FANBEST PROJECT

WP4. Action 4.2. Analysis of the potential of Atlantic R&D+i for blue growth
Title: Analysis of the potential of R&D and financial situation on Blue Economy companies
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Report versioning		
Version	**Date**	**Modified by**
Patenting data collection	09/11/2020	Raul Ríos
Draft outline	18/11/2019	Adrián Dios-Vicente
Draft 1	08/01/2020	Adrián Dios-Vicente, Raul Ríos, David Rodeiro-Pazos
Draft 2	22/01/2020	Amita Guneratnam, Helena Mcmahon, Morgan Raffray, Yoann Nesme, Emanuel Mendonça, Daniel Depellegrin
Final Draft	24/02/2020	Adrián Dios-Vicente, Raul Ríos-Rodríguez, David Rodeiro-Pazos

This report documents deliverable 4.2. of the FANBEST project. The present work has been carried out within the FANBEST Project (Funding Atlantic Network for Blue Economy Technology Transfer; EAPA_1022/2018) which is funded by the Atlantic Area INTERREG Programme through the European Regional Development Fund (ERDF).

This report may be cited as:

Dios-Vicente, A., Ríos, R., Rodeiro-Pazos, D., Nesme, Y., Depellegrin, D., Raffray, M., Guneratnam, A., McMahon, H., Mendonça, E. (2021). Analysis of the potential of R&D and financial situation on Blue Economy companies. FANBEST Deliverable 4.2. Web: https://fanbest.eu/, DOI: 10.5281/zenodo.4596434.

Partners:

List of Acronyms

BE: Blue Economy

COIN: Colegio Oficial de Ingenieros Navales y Oceánicos

EBITDA: Earnings Before Interest, Taxes, Depreciation, and Amortization

EPO: European Patent Office

EU: European Union

FR: France

FRCT: Fundo Regional para a Ciência e Tecnologia

GMCC: Great Manchester Chamber of Commerce

IE: Ireland

MSFD: Marine Strategy Framework Directive

NUTS: Nomenclature of Territorial Units for Statistics

OEPM: Oficina Española de Patentes y Marcas

PT: Portugal

R&D: Research and Development

SDG: Sustainable Development Goals

SP: Spain

TRL: Technology Readiness Level

UK: United Kingdom

UN: United Nations

USC: Universidade de Santiago de Compostela

WB: World Bank

WEF: World Economic Forum

WWF: World Wide Fund for Nature

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Summary

The present report is developed as the final deliverable for Activity 4.2. of the FANBEST Project (Funding Atlantic Network for Blue Economy Technology Transfer; www.fanbest.eu). This action is part of the W.P.4, related to the identification of the financial needs to propel Blue Economy innovation in the Atlantic Regions, being 4.2. the Analysis of the potential of Atlantic R&D+i for blue growth.

This document is based on a sample of 610 companies creating a panel data to perform a descriptive analysis in terms of patenting activity on Blue Economy companies and financial evolution of Blue Economy firms. Results show that the Blue Economy in the Atlantic Area has had an important capacity to innovate in the last two decades, where bigger companies were the ones capturing to a greater extent its potential benefits, and strong differences exist between regions in terms of company characteristics and innovative capacity.

1. Introduction

Blue Economy has become a key concept to understand new possibilities to boost growth and economic development using the Oceans, overcoming the traditional views for marine activities, particularly considering environmental effects as essential. Blue Economy effects are relevant not only in terms of wealth but also for their impact in the work market, labor and organization of the territory, especially in coastal regions. Around 80% of the global trade's volume is transported by sea with global ocean economy valued at 1.5 trillion dollars annually. New avenues for crude oil production will come from maritime exploitation.

These elements attract an increasing attention from market and public institutions to create a correct framework to develop Blue Economy and to boost potentialities for their activities. Particularly, the Atlantic Area has important interests in Blue Economy, since marine activities are crucial to ensure growth in the long term for coastal communities. On this basis, public policy can be implemented to reach objectives of growth and socio-economic development.

Over this general framework is where FANBEST Project aims to contribute. Even through the main objective of the project is related to connecting companies, financial resources and innovation, it is also critical to analyze current status of Blue Economy in the region. In that sense, a first initial report was developed in FANBEST to characterize the Blue Economy in the Atlantic Area (Depellegrin et al, 2020).

This second report aims to characterize Blue Economy in the Atlantic Area from a different perspective, related to the innovation potential. Literature shows that innovation becomes a crucial element for companies to survive and improve their performance (Hong et al, 2012). Consequently, it is relevant to understand the current capacity for companies to develop innovative strategies to support Blue Economy in the long term. At the same time, is not enough to study innovation itself, setting a secondary objective: to describe the financial situation of firms related to Blue Economy, showing growth evolution in the last decade and potentialities for new growth.

To fulfill these two objectives a sample of companies that have their main activity is related to Blue Economy was created, developed by the ten members of the FANBEST Project. A mixed approach was used, based on direct contact to companies, primary and secondary sources, interviews and tele-meetings, formed by 610 firms and research institutions. For the first objective, innovation is measured as patenting activity. At the same time, a second sub-sample was created to analyze the current financial situation, by creating a panel data based on 280 companies and 2147 observations.

This document is organized as follows: second epigraph is related to Blue Economy and its definition and activities related, the Atlantic Area and FANBEST Project, while third one shows the construction of the sample and the methodology. Forth section shows

the results in terms of innovation and fifth in terms of financial evolution, whereas sixth and seventh paragraphs develop the main conclusions and recommendations.

2. Blue Economy

Blue Economy (BE) became one of the biggest new concepts to escort economic growth and development. The extraordinary increase of popularity of BE is fundamentally a recent event, modifying traditional perspectives on using marine resources and integrating key concepts like sustainability to make these uses rational in a long term. This process of new theoretical approaches is settled in the complexity of the ocean's activities, since they are an important source of energy and minerals, feed for animals, food for humans, a relevant transport vector and a fundamental space for multiple industrial and economic activities (Smith-Godfrey, 2016), providing food to more than 3 billion people (World Bank & United Nations Department of Economic and Social Affairs, 2017).

