visibility and representation of common interests.
- The development of technical, technological and management capacities.
- Identification and capture of new business opportunities.

- Creation and promotion of good environmental practices in the naval and sea sector.

Clúster Marítimo Español

Website: www.clustermaritimo.es
Year of Establishment: 2002
Members: 106

The Spanish Maritime Cluster (CME) groups is a single organization all the industries, services and economic activities of the Spanish country related to the sea.

The initiative brings together companies that represent all the segments of the value chain in the ship industry. It involves activities such as: Maritime transport; Shipbuilding and repair; Marine auxiliary engineering and industry; Extractive fisheries and marine aquaculture; Nautical industry and marinas; Marine origin energies; The army; Ports and port services; Maritime services as well as regional clusters; Marine research; R&D&I system agents; Training bodies; Trade unions and professional associations; Culture, heritage and social welfare.

The mission of the Spanish Maritime Cluster (CME) is to boost the development and competitiveness of Spanish companies and maritime industries.

CME concentrates its efforts to:

- Create wealth and welfare for society.
- Seek business excellence in the Spanish maritime sector.
- Increase the competitiveness of Spanish companies in the global market.
- Improve the efficiency of industrial and commercial management of enterprises.
- Promote the professional development of workers.

In addition, the Spanish Maritime Cluster was born with the aim of attuning to the European Maritime Policy, approved in the so-called Blue Book, whose main objective is to maintain and strengthen the leadership, growth, competitiveness and sustainability of European maritime activities. In which the CME represents an important endorsement.

CMMA - Andalusian Maritime Cluster

Website: http://cmma.eu
Year of Establishment: N/A
Members: N/A

The Marine-Maritime Cluster of Andalusia (CMMA) is made up of innovative companies with a high technological quantification of different subsectors such as: fishing, aquaculture,

shipbuilding, maritime transport, recreational nautical, marine research and training, ports and port activities, maritime auxiliary and extractive industries, maritime tourism, underwater archeology, etc.

The objective of CMMA is the promotion and development of the Andalusian maritime sector, in order to achieve greater competitiveness of the whole sector and in general defense of its interests, as well as the creation and development of an adequate legal framework for the development of this industry In Andalusia, Spain and the rest of the world.

It offers the following services:
- Cooperation R & D projects

Promote cooperation, innovation and entrepreneurship in order to promote, stimulate and boost the business fabric and knowledge transfer
- Internationalization

To promote the industry of the Andalusian maritime sector in Spain and abroad, especially in fairs, congresses and events of the international sector. We take advantage of the synergy of the H2020

- Specialized training

Increase the coordination and continuous improvement of the training of professionals of the sector as basic principles of society, as well as facilitate their labor integration in society

- Demand and promotion of the sector

Promote, facilitate and intensify the communication between the members of the association, as well as between different segments of activity that constitute the maritime-marine sector of Andalusia

- Search for public tenders

We help companies find tenders that suit their sector
- Promotion and communication

Many of the entities that belong to the Cluster carry out outreach and sensitization days, so it will function as promotion of activities.

Cluster Marino Marítimo de Canarias (Best Practice)

Website: http://www.clustermc.es
Year of Establishment: 2006
Members: N/A

Cluster Marino Marítimo de Canarias is a regional non-profit association whose primary objective is to promote the development and international competitiveness of the Canarian Maritime Marine Sector, while at the same time raising the business, economic and social fabric of the Canaries through the integration, creation, strengthening and sustainability of the companies and institutions that are within the value chain of the maritime sector, promoting its international presence and raising the technological and innovative level of all the agents involved, aligned with development policies and social demands.

The strategy of the Canary Islands Marine Cluster (CMC) to achieve this goal is based on values such as cooperation, commitment, communication and competitiveness. In this way the CMC aims to be a meeting place and dialogue of all agents related to the sea, whose future depends to a large extent on the ability to maintain and create competitive advantages for companies in the Canarian maritime sector by developing activities that Increase their level of innovation and their international presence

CMC offers the following services:

- Innovation
- Internationalization
- Communication
- Training
- Certifications

The cluster is active in Business Areas such as: Ship repair, Sea transport, Port infrastructures & services, Sports & recreational fishing, Fishing & aquaculture.

The cluster has also been awarded a bronze cluster management excellence certificate.

5.5.2. IDENTIFIED BEST PRACTICES

Sistema de Vigilancia Exterior (SIVE)

SIVE is an advance surveillance system developed by a Spanish company and used by the Spanish Civil Guard to monitor the Spanish coast. It has also been installed in the coastal areas of Gibraltar and the Canary Islands. SIVE cost around €130 million and was created at the end of the '90s to provide information obtained through sensor stations that detect seacraft from a long distance, and transmit a televised signal to two Central Commands, currently located in Algeciras in Gibraltar and Fuerteventura in the Canary Islands.

External Borders Fund 2007-2013 – Spain

The Commission has adopted the multiannual programme under the External Borders Fund 2007-2013 for Spain (the biggest beneficiary of the Fund) for an estimated amount of € 356 million, together with the 2007 annual programme. The External Borders Fund is one of the four financial instruments of the General Program on "Solidarity and Management of Migration Flows" which encourages a fair share of responsibilities between Member States arising from the introduction of integrated management of the external borders and from the implementation of common policies on asylum and immigration.

The overall budget of this Fund for 2007-2013 is € 1820 million.

Fisheries Control – ISO 9001-2015

According to the Spanish Government, at the moment, Spain has achieved excellence in fisheries control and is a world reference in the field, which is proven by the achievement of ISO 9001:2015 certification in March 2016 for all the activities developed by the General Sub-directorate of Control and Inspection.

Transformations in Defence Industry & new partnerships

Back in the 1990s, the Spanish defence industry underwent profound transformations. These changes created new relationships between governments and industries. There were many opportunities arising from both public and private sector projects in which Spanish firms would welcome partnerships with U.S. high-technology defense companies. For example, Spain's heavy investment in infrastructure projects presented major opportunities for U.S. defense electronics manufacturers. In the past, public firms dominated the defense sector, but private firms now have the upper hand.