At the same time, BE is the bench for economic activity representing the equivalent of GDP of the seventh economy of the world (Hoegh-Guldberg, 2015) and with huge expectations of growth, since the ocean economy is expected to double between 2010 to 2030, contributing on US$3 trillion to the world economy (Bennett et al, 2019). Furthermore, technological advances increase the possibilities to industrialize oceans like humans did in land in the past (Golden et al, 2017).

Precisely the novelty of the concept creates a first methodological and theoretical bottleneck: the definition of BE is in discussion and not free of debate from different perspectives (Keen et al, 2018). In this sense, we can find two main sources: academic and institutional ones. The first group is characterized to be developed by academics and experts; the second group is also essential since regulation will mostly be focused on these interpretations of the BE.

Table 1. Definition of BE by some institutions

Institution	Year	Definition
UN	2012	Blue Economy refers to the de-coupling of socio-economic development from environmental degradation. In this regard, efficiency and optimization of natural marine resources within ecological limits becomes paramount.
WB	2017	The sustainable use of ocean resources for economic growth, improved livelihood, creation of jobs and preserving the health of ocean ecosystems.
EU	2019	All the economic activities related to oceans, sea and coasts.
WEF	2019	Investment that should ensure that the economic development of the ocean contributes to a true prosperity, today and long into the future.
UN	2019	Economic activities that comprise of economic sectors and policies that determine whether the use of the ocean is sustainable.

FANBEST	2020	The economic activities that derive direct and/or indirect economic and social benefit from the existence and utilization of the ocean.

Sources: UNCTAD (2014), European Commission – Maritime Affairs and Fisheries (2017), WEF (2019), UNEP FI (2019), Depellegrin et al (2020).

Since Blue Economy[1] was defined for the first time in the United Nations Conference on Sustainable Development that was held in Rio de Janeiro in 2012, different relevant institutions developed their own definitions with their own approaches. Clearly, BE is focused on ocean resources, but this first idea can be complemented. The EU (2019) accepts this general approach, which admits that Blue Economy can be understood as the whole marine economy (Wenhai et al, 2019).

On the other hand, the very first definition of BE also includes an ecological perspective, trying to solve the traditional problem between socio-economic development and environmental degradation (Smith-Godfrey, 2016). Other institutions add elements related to sustainability as a key point to develop BE instead of just economic activities related with the oceans (WB, 2017; UN, 2019), since WB (2017) and WEF (2019) also include elements related to goals of the BE development, like job creation or long-term prosperity, while other authors (Smith-Godfrey, 2016; Van den Burg et al, 2019) also includes industrialization as key concept on BE.

At the same time, there are significant differences inside sustainable definition: while some of them explicitly assume the idea of protecting the ocean ecosystems in the long term (Goddard, 2015; Golden et al, 2017), other kind of definitions focus their interpretation under the idea or reducing consumption or environmental risks (Steffen, 2012). Even this second type is also interesting, this reduction can be not enough for long term environmental protection. In this sense, some authors even point out that BE growth and increasing the economic returns can be harmful for oceans sustainability (Bennett et al, 2019). Furthermore, we can identify stakeholders that formally take part of BE but they are not aligned with the UN Sustainable Development Goals (SDG)[2], even the relation between BE and SDG is higher than regular companies and SDG (Lee et al, 2020).

Considering these different approaches, this document will follow the previous definition developed by Depellegrin et al (2020) on another FANBEST document: we understand **Blue Economy as the economic activities that derive direct and/or indirect economic and social benefit from the existence and utilization of the ocean**. As we can see, sustainability is also relevant in this definition.

In this sense, this approximation is not exempt of problems, particularly once research is done to understand the scope of BE and his impact on economic development, since

[1] Also known as Ocean Economy in this first document.

[2] Even some of the SDG are related to BE, number 14 has a specific importance: *conserve and sustainable use the oceans, seas and marine resources.*

little information can be used framed on this definition. Blue Economy is related to a particular sustainable way to use marine resources, not with a unique specific economic sector, hindering the obtainment of data and information. This particular idea obviously creates problems to quantify BE and its effects in the economy[3].

2.1. Sectors, activities, and Blue Economy

Therefore, once BE is defined, another challenging debate arises. Since BE is not only a sector, it is difficult to identify correctly what kind of activities are within. Of course, this evaluation will be different when we use different definitions of the concept. Following this idea, academics and institutions try to catalog BE activities using their own criteria. Thereby, first approaches made by the UN simply point basic BE activities: fishing, aquaculture, coastal and marine tourism and research activities (UNCTAD, 2014).

From this initial point of view, a new and more complex structure was developed to identify BE activities based on the idea that traditional land activities are moving their action to the oceans (Smith-Godfrey, 2016), creating a new ocean value chain, formed by five categories:

A) Harvesting of living resources, where we can find different traditional activities like aquaculture and mari-culture but also emerging ones like pharmaceutical and chemical industries.
B) Extraction of non-living resources, especially mining.
C) Generation of new resources, focus on energy and water.
D) Trade of resources, most of them being traditional marine industries like transportation of resources, transport, trade tourism and recreation. New activities can arise, like eco-marine tourism or marine real estate development.
E) Resource health, where some activities should be developed to maintain ocean ecosystems in the long term, like surveillance, monitoring, coastal governance and ocean management.

In a similar way, Golden et al (2017) developed another categorization of components of BE that we can find in Table 2, complementing this initial structure.

[3] Another problem related to information is pointed out by Golden et al (2017): the needs of open access to ocean-use data, liberating historically property information like in land-based life cycle, where some information is developed by companies engaged in specific sectors of the economy.

Table 2. Components of the ocean economy

Type of Activity	Ocean Service including R&D	Economic Sector industry
Harvesting of living resources	Seafood	Fisheries and aquaculture
	Marine Biotechnology	Pharmaceuticals, chemicals, etc.
Extraction of non-living resources, generation of new resources	Minerals, sand and gravel	Seabed Mining
	Energy	Oil and gas Renewables
	Freshwater	Desalination
Construction of the built environment excluding ports		Airports, defense structures (South China Sea), cities (Palm Island), bridges
Commerce, tourism and trade	Transport and trade	Shipping Port infrastructure and services
	Tourism and Recreation	Tourism Coastal development
Ocean Observation and forecasting	Instrumentation and personnel	Electronics, research
Indirect Contribution to economic activities and environments	Carbon sequestration	Blue carbon (that is, coastal vegetated habitats)
	Coastal protection	Habitat protection, restoration
	Waste disposal for land-based industry	Assimilation of nutrients, solid waste
	Existence of biodiversity	Protection of species, habitats

Source: Own elaboration from Golden et al, 2017.

We can find two characteristics of this organization of BE activities: firstly, not every component creates markets, but every activity impacts the oceans. That means that even if commercial or industrial activities are clearly focused to the market, other activities focused on the sustainability of the ocean in the long run will also be developed, not always through market instruments. Secondly, most activities being developed in the oceans within BE are also traditionally developed inland (like chemical or pharmaceutical), which renders difficult the segmentation of some BE activities, because the main difference comes from the space where the activity is developed, not the activity itself. Most of the statistical systems are not prepared to provide this kind of data yet.

From a geographical point of view it is also relevant to point out that many BE activities, particularly related to R&D and innovation, are urban activities that need specific facilities. In this sense, it is important to remark that BE is focused on marine and coastal activities but some of the activities are settled inland and probably far away from the population that directly carries out most of the BE activities, which means that losers and winners from BE are not clear in the territory.

Over this academic organization of BE, EU also creates its own characterization, that has evolved in the last decade. The very first interpretation was created in 2012 (European Commission, 2012), which identified 18 distinctive activities[4] from coastal tourism to ocean renewable energies. It focuses on potential growth in five value chains due to their opportunities on job creation and innovation. This value chains are focused on blue energy; aquaculture; maritime, coastal and cruise tourism; marine mineral resources and blue biotechnology.

From this initial point of view, activities taking part in BE had slightly changed on EU analysis, as we can see in recent reports (European Commission, 2019, 2020), introducing a first division in established and emerging sectors. In this sense, EC is still focused on the idea of pointing key sectors to boost development though innovation. Established sectors are marine living resources, marine non-living resources, marine renewable energy, port activities, shipbuilding and repair maritime transport and coastal tourism. As we can see, most of these activities are basically traditional marine industrial activities. On the other hand, the second group of activities are ocean energy, blue bioeconomy and biotechnology, desalination, marine minerals, maritime defense and submarine cables. In this sense, EU does not analyze in its report's activities outside the market, related to ocean observation, forecasting or coastal protection. On the other hand, the EU has come up with several initiatives to increase the importance of Blue Economy and co-operation among member states along with information portals and schemes for the benefit of companies wherein they could be established or start-ups and SMEs

Considering all these approaches, this document follows the last FANBEST Project report developed by Depellegrin et al (2020), identifying five sectors: aquaculture, coastal tourism, seabed mining, ocean energy and marine biotechnology. At the same time, a sixth group identifies BE sub-sectors based on the EC (2012) initial segmentation.

2.2. Atlantic Area

Since Atlantic Area represents a major economic and social interests for the European Union, the European Commission (2011, 2013) approved a specific strategy to develop

[4] Eighteen activities are: coastal tourism, offshore oil and gas, Deepsea mining, short-sea shipping, yachting and marinas, passenger ferry services, cruise tourism, fisheries, inland waterway transport, coastal protection, offshore wind, monitoring and surveillance, blue biotechnology, desalination, aggregates mining, marine aquatic products, marine mineral mining and ocean renewable energies (European Commission, 2012).

this region. We can find five countries inside it: France (FR), Ireland (IE), Portugal (PT), Spain (SP) and the United Kingdom (UK). At the same time, not every region of each country takes part of the Atlantic Area, so a regional subdivision should be done. Using EU NUTS (Nomenclature of Territorial Units for Statistics) division, we can find 36 regions:

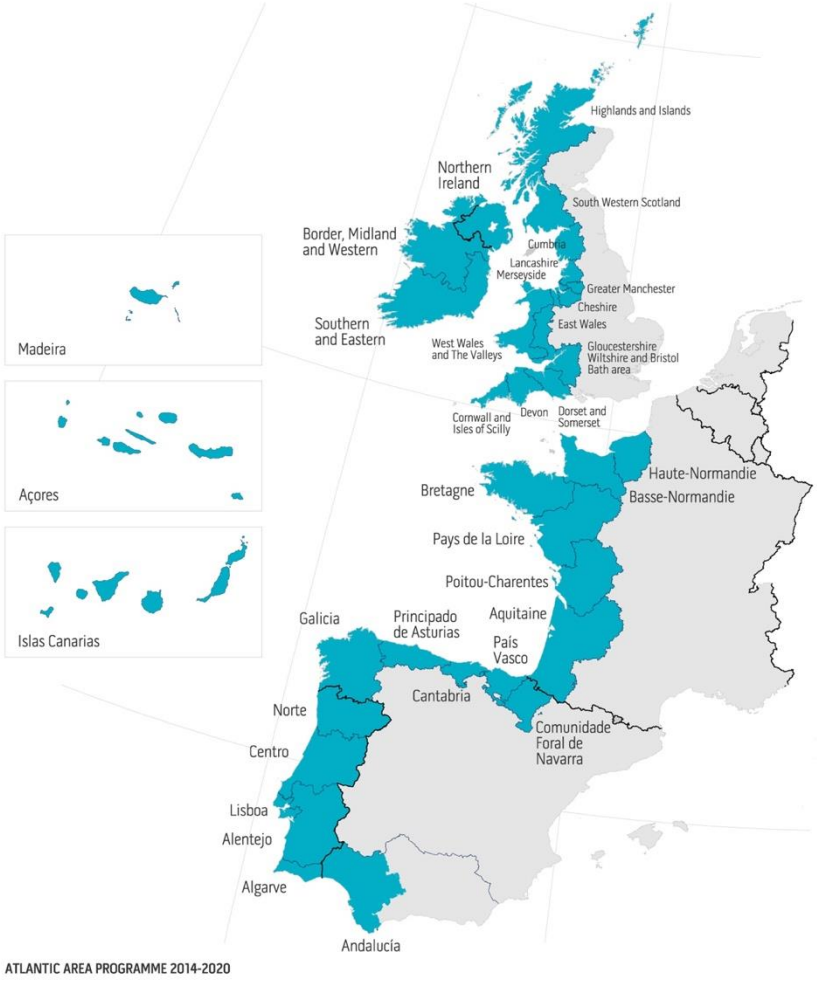
Table 3. Atlantic Area Regions

Country	Regions
France	Haute-Normandie; Basse Normandie; Pays-de-la Loire; Bretagne; Poitou-Charentes; Aquitaine.
Ireland	Border, Midland and Western; Southern and Eastern.
Portugal	Norte; Algarve; Centro; Lisboa; Alentejo; Açores; Madeira.
Spain	Galicia; Principado de Asturias; Cantabria; Navarra; País Vasco; Andalucia (Huelva, Cádiz and Sevilla); Islas Canarias.
United Kingdom	Cumbria; Cheshire; Greater Manchester; Lancashire; Merseyside; Gloucestershire, Wiltshire and Bristol/Bath area; Dorset and Somerset; Cornwall and Isles of Scilly; Devon; West Wales and The Valleys; East Walles; South Western Scotland; Highlands and Islands; Northern Ireland.