Spain uses offsets on defense orders to support and develop its defense industry. Spanish industry has manufactured a significant share of the material requirements of the armed

forces, notably light arms, vehicles, ships, and light transport aircraft. As a member of NATO, Spain had joined in the planning of several coproduction projects with other West European countries.

5.5.3. IDENTIFIED INITIATIVES & PROJECTS

Important maritime surveillance initiatives in the form of projects have been implemented in the EU territory, several of which are dealing with the area of Spain. The most important identified are briefly presented below.

1. **CoopP – Cooperation Project**

The Cooperation Project is paving the way for smooth data transmission and easy access, whenever relevant, between public authorities (including EU Agencies) in the execution of the defined maritime surveillance functionalities.

2. **BLUEMASSMED – Blue Maritime Surveillance System MED (**www.bluemassmed.net**)**

The BlueMassMed pilot project was one first step toward achieving a better cooperation between the numerous actors of maritime surveillance (Member States' administrations and European agencies principally) and obtaining a better efficiency of resources through the sharing of maritime information, in a cross-sectoral and cross border understanding and implementation.

BMM supports the process of creating a Common Information Sharing Environment (CISE). BMM has been developed with the intention to demonstrate the willingness and the capability of 37 partners involved in maritime surveillance in one way or the other, from six different EU Member States littoral to the Mediterranean Sea and its Atlantic approaches, while identifying potential obstacles and the appropriated solutions.

3. **AMASS - Autonomous Maritime Surveillance System (**www.amass-project.eu**)**

The AMASS project sought to develop a surveillance system for the observation and provision of actionable data for securing critical maritime areas against potential illegal immigration; and to help prevent the trafficking of weapons, drugs and illicit substances.

The project aimed to carry out the key research and technological development required to engineer an unmanned platform capable of remotely monitoring maritime areas a considerable distance from shore.

4. **ARGUS 3D - AiR GUidance and Surveillance 3D (**www.argus3d.eu**)**

The overall objective of the ARGUS 3D project is to enhance the security of European citizens, as well as of strategic assets by contrasting, over large areas, unpredictable and

unexpected terrorist threats that can be delivered by means of small and low-flying (manned or unmanned) aircraft.

In order to achieve this general objective, the project intends to carry out R&D activities aimed at improving the current ATC systems for civil applications, extending their coverage and making them able to detect, recognize and track non-cooperative targets.

5. **EFFISEC - Efficient integrated security checkpoints (**www.effisec.eu**)**

Illegal immigration and illicit material detection is a growing concern at the European borders; in that respect border security checkpoints must be particularly effective against any kind of threat.

Seaport checkpoints differ strongly from airport ones and are more complex to process. The global objective of EFFISEC, a mission oriented project, is to deliver to border authorities more efficient technological equipment, providing a higher security level of identity and luggage control of pedestrians and passengers inside vehicles, at land and maritime check points.

6. **GLOBE - Global Border Environment (**http://globe.ti-projects.com/**)**

The GLOBE project aimed to produce a comprehensive approach to integrated border management in Europe that factors in the internal, border and global aspects of border management. It set out to assess the existing technical, legal, political and societal environment of Europe's borders, and to suggest information management and integration steps to be taken to enhance border security.

7. **I2C - Integrated system for Interoperable sensors & Information sources for Common abnormal vessel behaviour detection & Collaborative identification of threat (**www.i2c.eu**)**

The I2C project foresees the design of a new generation of maritime surveillance system which must allow:

- Permanent and all weather coverage of border maritime areas;
- Continuous collection and fusion of heterogeneous data provided by various types of sensors deployed on shorelines and on mobile platforms and other information from external sources;
- Supervised automatic detection of abnormal vessel behaviours and generation of justified alarms;
- Understanding of suspicious events and early identification of threats from series of detected spatiotemporal abnormal vessel behaviours (alarms);
- Generation of electronic and formatted interpretation reports on suspicious events to keep decision-making authorities periodically informed.

8. **OPARUS - Open Architecture for UAV-based Surveillance System**

OPARUS aimed to define an open architecture for operating unmanned aerial systems (UAS) for wide-area land, coastal and sea border surveillance in Europe. This took into account emerging legislation for the safe deployment of UAS platforms across Europe's controlled civil airspace – a regulatory and technical concept known as "air insertion".

The project's technical work focused on surveillance sensors, aerial platforms, secure data links, communication networks and generic ground control stations. Directly connected to the needs of end-users such as Frontex and national Border Guard authorities, OPARUS also looked at cost-efficient solutions to promote maximum efficiency for UAS-based border surveillance operations.

9. **PERSEUS - Protection of European seas and borders through the intelligent use of surveillance (**www.perseus-fp7.eu**)**

The PERSEUS project scope was three-fold:

- Design of a system of systems architecture that integrates existing and upcoming surveillance systems as well as innovations created within PERSEUS and those originating from other projects. The goal of the system of systems is to address the complex security missions, focusing on irregular migration and trafficking;
- Validation and demonstration of the system of systems through six exercises representing specific surveillance missions, instantiated in the MED sea;
- Strong involvement of end users to warrant a realistic step by step approach to reach an efficient operational cooperation among the Member States while preserving the national prerogatives;

10. **SEABILLA- Sea border surveillance (**www.seabilla.eu**)**

SEABILLA project main objective was to define the architecture for cost-effective European sea border surveillance systems, integrating space, land, sea and air assets, including legacy systems, as well as to apply advanced technological solutions to increase performances of surveillance functions. It also aimed at developing and demonstrating in the field significant improvements in detection, tracking, identification and automated behavior analysis of all vessels, including hard to detect vessels, in open waters as well as close to the coast.

11. **SUPPORT - Security UPgrade for PORTs (**www.support-project.eu**)**

The primary project objective of the project is to support the principal stakeholder groups involved in the security of European main sea and/or inland ports to build distributed cooperative security systems. SUPPORT will facilitate optimized interchange of surveillance

and administrative information as well as threat alerts between port stakeholders, thus enabling cost effective, multiple use of available data in tailored decision support systems.