Source: Atlantic Area (2020).

Following the initial stages of development of this framework in the Atlantic Area, the European Commission (2013) valuates a potential to create 7 million marine and maritime jobs in a coastal length of 20.585km and 700.000 km^2 of catchment area where more than 1.100 species of fish can be found, 10% of them being captured directly or incidentally (OSPAR Commission, 2000). At the same time, deterioration of the Atlantic Area also drew attention on European institutions (Johnsen et al, 2002), leading to the Marine Strategy Framework Directive (MSFD) on 2008 (European Commission 2008), which also accompanies Blue Economy development.

Figure 1. Atlantic Area



Source: Atlantic Area (2020).

2.3. FANBEST Project

One key aspect of the development of Blue Economy in the Atlantic Area should be based on innovative activities (European Commission, 2012), although the business environment faces some problems to reach this goal. In this sense, this business environment is composed mainly of SMEs, hindering this innovative process. Following this main idea, another two factors appear:

a) Disconnection between the business environment and the innovation system and lack of knowledge from both sides. Market agents are unfamiliar with the lines of research and their results. On the other hand, research centers have little knowledge about the market and the business potential of their findings.
b) Difficulty for the Atlantic Area companies linked to the maritime economy to access external financing to undertake innovative projects and developing value products.

This situation can block their possibilities to grow, to move forward to the "scaling up phase" and to become more competitive in the global market. Under these circumstances FANBEST is aimed to foster the technology transfer to SMEs in blue biotechnology and exploitation of marine resources by creating a network of public and private entities focused in fund raising that would enable the start and scale-up phases. Sources such as venture capital, business angels, participatory loan or crowdfunding will be offered by tools and services, so that the technologies and innovations "made in Atlantic regions" can reach the market and hopefully evolve into successful business projects (FANBEST, 2020).

The Interreg Atlantic Programme is funded by the European Regional Development Fund (ERDF) under the European Territorial Cooperation objective of the European Union Cohesion Policy for the programming period 2014-2020.

2.3.1. Objectives of the Project

Improving the information about the financing needs and the potential of technology transfer, with special attention to projects led by women.

Taking advantage of the knowledge and opportunities that represent business angels and other not banking financing agents like crowdfunding platforms for SMEs of the maritime economy that do not have the necessary size to access to R&D projects investment.

Improvement of skills and abilities of the support services for entrepreneurs and spin-offs so that they can facilitate the fund raising for innovative projects and positioning the universities as agents that become agents connected with the necessary funds and financing support for innovation.

Exploration and exploitation of university R&D in all their potential. This network will facilitate and coach that the research outputs reach the market in the form of new commercial products or innovative services, provided by SMEs located in Atlantic regions.

Increasing the funds and financial instruments available for innovation and scaling up in SMEs linked with marine resources sustainable exploitation.

2.3.2. FANBEST Services

a) **Training Programme**. This programme is based on the idea of enhancing the capacity of advisers and support services in fundraising for technology transfer. The programme mainly targets two types of beneficiaries located in the European Atlantic Area: consultants/trainers of incubators and accelerators, development agencies, knowledge transfer department of universities, etc; any entrepreneur, researcher and manager with an interest in the Blue Economy. This task corresponds to an online training programme aimed at improving knowledge on financial support and good practices applicable to start-ups (including spin-offs) and larger-scale enterprises in the blue economy.

b) **Stock Market**. A website for the transfer of innovations and technologies of the Blue Economy in the Atlantic Area. The purpose of this portal is to know about technologies and innovations close to market originated from marine and maritime resources and with a great potential for industrial use. Also, with a directory of investors potentially interested in investing on these technologies and innovations. In short, it is a meeting point between R&D+i entities, technology centers, companies and startups related to the Blue Economy and investment entities potentially interested in making the BE an Atlantic Area competitiveness pole.

c) **Virtual Business Missions**. The project will organize some webinars to enhance the knowledge across key stakeholders on the opportunities offered by the blue sector and facilitate “virtual” platform for innovative projects promoters and investors or mentors, as well as for companies to exchange best practices and develop commercial links.

d) **Investment coaching**. This activity aims to coach selected projects in Blue biotechnology and/or marine resources, particularly SMEs that are trying to scale up or projects that are going to be launched. At the same time, the project will also check the success of the financial instruments set and the funded innovation projects during the first year.

e) **Stakeholders Map**. Since Blue Economy is not a sector itself it creates a major challenge to correctly identify agents taking part of BE activities. In this sense,

FANBEST Project aims to create a map to solve this situation, also accompanied by a set of conclusions and recommendations about this stakeholder landscape.

2.3.3. Objectives of the report

The present document represents the deliverable of the activity 4.2. of the FANBEST Project, taking part of the Working Package 4: Identification of the financial needs to propel innovation in Blue Economy in Atlantic Regions.

Following this general idea, the aim of the study is double. On one hand, to identify the private R&D+i though examining BE companies in the Atlantic Area analyzing their patenting activity. To avoid overrepresentations, only firms whose core activity is related to BE are going to be considered. On the other hand, to describe the financial situation of BE companies and R&D impact on them, specially focused on the growth capacity of the firms.