SUPPORT solutions will: provide integrated state-of-the- art surveillance/security systems for border control ; assist port security operators in decision making; take into account the port's organizational structure and operational modalities; and ensure that differing legal and regulatory constraints and standards for security are met in a cost effective manner.

12. **WIMAAS - Wide maritime area airborne surveillance (**www.wimaas.eu**)**

WIMAAS aimed to assess the potential cost reduction, efficiency and enhanced border control benefits for European maritime domain surveillance to be gained via a large-scale integration of unmanned or otherwise remotely piloted airborne vehicles. The project explored the application of such systems for tracking illegal immigration, illegal fishing, smuggling, pollution and terrorist threats. The final outcome aimed to develop simulation models based on operational scenarios, innovative concepts and technologies for unmanned systems, in-flight experiments, a detailed cost benefit analysis and, finally, a roadmap for the wider use of unmanned aerial vehicles (UAVs), including R&T priorities and future program suggestions.

13. **DOLPHIN - Development of Pre-operational Services for Highly Innovative Maritime Surveillance Capabilities (**http://www.gmes-dolphin.eu/)

DOLPHIN is an FP7 Copernicus research and development project in the field of support to Maritime Surveillance. Over its 30-month duration, the DOLPHIN project will develop new methods and algorithms for processing satellite radar and optical images in order to improve the detection and monitoring of seafaring vessels.

DOLPHIN intends to create innovative algorithms and software tools applicable at global scale for the policy areas of interest by addressing major technological gaps. The tools will be linked with existing operational systems to form a cohesive and integrated decision support environment, integrating satellite and non-space data sources.

NEREIDS - New Service Capabilities for Integrated and Advanced Maritime Surveillance (http://www.nereids-fp7.eu/**)**

NEREIDS is an FP7 Copernicus research and development project in the field of support to Maritime Surveillance. Over its 36-month duration, the project aims to support the development of an integrated vision of Maritime Policy and Maritime Surveillance, with implications for a number of different maritime domains (Illegal trafficking, illegal immigration, fisheries control, piracy).

14. **SIMTISYS - Simulator for Moving Target Indicator System (**http://88.32.124.85/SIMTISYS/**)**

SIMTISYS is an FP7 Copernicus research and development project in the field of support to Maritime Surveillance. Over its 30-month duration, the SIMTISYS project aims to support the use of space-borne radar mounted on single or formation-flying satellites through the development of a software simulator. Such systems have proven to be pivotal in enhancing the EU's capabilities to undertake efficient Maritime Surveillance.

15. **MERSEA - Marine Environment and Security for the European Area**

Mersea aims to develop a European system for operational monitoring and forecasting on global and regional scales of the ocean physics, bio-geochemistry and ecosystems. The prediction time scales of interest extend from days to months. This integrated system will be the Ocean component of the future GMES system. At the core of the system is the collection, validation and assimilation of remote sensed and in situ data into ocean circulation models that allow for the self-consistent merging of the data types, interpolation in time and space for uniform coverage, now casting (i.e. data synthesis in real-time), forecasting, and hindcasting, and delivery of information products.

16. **MEMO - Mediterranean Electronic Marine Highways Observatory**

The ultimate goal and the foundation of the MEMO project is the integration of innovative maritime and environmental management technological tools to maintain and expand the marine information infrastructure for enhanced maritime safety and sustainable development of coastal and marine resources in the MED. System integration with new additional services and tools will ensure that technologies are adapted with appropriate calibration, quality control and reliability.

17. **MEDES4MS - Mediterranean Decision Support System for Marine Safety (**www.medess4ms.eu**)**

The main objective of MEDESS-4MS is to deliver an integrated operational service for oil spill forecasting connected to existing oil spill monitoring platforms (EMSA CSN and REMPEC) for the Mediterranean, using available environmental data from the MCS-Marine Core Service and the downscaled national ocean forecasting systems.

5.6. PORTUGAL

5.6.1. IDENTIFIED CLUSTERS

Fórum Oceano – Associação da Economia do Mar (Best Practice)

Website: www.forumoceano.pt
Year of Establishment: 2009
Members: 135

Fórum Oceano – Associação da Economia do Mar (Association of Maritime Economy) is a private non-profit association created in 2009 and is formally recognized by the Portuguese Government as the entity responsible to implement collective efficiency strategies in the Sea Economy sector.

The Association gathers 135 members from the whole country, covering different key sectors of the maritime economy, among them companies and business associations, R&D centres, higher education institutions, local authorities and other associative organizations. The Association main priority is to promote the sea as a valuable source for the economy, promoting cooperation between stakeholders through the intersection of knowledge and support for innovation, internationalization and entrepreneurship contributing, in sustainability conditions, for the country's competitiveness.

Fórum Oceano works with supply chains and customers by organizing international business contacts. By identifying projects and cooperation between academy and industry through promoting focus groups' discussions, the organization promotes and develops innovation. Other activities include monitoring of anchor projects, dissemination of maritime affairs, promotion of studies and strategic reports, participation in national and international projects and networks, participation in B2B meetings, organizing and participation in entrepreneurial missions, organizing open and info days and organizing Sea Forum, yearly event in Portugal that comprises exhibition of products, business meetings and conferences about the maritime economy.

Fórum Oceano participates in cooperation projects, at regional, national and EU levels, namely REMCAP (FP7 Regions of Knowledge), AtlanticBlue Tech (INTERREG IVB) and CINMars (ESA). It has also participated as stakeholder in COFASP (FP7 ERANET) and has recently submitted several applications to international competitive calls.

Fórum Oceano was recognized with the BRONZE LABEL Excellence, assigned by European Cluster Excellence Initiative (ECEI), and is considered a Public Utility Institution (publication in Diário da República - the Portuguese Official Republic Gazette, October 2014).\

Maralgarve – plataforma mar do Algarve

Website: N/A
Year of Establishment: 2011
Members: 24

Association for the Promotion of Knowledge and Economy of the Sea in the Algarve, private non-profit law. The Platform's objective is to promote, valorise and boost the knowledge and economy of the sea, stimulating innovation, concerted interests, efforts and actions of the different agents around a common strategy.

The mission of the Platform is to promote, enhance and enhance the knowledge and economy of the sea by stimulating innovation, the coordination of interests, efforts and actions of the different players around a common strategy. The structure now formed will adopt a cluster logic, synergistically leveraging the skills of the various partners to bring about sound and comprehensive projects in the sea area. According to the Installing Commission of the association, the development of partnerships, the transfer of knowledge and the insertion in national and international networks will be aspects to which the Mar do Algarve Platform will pay particular attention.

The birth of this new association is a further step in the course started in 2006, when the international conference "Maralgarve - An Ocean of Opportunities" was held in the region, which promoted reflection and broad discussion on the theme of the sea. Since then, a number of other initiatives have taken place, including the elaboration of the "Regional Sea Agenda - Contributions to the Action Plan for the Algarve Sea Cluster". The results of these discussions have demonstrated the strategic advantage of an association that integrates the various players in the sea sector in the Algarve.

5.6.2. Identified Initiatives & projects

1. **EASME/EMFF/2014/1.2.1.2/3/SI2.716885 (http://www.dgpm.mam.gov.pt/Pages/602_EN.aspx)**
2. **ICARUS - Integrated Components for Assisted Rescue and Unmanned Search operations (ICARUS http://www.fp7-icarus.eu/)**
3. **SAFEPORT (safeportproject.eu)**
4. **SUBECO Project (2016 - 2018). Robonoise Project (2013); AcusticaExport (2013-2015). ShipingNoise (http://www.shippingnoise.com/)**
5. **BRIDGES - Bringing together Research and Industry for the Development of Glider Environmental Services**
6. **RAWFIE - Road-, Air-, and Water- based Future Internet Experimentation**
7. **MOSES - Moving Sands - Equilibrium State of Crenulated Coasts**
8. **Mare-Fi - Wi-Fi for Land-Sea Communications**
9. **SUNNY - Smart UNmanned aerial vehicle sensor Network for detection of border crossing and illegal entrY**

5.7. Chapter's key points

Table 13 presents the number of clusters, best practices and initiatives related to MS that were identified in del. 3.2.1 per country of reference.

Table 13. Number of idenfied clusters, best practices & initiatives per area of reference

Country	Number of identified clusters	Identified key Clusters[19]	Number of best available practices and initiatives identified
France	4	▪ **Pôle Mer Méditerranée** ▪ SAFE Cluster ▪ Secured Communication Solutions Cluster ▪ OPTITEC Cluster	23
Greece	3	▪ ECOMASYN ▪ STRATEGIS ▪ Hellenic Space Technologies and Applications Cluster (si-Cluster)	29
Italy	2	▪ Federazione del Mare ▪ **Maritime Technology Cluster FVG S.c.ar.l.**	123
Spain	7	▪ The Basque Maritime Forum ▪ Asociación Cluster del Naval Gallego – ACLUNAGA ▪ **CTN - Marine Technology Centre** ▪ NYM AEI Naval y del Mar ▪ Clúster Marítimo Español ▪ CMMA - Andalusian Maritime Cluster ▪ **Cluster Marino Marítimo de Canarias**	21
Portugal	2	▪ **Fórum Oceano – Associação da Economia do Mar** ▪ Maralgarve – plataforma mar do Algarve	9
Cyprus	*pending*	*pending*	*pending*

[19] Best Practices Clusters are in Bold

6. COMPARATIVE ANALYSIS OF THE ONGOING SYSTEMS AND THE BEST PRACTICES

This chapter presents a comparative analysis per sector for all participating countries and it is solely based on the information available and extracted from the individual deliverables submitted by each participating country.

The evaluation of the MS systems is based on a set of tailored quantitative and qualitative indicators that aim at facilitating the identification of gaps, needs and opportunities of each of the 5 countries which will host the national MS Node in order to improve the quality of the available information and improve its future functions. Cyprus will be the 6th country that will host the national MS Node and the related data is pending.

As regards the comparative approach that has been selected, this is based on a set of quantitative and qualitative indicators that facilitate the extraction of quick and sound conclusions.

The quantitative information is self-explanatory; namely, qualitative indicators indicate a quantity (a pure number, an index, ratio or percentage). They provide a very clear measure of the studied sectors and sub-sectors and are numerically comparable as they compare the performances of the countries on specific sectors.

On the other hand qualitative indicators depict the status of the studied sectors and sub-sectors in more qualitative terms. Qualitative indicators have been selected not only because the nature of some data is not quantitative but also because in many cases an analysis is better captured/ explained/ graded/ measured by strict qualitative terms and findings. For example, whether a competent body/ stakeholder related to maritime surveillance is properly functioning or not, can be assessed in qualitative terms. It is noted that in this report the qualitative indicators are “quantified” using a numerical point system from 1 to 5, where 1 represents “Very poor quality” or a “negative” result and 5 represents “high quality” or a “positive” result.

“Very Poor quality” = 1
“Poor quality” = 2
“Moderate quality“= 3
“Good quality” = 4
“High quality” = 5

In this context, the comparative analysis for each sector uses a set of indicators that aims at facilitating the drawing of conclusion for Maritime Surveillance for the following indicative questions:

1. Extent and level of available information
2. Weaknesses and capabilities
3. Transparency of data in the study area
4. Timing of technical implementation in the study area
5. Operational resources
6. Difficulty in implementing and operating the system

7. Sustainability

Key assumptions

Qualitative indicators are requiring feelings and judgment in order measure them and extract comparable results from them. On the other hand, qualitative indicators only need mechanical methods that are theoretically expected to give always the same results; however, the results extracted from the quantitative numbers do not consider the fact that in some cases data may be available (e.g. for involved stakeholders) but they haven't been identified and recorded. In this context, drawing conclusions is an holistic approach that takes under consideration the local/regional/national characteristics of each area and the extent of information available from the submitted individual deliverables.

6.1. COMPARATIVE ANALYSIS

Taking under consideration the outputs presented in the previous chapters, a comparative analysis has been elaborated in order to identify the opportunities for synergies in the MED area. This comparative analysis includes information related to the Involved Stakeholders, the ongoing clusters as well as Best Practices/ Initiatives related to the Marine Surveillance (MS).