2.4. Innovation as tool for growth

As mentioned above, the EU focuses on their BE policy based on innovation as a tool to growth and firm survival (Hong et al, 2012, Mansury and Love, 2008). In the long term, betting on technology can increase efficiency, competitiveness and allow European companies to improve positions in the market (Esteve-Pérez et al, 2004; Gálvez and García, 2012; Ortega-Argilés and Moreno, 2007), since innovation can allow companies to deal with external changes (Christensen, 2013) or increase profits (Baltar et al, 2012), which become particularly crucial in the current COVID context. Following up on this idea, this document tries to analyze growth for BE companies.

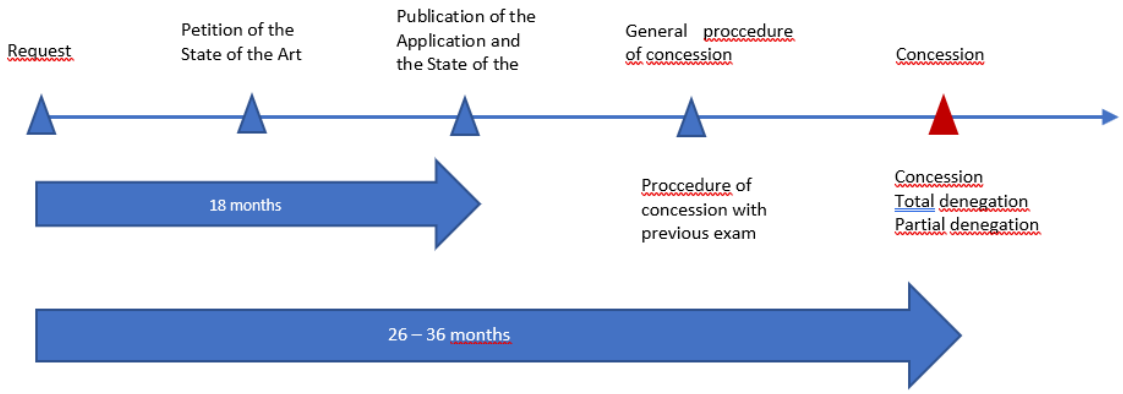
However, measures of innovation are complex (Dahlstrand, 1997; Leijpras, 2012), since there is no accounting record to precisely cover innovation inside companies and institutions (Buddelmeyer et al., 2010). In this sense, there are different mechanisms to solve this problem, being a common one to analyze patents and patenting activity (Dahlstrand, 1997; George et al., 2002; Löfsten and Linderlöf, 2005; Yagüe-Perales and March- Chordà, 2012; Fernández-López et al, 2020b).

Patents can be defined as “physical, codifiable manifestations of innovative ideas, techniques, and products that embody the knowledge of one or several employees” (Decarolis and Deeds, 1999. p.6), being representative elements of the knowledge of the company and a measure of diffusion of this technology (Löfsten and Linderlöf, 2005). Once patented, it is supposed that companies will use this patent to improve products or processes on its productive chain (Yagüe-Perales and March- Chordà, 2012). This is important for a company better performance and because external agents, such as risk capital managers, can learn about the effort and success of technology changes inside the company (George et al., 2002), generally showing growth potential and increasing their future profitability (Rodríguez Gulías, 2014) when the technological progress of the company rises (Grant, 1996).

On the other hand, it is also important to face a relevant limitation using patenting as a tool to analyze innovation. There are companies that carry out innovative process but decide not to patent then even when they succeed, using alternative mechanisms like industrial secrecy, underestimating innovative results inside the company (Cantner and Goethner, 2011). At the same time, some companies can decide not to patent since it is an expensive and long process or just sign cross collaborations with research institutions and Universities to use patents created outside the company, underestimating, again, the innovative potential inside companies (Bonardo et al, 2009).

Another relevant point is that patenting is a long process, sometimes close to three years, as we can see in the Figure 2. In this sense, companies need to use an important number of resources and time to obtain the patent.

Figure 2. General Procedure of concession of patents



Source: Based on the available information on the website of the Oficina Española de Patentes y Marcas (OEPM, www.oepm.es).

Considering these elements related to innovation process and patenting, two ideas are also relevant. On one hand, size becomes a crucial factor to understand possibilities to innovate, because smaller companies will have fewer resources to start innovation processes, and probably patenting becomes difficult in terms of time and amount of resources needed to apply the innovations. This idea indicates the existence of a minimum efficient size to start innovative and patenting processes. In this sense, larger companies will find it easier to innovate, SMEs also benefit from the patenting process when compared to other non-innovative SMEs (Andries and Faems, 2013). However, in the early stages of the life cycle, small firms have higher potential to innovate (Acs and Audretsch, 1987), which becomes relevant since BE includes some new activities with growth potential.

Related to this, BE is a huge field with different sectors and activities with specific characteristics. These characteristics also affect innovation process, where some activities have higher potential to innovate than the others. European Union itself recognize this situation (European Commission, 2012), detailing five activities with the most potential to be more innovative and help in job creation:

a) Blue Energy: key to reduce greenhouse gas emissions, focusing special attention on offshore wind. At the same time, other technologies should be developed to increase green energy production related to oceans, like tidal barrage, wave power devices and ocean thermal energy conversion.
b) Aquaculture: aquaculture has seen tremendous growth as it contributes more than 50% of the total fish captured. However, in a geographically concentrated process in Asia, since the European Union is not being able to increase its production. It is important for EU aquaculture sector, based on SMEs, to be capable of taking part in this favorable evolution of the sector, since wild fish markets have collapsed during the last few years and he only way to increase fish production has come to be through aquaculture, which means that this an activity with growth potential due to the increase in demand for fish in the global markets.
c) Maritime, coastal and cruise tourism: even most of the companies that act in these sectors are micro businesses, more than 2.3 million people work in these activities, representing more than 1% of the total employees in European Union and the largest maritime economic activity, being the key for economics independence for lots of communities. In this sense, tourism becomes a crucial activity for the European economy and, of course, inside BE, which implies that environmental control is fundamental to ensure these activities can still operate in the long term. At the same time, it is also important to notice that maritime, coastal and cruise tourism is a mature sector, with a huge impact on the economy but with less potential for growth than other BE sub-sectors. In a similar way, potential to innovate, specially through patenting processes, becomes difficult.
d) Marine mineral resources: This sub-sector is relevant in several ways. Firstly, because rising of mineral prices produced on land is slowly becoming a huge problem for consumers and companies across the European Union. Secondly, because imports can suffer cut offs on critical minerals for European economy. Thirdly, because operating mining in deep waters has potential environmental implications that can threaten other BE activities. Lastly, because sea mining is an absolutely new activity and legal implications are still unknown. Considering these elements, it is also important that cost structure of this new production can make difficult its development.
e) Blue Biotechnology: oceans can provide marine organisms different from fish and shellfish, obtaining critical new inputs on different activities related to biotechnology, like industrial enzymes and pharmaceutical. These activities face a different position from the maritime and coastal tourism: Currently Blue Biotech's economic impact is limited, but due to its potential for growth, specially through innovation and creation of high skilled workers makes this a key sub-sector for any BE strategy.

As we can see, not all BE activity have the same potential for growth or to innovate, also hindering the process to analyze BE, since internal differences are relevant. Particularly, it depends on the sector Technology Readiness Level (TRL) and its maturity, inducing different effects in several ways. First, due to its impact on financing BE activities, since public participation is justified if institutions are trying to develop emerging sectors. On the other hand, in mature sectors public financial activities should focus to maintain business as usual and adapt them taking into consideration environmental constrains, new restrictions and the sustainable exploitation of resources.

This statement is also useful in sectorial terms, since not every sector has the same market opportunities. On one hand, particularly coastal tourism is mostly driven by market demand and innovation will only be related to Tourism 4.0 and new services. Public finance participation will be useful in this innovation activities and mostly to support sector facing external impacts, as we can see today due to the COVID-19 crisis. On the other hand, emerging sectors with strong growth potential, like marine biotechnology, should be boosted by public institutions and public-private collaboration such as with research institutes and Universities.

3. Methodology

In this section we will explain how this work is developed, focusing our attention on the sample construction and the obtaining of data. Firstly, it is important to notice that this document tries to analyze two elements: innovative actions through patenting and financial evolution of BE companies. To develop this study a sample should be developed but, obviously, not every company will develop patents and not all the financial information can be obtained in databases. This implies that the sample can slightly differ from the first analysis to the second.

3.1. Sample

As we saw in the previous section, BE is not a sector neither an activity, making it difficult to quantify and obtain data about it. Having this into account, methodology is based on a mixed process to obtain data from direct contact to companies, primary and secondary sources, interviews and tele-meetings.

The first element to create the sample was to define what kind of entities we are going to analyze, accepting any firm, research center or public institutions (universities included) to create a first list. This work of list development was divided into the different partners taking part in FANBEST Project from a national level, as we can see in the next table. Since this process was developed by different partners, number of entities by country varies significantly, but ensures representation since are partners into the territory the ones which collect the data.

Table 4. FANBEST Partners involved on data collection by country

Country	**FANBEST partner**
Spain	Universidade de Santiago de Compostela (USC), Colegio Oficial de Ingenieros Navales y Oceánicos (COIN)
Ireland	Ryan Academy, Munster Technological University
United Kingdom	University of Exeter, Great Manchester Chamber of Commerce (GMCC)
France	Atlanpole, Vertigo Lab
Portugal	Orange Bird, Fundo Regional para a Ciência e Tecnologia (FRCT)

Source: Prepared by the author.

Table 5. Initial number of entities of the sample by country

Country	**Number of entities**
United Kingdom	89
Portugal	85
France	157
Spain	204
Ireland	191
TOTAL	726

Source: Prepared by the author.

After this selection was done, another review was necessary to correctly evaluate BE, discarding companies whose main activity was not related to Blue Economy. At the same time, Universities and research centers were also removed, since their activity is focused in several sectors outside BE, which ends in an overrepresentation of these institutions even though they were not specifically researching about BE. It is not possible to obtain patenting data from every research group, which preclude the identification of BE patents inside Universities.

The final sample was finally created with 610 entities, mostly private firms, from the five countries of the Atlantic Area, discarding 116 elements, particularly universities and other public entities where their fundamental scope is not Blue Economy, and few companies founded twice in the initial list.

Table 6. Definitive number of entities of the sample by country

Country	Number of entities
United Kingdom	35
Portugal	84
France	157
Spain	176
Ireland	158
TOTAL	610

Source: Prepared by the author.

3.2. Data Collection

After developing the sample, the data collection process started that were divided in two different actions. Firstly, every company or entity in the sample was searched in the EspaceNet European database, the biggest free patents database, provided by the European Patent Office (EPO). The objective of this process was to know how many patents were being registered by every company and when they started the process of patenting. It is important to notice that even if the database is European, country level legislation on intellectual property rights differs, leading to different mechanisms of patenting. To solve this problem, any patent or other intellectual property right was considered avoiding overrepresentations by country, also including utility model[5].

Data was collected following these rules: every IPR is generally written down from the beginning of the process due to the long period necessary to the final patent be published. In this sense, period will end in 2018 because EspaceNet has delays publishing the final information and use the last two years can distort the results (Rodríguez Gulías, 2014). At the same time, family of patents[6] will be considered only as one request (Rodríguez Gulías, 2014).

[5] Utility model does not exist in every European Union country but is an important intellectual property mechanism in some territories like Spain.

[6] Family of patents is the concept used to group the same patent requested in different countries, opening different processes of acceptance even it is the same technological proposal.

The patent search was started from the year 1955 simply because is the first year a patent related with Blue Economy was registered by any company of the sample. It is important to notice that since the sample is created by companies that still exist, number of patents can be overrepresented in last part of the period, but being Blue Economy conformed mostly by new activities, this effect has a limited impact on the results.

Secondly, financial information was also collected for private companies. Amadeus[7], common database used to collect financial information about firms (Déniz et al, 2017; Fernández-López et al, 2020a) was used. Given that Amadeus does not have information for every company[8], a new sub-sample was created, building a panel data with 2435 observations. A second review of this initial sample was done to delete any problematic data and outliers, following the path of the Table 7 and Table 8. These are financial elements commonly selected (Déniz et al, 2017; Fernández-López et al, 2020a) to avoid data that was incorrectly logged by companies or main SABI database.

Table 7. Final adjustment on Panel Data

Adjustment	**Number of Observations deleted**
Negative total assets	97
Negative intangible assets	1
Intangible assets > total assets	169
More than 15.000 employees	13
Operating Income <0	6
Exports > Sales	1
Other adjustment[9]	1
TOTAL	2147

Source: Prepared by the author.