Abbreviations for MS Sectors:

- Border Control (BC)
- Maritime Safety and security (MSS)
- Fisheries Control (FC)
- Customs (C)
- Maritime Environment & pollution (ME)
- Defense (D)
- General Law Enforcement (GLE)

Table 14 provides a comparative analysis and presentation of the stakeholders/actors per area and per sector. The quantitative indicators that have been selected are the number of identified stakeholders (incl. per sector) and the percentage of public/ business oriented stakeholders. The qualitative indicators are divided in horizontal indicators which correspond to the quality and extent of the available data and tailored to the specific section qualitative indicators that correspond to the capacity and relevance of the stakeholders to facilitate the project objectives and address the identified threats.

Table 14. Comparative Analysis of the key involved stakeholders/actors (public & private) by country of reference

	Quantitative Indicators		**Number of Involved Stakeholders per Sector**[20]							**Qualitative Indicators**				
Country	Number of Identified Stakeholders[21]	Public vs Private/ Business oriented Stakeholders (%)	BC	MSS	FC	C	ME	D	GLE	Quality of available data	Extent of available data	Capacity to extract data from the stakeholders	Relevance of the identified Stakeholders to the Maritime Surveillance	Capacity of Stakeholders to facilitate the achievement of project objectives
France	41	89%	3	9	4	2	15	9	1	5	5	5	5	5
Greece	56	32%	5	31	3	2	10	23	3	5	3	5	5	5
Italy	41	N/A	5	17	2	4	10	2	1	5	3	5	5	5
Spain	32	41%	7	13	4	3	9	20	4	5	5	5	5	5
Portugal	18	61%	1	3	4	1	12	2	1	5	3	5	5	5
Cyprus	*pending*	*pending*										*pending*	*pending*	*pending*

Table 15 provides a comparative analysis and presentation of the identified common challenges and threats. The quantitative indicators that have been selected are the number of identified challenges and number of identified weaknesses as well as their sum. The qualitative indicators are divided in horizontal indicators which correspond to the quality and extent of the available data and tailored to the specific section qualitative indicators that correspond to the relevance of the recorded issues with the specific project objectives and the difficulty to address them.

[20] Some Actors/Stakeholders are involved in more than one MS sector.
[21] Only the key actors/key stakeholders related to MS are presented, based on the reports of Del 3.2.1 per area of reference.

Table 15. Comparative analysis of the identified Common Challenges & Threats by country of reference

	Quantitative Indicators			**Qualitative Indicators**			
Country	Number of Threats and challenges identified	Number of Weaknesses identified	Total Number of identified issues	Quality of available data	Extent of available data	Relevance of recorded challenges/ threats to the Maritime Surveillance	Difficulty to address the challenges/ threats (1=difficult, 5=easy)
France	2+5	2	9	5	3	5	3
Greece	4	8	12	5	3	5	1
Italy	10+8	20	22	5	3	5	1
Spain	5	4	9	5	3	5	2
Portugal	8+3	4	15	5	3	5	2
Cyprus	*pending*	*pending*	*pending*	*pending*	*pending*	*pending*	*pending*

Table 16 provides a comparative analysis per country of reference regarding the available clusters, best practices and initiatives related to MS. The quantitative indicators that have been selected are the number of identified clusters and the number of identified practices and initiatives. The qualitative indicators are divided in horizontal indicators which correspond to the quality and extent of the available data and tailored to the specific section qualitative indicators that correspond to the capacity to obtain more data about these clusters/ practices/ initiatives and their relevance to the Maritime Surveillance.

Table 16. Comparative analysis regarding the available clusters, best practices and initiatives related to MS by country of reference

	Quantitative Indicators		**Qualitative Indicators**			
Country	Number of identified key clusters	Number of best available practices and initiatives identified	Quality of available data	Extent of available data	Capacity to obtain further data from the recorded clusters/ practices/ initiatives	Relevance of the recorded clusters/ practices/ initiatives to the Maritime Surveillance
France	4	2+21	5	5	5	5
Greece	3	29	5	3	5	5
Italy	2	6 +117	5	3	5	5
Spain	7	4 +17	5	5	5	5
Portugal	2	9	5	3	5	5
Cyprus	*pending*	*pending*	*pending*	*pending*	*pending*	*pending*

Table 17 provides a comparative analysis and presentation of the opportunities and threats in the 5 participating countries. The quantitative indicators that have been selected are the number of identified strengths and the number of identified opportunities. The qualitative indicators are divided in horizontal indicators which correspond to the quality and extent of the available data and tailored to the specific section qualitative indicators that correspond to the relevance of these strengths and opportunities with the Maritime Surveillance, the difficulty to capitalize them and the research, development and innovation potential linked with the Maritime Surveillance.

Table 17. Comparative analysis of the identified opportunities and strengths related to MS by country of reference

	Quantitative Indicators		**Qualitative Indicators**				
Country	Number of identified Strengths	Number identified opportunities	Quality of available data	Extent of available data	Relevance of the recorded strengths/ opportunities to the Maritime Surveillance	Difficulty to capitalize the strengths/ opportunities (1=difficult, 5=easy)	RDI potential linked with Maritime Surveillance
France	4	4	5	4	5	4	5
Greece	4	5	5	4	5	3	3
Italy	9	11	5	4	5	4	4
Spain	5	6	5	4	5	3	4
Portugal	9	10	5	4	5	3	4
Cyprus	*pending*	*pending*	*pending*	*pending*	*pending*	*pending*	*pending*

Table 18. Prominent MS sector by country of reference

Country	**Identified prominent MS Sectors**	**Other identified MS Sectors**
France	▪ Maritime Security & Safety ▪ Maritime Environment	
Greece	▪ Maritime Security & Safety	▪ Defence ▪ Border Control
Italy	▪ Maritime Security & Safety ▪ Fisheries Control ▪ Marine Environment ▪ Customs	
Spain	▪ Defence	

Portugal	▪ Maritime Security & Safety (focused in tourism) ▪ Fisheries Control	▪ Marine Energies
Cyprus	*pending*	*pending*