Table 8. Subsample to analyze financial situation on companies from Blue Economy

Country	**Number of entities**
United Kingdom	27
Portugal	56
France	59
Spain	81
Ireland	57
TOTAL	280

Source: Prepared by the author.

[7] https://amadeus.bvdinfo.com/
[8] Particularly smaller companies cannot be index in Amadeus.
[9] Last adjustment was done in one Operating Income observation, being zero one year even the company shows profits in the whole period and sales in the rest of the years. Average value was created to solve this problem.

With all these modifications, the final sample was created with 2147 observations from 280 companies creating a panel data. Variables collected in Amadeus to develop the financial analysis are shown in the Table 9.

Table 9. Variables collected

Variables	**Definition**
Operating income	Gross Income – Operating expenses
Earnings	Total sales
Employees	Total number of employees
Total assets	Total amount of assets
Export sales	Total sales on foreign markets
EBITDA	Earnings Before Interest, Taxes, Depreciation and Amortization

Source: Prepared by the author.

These variables were selected to analyze different characteristics of the companies as incomes (operating income, earnings), size (employees and total assets), export capacity (export sales) and profits (EBITDA).

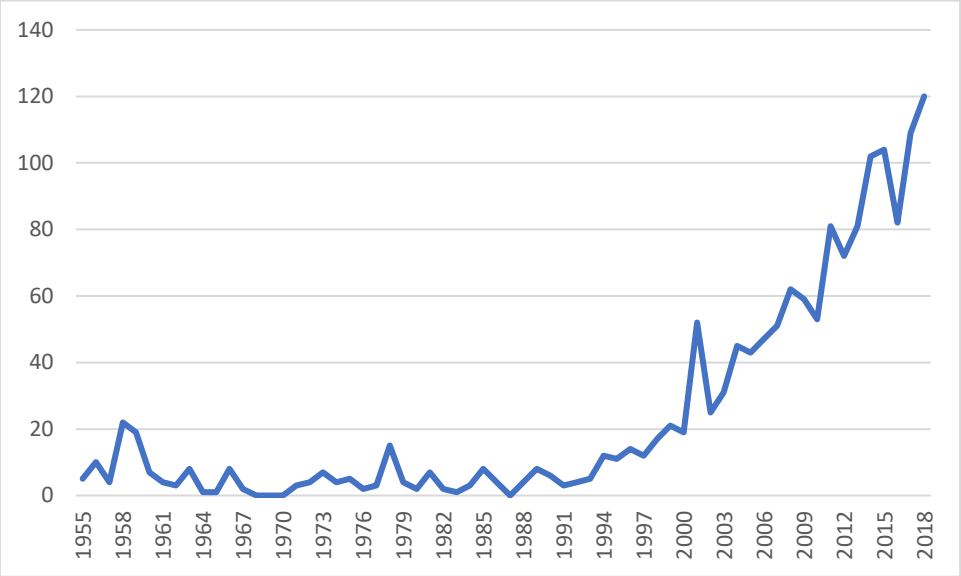
Finally, the period of analysis was 2010 – 2019, but the year 2019 is sometimes not used in the analysis to avoid misrepresentation of data due the lack of some indicators in the database until two years after the year ends.

4. Blue Economy Patenting evolution in the Atlantic Area

4.1. Atlantic Area

As it was explained in the methodology, the first patent related with Blue Economy from the sample was developed in 1955. From these initial years to the actuality, 1406 patents were requested in the five European countries of the Atlantic Area. As we can see in Figure 3, after the first years of the period during the 50', the patenting process was not highly successful until mid-90', thereafter the number of patents started to rise, particularly after the year 2000.

Figure 3. Number of Patent request



Source: Prepared by the author.

This fast increase defines that most of the patents were requested in the last two decades, since 1259 patents were requested from 1999 and only 147 between 1955 and 1998. That means that 89,5% of the patents were requested in the last 20 years, indicating renewed and growing interest in Blue Economy since 1999. In total, 152 different companies developed patents, which means that 24,84% of the companies in the sample initiated patenting processes.

Only three companies that patented before 1999 did not patent any more in the last three decades, which lead us to some important deductions: Blue Economy activities are highly dependent on technology. The potential to innovate is big and most of the companies that innovate continue innovating in the long term. At the same time, Blue Economy is growing, and activities related to it are increasingly dependent on innovation, inducing new research and innovative needs. Due to these reasons increased funding at the national and international level have also propelled the growth of Blue Economy.

On the other hand, we can find important evidence about differences between countries inside the Atlantic Area, as we can see in Table 10. Considering that samples by country are different, we need to elaborate a table focused on the average patents by companies, not in absolute terms. If we only focus on the number of patents requested, clearly Spain and France look like the two countries with more innovative effort but including the number of companies. The United Kingdom also has an important capacity of innovation.

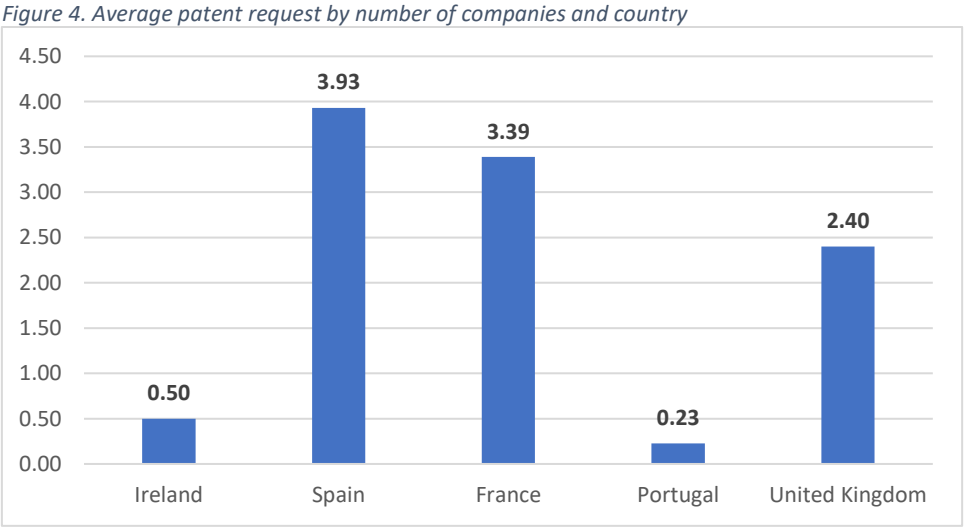
Table 10. Patent requests by country

Country	Companies	Number of patents	Number of Patents/Companies
Ireland	158	79	0.50
Spain	176	692	3.93
France	157	532	3.39
Portugal	84	19	0.23
United Kingdom	37	84	2.40
TOTAL	**610**	**1478**	**2.30**

Source: Prepared by the author.