6.2. KEY POINTS OF COMPARATIVE ANALYSIS

- **Four (4) out of the five (5) countries** that will host the National Nodes identified the "**Maritime safety and Security**" **as the prominent MS sectors**.[22]
- All partners have identified a significant number of key actors/stakeholders related to MS both from private and from public sector.
- The **capacity building potential of the identified involved stakeholders** to facilitate the achievement of the project objectives is **high**.
- The available information for the involved stakeholders and the overall capacity/ potential to extract further information is high.
- **Most of the identified stakeholders/actors** are involved in "**Maritime Safety** & **Security"** and **"Defence".**
- Several issues related to MS have been extendently recorded for all participating countries. Italy has identified most of them.
- The quality of the recorded data regarding the indentified threats related to MS is high.
- All countries present specific difficulties in order to address the identified threats.
- **Clusters related to MS have been recorded by all countries**.
- All countries have recorded several best practices or/and innitiatives related to MS sectors.
- **The quality of** the available data regarding the **Best Practices** related to MS is considered **high;** the extend of data availability is moderate to high.
- The capacity to obtain further data from both the recorded clusters and the best practices/initiatives is high.
- All participating countries have identified strenghts and opportunities related to MS sectors.
- The RDI potential linked to MS sectors varies between Moderate and High.

[22] The data for Cyprus is still pending

7. OPPORTUNITIES FOR SYNERGIES IN MED AREA

7.1. OPPORTUNITIES & STRENGTHS OF EACH COUNTRY RELATED TO MS

Table 19. Opportunities & strengths related to MS by area of reference

	France	Greece	Italy	Spain	Portugal
STRENGTHS	• Favorable ecosystem • A dedicated Cluster acts as facilitator for interactions between LEs and SMEs in the fields • Recognized expertise worldwide on complex system development • French navy and the biggest navy base in the Mediterranean	• Lots actors operating in related fields and strong maritime tradition (largest fleet in EU) • Synergies with other EU countries through past project implementation • Key core MS products are complementary to products already produced for other sectors (eg. satellite observation, navigation systems, aviation etc) • strongly related to public duties and other sub-functions, thus creating a basic demand or political drive;	• Shipping and ship building • Large strong companies (e.g. Leonardo and Grimaldi) • Small Medium enterprises with high index in R&D • Lots actors operating in related fields and strong maritime tradition • Synergies with other EU countries through international operations in MED area • Key core MS products are complementary to products already produced for other sectors (eg. satellite observation, navigation systems, aviation etc) • Established position of European industry in detection systems • Good infrastructure and traffic management (maritime security) • Strategic port location	• SIVE in-house developed system for border control • Well developed and organized supply-chain for fisheries management & Largest fisheries fleet in EU • Strong private companies consist the backbone of the defense sector • Allocated Funds under the external border funds for border control • Spanish OP Funds allocated for fisheries and marine environment management	• Algarve is the region with the greatest extension of coast in the continent; • Excellence of the Algarve coast (both in quantity and quality); • Consolidated market for fisheries and aquaculture; • Traditional fishing is an important component of regional identity; • Competence and dynamics of several research units in marine sciences; • Protected Areas and Biodiversity; • Existence of exporting companies in various areas related to the sea (fisheries, sea salt, aquaculture, preserves, biotechnology), with international recognition; • Excellent soil and climate conditions for marine and bivalve crops; • High-quality products of aquaculture enterprises as a result of the modernization of production units.

OPPORTUNITIES	• To seek from the actors of the maritime domain the needs not, little or badly treated including the phases of intervention and prevention • Support the development of new maritime activities, in particular those related to the exploitation of new energy resources, ensuring initial consideration of safety and security needs. • Promote the emergence of concepts and ideas of low level of maturity (TRL <5) that can lead in particular to electronic products, computer (hardware or software), robotics or cyber security. • Promote access to the market of solutions already developed (TRL> 6) in maritime poles in maritime safety and security.	• Country with long maritime tradition – plenty of room for companies to offer surveillance services and products • growing demand for security products because of an increase in threats over the last decade, including piracy, illicit drug trafficking and terrorism • MS can not only create revenue for the country as a sector, but can secure revenues in other economic activities • Quick integration of new technologies through open innovation schemes between Large enterprises and SME, • Dual use aspects.	• Networking and cooperation between actors • to benefit from synergies (e.g. between ports) • Awakening political interest • Increased cooperation between the Mediterranean maritime clusters • Globalization increase transport of goods (Europe and Asia) – Further rapid growth of China & India offer new opportunities • Access and exploit European structural funds • Development of Maritime Clusters to foster R&D in maritime security • New strategic partnerships • Use of predictive analytics and behavioral models and increased availability of data, advances in Big Data analytics • Creation of high qualified jobs to increase employment • Country with long maritime tradition, plenty of room for companies to offer surveillance services and products • Growing demand for security products because of an increase in threats over the last decade, including piracy, illicit drug trafficking and terrorism	• Sustainability of small-scale fisheries – share of good practices • opportunity for cooperation in terms of capacity building in order to reduce red tape to access public funding and to facilitate access to private funding for fisheries control • Development of Maritime Clusters to foster R&D in maritime security • New strategic partnerships • Use of predictive analytics and behavioral models and increased availability of data – advances in Big Data analytics • Creation of high qualified jobs to increase employment	• Concerted promotion of Algarve products (eg. fish, salt and molluscs); • Strategic geographical location between the Atlantic Ocean and the Mediterranean Sea; • Favourable national and international context for the integrated development of maritime activities; • Strengthen links with industrial activities (shipbuilding and repair, preserves); • The growing demand for seafood in Portugal (with only half being produced internally); • Strengthening of fishing port equipment; • Offshore aquaculture facilities; • New technologies (genetics, nutrition, management techniques) allow the development of niche services, diversification of production and increase of productivity; • Availability of accumulated local knowledge and skilled labour; Modernization of the fishing fleet.

7.2. RECOMMENDATIONS BASED ON DEL 3.1.1

7.2.1. FRANCE

Within the framework of the Strategic Area of Security and Maritime Security, a detailed analysis of market elements, technological and non-technological challenges and the skills present among the members of the areas concerned led to focus action on the needs of governmental or private authorities to cover different types of missions such as:

- Fight against all forms of trafficking and illegal immigration;
- Prevention of voluntary or involuntary pollution;
- Protection and combating of terrorism from the sea, piracy;
- Prevention and resolution of conflicts of use;
- Protection and management of the natural resources of the maritime domain;
- Prevention of environmental risks;
- Control of navigation and safe havens;
- Prevention and management of accidents and disasters;
- Safety of ships and their navigation;
- Rescue at sea and safety at sea and protection of persons.

Attention will be paid to the intervention capabilities including the use of warning and counter-measures that can be implemented in a graduated manner in order to guarantee the required level of safety and security of the zone. In certain cases of application, the resources implemented, at the level of surveillance and intervention level, may constitute active elements participating in the concept of the Security-Safety-Defence continuum often put forward in the framework of the action of The State at sea.

The markets targeted by the areas covered action are global markets, many coastal States have embarked on processes to upgrade their surveillance and response capabilities adapted to their specific needs.

They are characterized by strong fragmentation and a significant number of potential users of these means, making procurement processes often fragmented and therefore complex market access. Moreover, the acquisition and use of these means in many cases require close national and even international co-operation between State administrations.

Many private actors, such as oil companies, developers and operators of wind farms, have to be added to the numerous public actors (as in France with the Navy, the Maritime Affairs Directorate, the Maritime Prefecture, the Maritime Gendarmerie, etc.) Offshore, etc.

In addition, this market is based on new national and international directives and regulations, in particular those of the IMO and its Maritime Safety Committee (MSC), which regulate international shipping, construction and equipment issues Collision prevention, handling of dangerous goods and any other safety-related topic at sea. The resulting conventions such as SOLAS (Safety of Life At Sea) are structuring for the field. The tightening of the regulatory aspects currently in place (ISPS codes, IMO rule, etc.) can be one of the origins of decisions to acquire new needs for surveillance and security equipment.

The segmentation of the market appears as follows. It is marked by a reduction in the boundaries between civil, defense and environmental applications. It takes into account both ships, on-board means and external means (terrestrial, aerial, satellite).

Safety analysis, the cornerstone of safety

Each year, tens of thousands of merchant ships stop at French ports (metropolitan France and overseas). The action of the State requires either to protect that ship during its call (ship escort, surveillance patrols ...) or to protect itself from this ship which can serve as a vector to introduce illegal objects into the national territory, Malicious or irregular persons (discreet surveillance, control of the ship, etc.).

As all ships are not feasible and realistic, a safety analysis (so-called targeting) of all ships calling at sea should be carried out. This process, which is similar to profiling, enables the detection and targeting of merchant vessels of safety interest. It is based on information related to the ship, to evaluate all ships in stopover through a dedicated organization.

Coastal monitoring

Extended coastal surveillance integrates the safety and security of sea-lanes up to 200 nautical miles from the coasts and buildings and their crews, to enable them to operate with minimal risk. This segment also integrates the sharing of inter-state or inter-agency maritime surveillance information (e.g. CISE - Common Information Sharing Environment for the European Union Maritime Domain).

Monitoring sensitive sites:

This segment includes the security of immediate access to harbours, docking facilities and coastal installations from attacks or infiltration from the sea. This requires the establishment of a coherent, integrated and permanent surveillance system, Enabling the management of maritime traffic in the approach area and the port at the same time as the detection, classification and tracking of underwater and surface intrusions in real time and with a very low false alarm rate; All of which must be linked to a highly automated control and decision center. This sub-segment is strongly oriented by the implementation of the ISPS code which specifies the roles to be played by each of the actors involved in securing maritime activities, namely governments, port authorities and ships. In this context, it should be noted that the protection of the water body as such is rarely differentiated from a more global security approach to the port, which may leave room for actors already recognized in integrated water control systems. Access to land.

This segment also includes the more emerging market for the close protection of offshore or offshore sites: oil infrastructure and ships, which must deal with targeted terrorism or piracy.

Surveillance of areas on the high seas: fishing zone, piracy zone, etc.

The objective is to cover farther, more widely and for a longer period of time the maritime zones which are observed today only in a punctual way.

Even if not all the needs are covered by actual financing solutions, the annual global market that can be addressed by MS actors (excluding ships, planes, helicopters, satellites, etc.) can be estimated at 500 million euros per year on average over the next few years. Beyond the figure, new economic models are to be envisaged with the effective implementation of solutions to meet the needs of the contractors.

Thanks to the PROTEUS project, PMM will be able to source technologies, products, solutions in the domain of competence that are less known by our members.

PMM members will have also the opportunity to propose their solution, their products and their collaborations to the other European State in a win-win strategy.

Focusing on our best expertise in each state is a good way to offer to Europe new opportunities for this global market.

7.2.2. ITALY

The sector identified as most prominent one for the Italy National MS Node in PROteuS, is **maritime security and safety**, **fisheries control, marine environment and customs**. The criteria used for the selection of the focus sector are:

- Number of actors operating in the sector according to the National Mapping (main selection criterion).
- Ability to reach the actors selected and availability to be involved.
- Capacity of the sector to meet trends and megatrends identified (additional selection criterion).

The megatrends process is one of the key ways in which we gain insights that support our project objectives. The process helps us to better understand the challenges and opportunities that Consortium's members face so that we can effectively respond to their needs.

With regards to Maritime Surveillance, taking into account the global trends identified, the megatrends that appear to be most closely are:

- **Digital future**

Naval power will double in 2030, although navies will only maintain and refresh the numbers of platforms and personnel, rather than expanding them. This escalation in naval capability suggests that there are growth opportunities for the naval sector in systems capability rather

than platforms or people. The growth of automation, sensor integration, cyber security and related technologies will help to determine the nature of future naval power.

The technological aspect is considered vital for maritime surveillance, since the sector is largely based on electronic systems. Drones, IoT, Cyber-security and Artificial Intelligence are expected to have a large impact in many sectors in the near future, leading the world into a digital future and creating opportunities for many ICT based companies.

- **Global marketplace**

Globally, the volume of seaborne trade will double from nine billion tonnes per annum to somewhere between 19 and 24bn tonnes by 2030. China will play a key role in 2030 as the emerging maritime superpower in shipping. China will see the largest growth in commercial fleet ownership, rivalling Greece and the rest of the European countries combined. China will become the world's primary maritime market, leading in seaborne trade, shipbuilding and vertically integrated ownership and ship management. The economic development of India follows closely behind China, and it is expected to become a giant driver of global trade in an order of magnitude similar to China.

The focus of global growth has shifted to the East and to the South, but international trade will continue to grow unabated. This will create more powerful national economies in different regions with greater resources to protect, and greater resources available to invest in defense and security. That means to adapt and to develop new patterns to manage future security activities in the MED area particularly with north Africa.

- **Urban world**

The number and scale of cities continues to grow across the globe.

The explosion in urbanization will present tremendous challenges for law enforcement, intelligence and internal security. The most of these cities are situated long the sea coast, this also implies implementation of activities which impact at environmental level: increasing of pollution with consequently major risk for the fishing stock and human safety. Not only, the powerful mega-cities continue to proliferate with important consequence on national defence and security.

- **Resourceful planet**

Oil and natural gas is expected to account for 60% of global demand for energy in 2030. Advances in technology, underpinned by innovation, research and development will be the keys to meeting the growing demand for energy from more diverse sources. The number of offshore platforms and renewable energy devices required to meet global demand will grow significantly. This indicates growing challenges and opportunities to produce offshore oil and gas, and offshore renewable energy.

The application of new technologies, as well as the shifting supply environment, will drive business model adaptation and innovation in multiple sectors, as well as impact the geopolitical balance of power. That imply change of international trade related to raw materials, as a consequence new security and safety risks of activities carry out sea.

7.2.3. SPAIN

The maritime surveillance subsector **"Defense"** emerged as the most prominent one in relation to the following criteria: 1. No of key actors operating in the field, 2. Innovation and R&D ecosystem in the region, 3. National and Regional Strategies and main trends.

The Spanish defense sector is dominated by strong private for-profit large companies with vast experience and know-how, employs a large percentage of the population and was identified as a sector of major importance for the country. Furthermore, the data collection for the sector showed that a significant amount of investments are made and the trend growing.

As already presented earlier in the report, the aerospace and defense sector is already widely developed in Spain. The industry accounted for about 850 companies in 2010, generating over 18,000 direct jobs and a joint turnover of €3.6 billion (40% is exports). The sector is characterized by its high growth and its significant investment in R&D, which in 2015 amounted to 11% of the turnover of the sector.

Finally, concerning the rest maritime surveillance sectors analyzed, as second emerged the "Maritime Security and Safety" which will also be considered within the framework of PROteuS, but will be treated as additional sector to "Defense".

With regards to Maritime Surveillance, taking into account the global trends identified, the technological megatrends appear to be most closely related and more specifically the following trends:

- Digital Transformation and Proliferation of Data.
- Cyber Threats and Data Security.
- Digital and Robotic Technologies.
- Artificial intelligence (AI).
- Augmented Reality and Virtual Reality.
- Drones.
- Internet of Things (IoT).
- 3D printing.

The technological aspect is considered vital for maritime surveillance, since the sector is largely based on electronic systems. Drones, IoT, Cyber-security and Artificial Intelligence are expected to have a large impact in many sectors in the near future, leading the world into a digital future and creating opportunities for many ICT based companies. At the same time,

those opportunities constitute challenges for the companies to adapt and follow the global trends before they will be already considered outdated and enter first-to-market competitive added-value products.

7.3. FINAL CONCLUSIONS & PROPOSED SYNERGIES

Following, a set of synergies, which is the outcome of the comparative analysis has been elaborated, taking under consideration the identified institutional, financial and technical capacity building potential of the study areas. Particularly, the main factors that are taken under consideration are:

6. The identified prominent MS sector per reference country;
7. The identified challenges and threats for each reference country;
8. The identified strengths and opportunities;
9. The involved stakeholders/actors capacity building potential;
10. The identified clusters, best practices and initiatives of the reference areas.

The key findings that can be concluded from the analysis are the following:

- All the countries have identified key private & public stakeholders that are related to MS sectors and can play a crucial role in the establishment and the operation of both MS national Nodes and transnational MS cluster.
- The area of reference in France has the highest RDI performance and potential compared to the other areas.
- All the countries of reference have presented several initiatives and best practices related to MS which should be further valorised for the purposes of the project and the establishment/operation of the National MS Nodes and Transnational MS Cluster.
- Marine Security and Safety is the MS Sector that is described as prominent by most of the countries.
- Marine Security and Safety is the sector with the most involved stakeholder's compared to the others.
- All countries of reference have to face economic obstacles: lack of funds for investments, high cost of vessel's operations, increased ICT cost.
- In most cases, there is lack of well defined structures for maritime clusters.
- There are obstacles in the Legal Framework (e.g. incompatibility) of the countries in order to ex-change MS data.
- The sharing of Information between sectors and countries is limited.
- Bureaucracy and delays were mentioned in public procurements due to the public nature of the MS sector.
- Mediterranean sea links over 20 countries from Asia, Europe and Africa, constituting the cooperation a big challenge.

- Due to the lack of a secure environment on the seas, maritime activities are being compromised.
- The market of security and surveillance products is fragmented because of sectoral, institutional and legal differences within and between EU Member States.

Proposed Synergies

- The successful operational and structural model of the best practices Clusters should be taken under consideration when outlining the methodology for the establishment of the transnational MED MS cluster.
- The factors that will contribute to job creation through Blue economy should be further examined through cross-border cooperation and by exchanging knowledge and best practices.
- The development and the valorisation of financial tools in order to address funding challenges and difficulties. Systematized private-public partnerships will maximize the private and public capital flow contributing to further development and valorisation of RDI capacity related to MS that could potentially contribute to job creation.
- Improve capacity building of the indentified stakeholders/actors related to MS through the exchange of existing knowledge and experiences.
- Identification of obstacles and inconsistencies of existed legislation and define policy recommendations.
- The development of a favourable investment environment for the enterprises related to MS.