Following this data, the average patenting capacity of companies from the sample represent more than two patents by each firm, as we can see in Figure 4. But this average hides an incredibly diverse situation by country, where France and Spain clearly are more successful in terms of requesting patents and United Kingdom is close to European Union numbers. On the other hand, Ireland and specially Portugal have small capacity of patenting, far away from one patent by company. It is also important to develop this data by country, since innovative effort can be concentrated in a small group of companies, showing that effort maybe is not done by country but rather by sector, activity or even by firm.

Figure 4. Average patent request by number of companies and country



Source: Prepared by the author.

Two elements help to understand this data: the first of them is related to the sample configuration, that can be overrepresenting big and innovative companies of the United Kingdom due to the small number of total companies. The second is related to Blue Economy activities itself: probably Ireland and Portugal are mostly based on small companies oriented to Blue Economy sub-sectors less intensive in innovation.

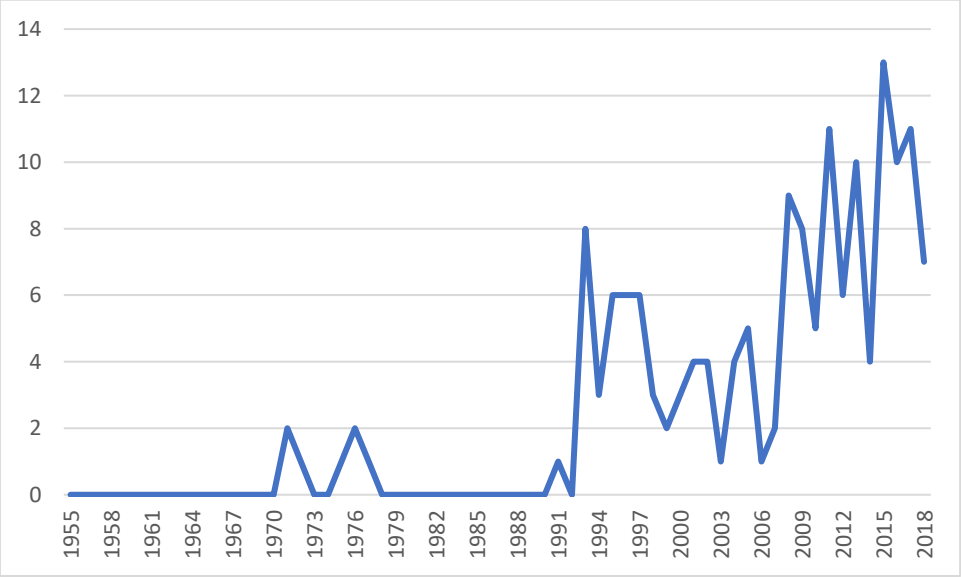
4.2. National Level Analysis

After this initial analysis of global patenting evolution, we are now going to watch in detail situation country by country.

4.2.1. United Kingdom

As we saw, Blue Economy firms from the United Kingdom have similar numbers as the average European Union. They requested 84 patents, being 76 after 1999, which means that 90% of them were requested after 1999, close to EU's 88%. United Kingdom started to innovate in BE at the same time European Union was developing this process. A positive aspect about innovation in the UK in Blue Economy is that more companies can request patents, since 57% of British companies of the sample are doing it, more than the double of the average European Union numbers (24,84%)

Figure 5. Patent request in the UK



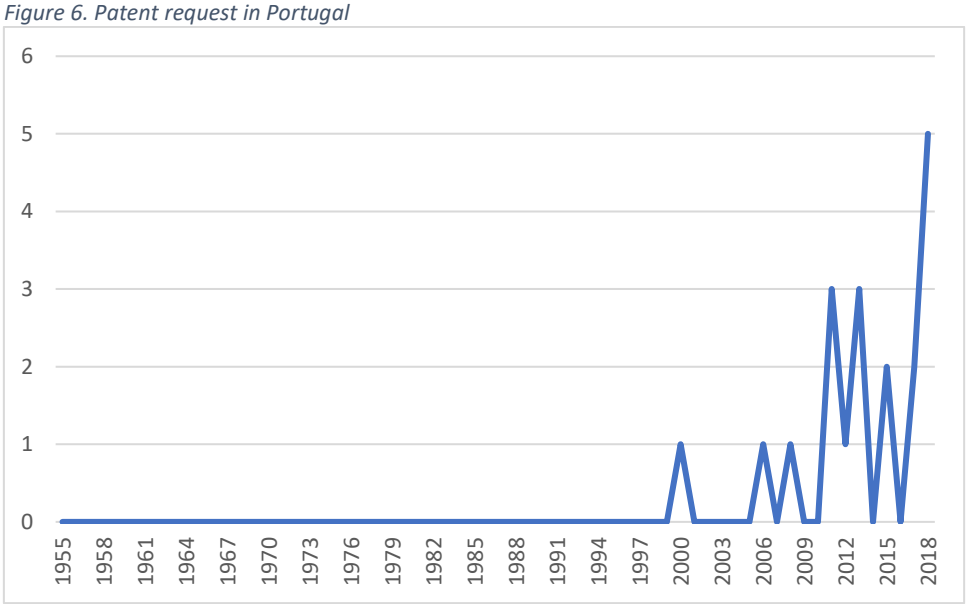
Source: Prepared by the author.

Even if during the first four initial decades innovation were minimal (with few exceptions during the 70's), early 90's became the key period to increase innovative activities, and after a stagnation between 1997 and 2007, last decade became clearly the most important years in terms of patenting.

4.2.2. Portugal

Portugal shows an important number of companies, low number of patent requests and very low average number of patents by firm. Only 19 patents were requested from 1955 to 2018, being the first of them in the year 2000. That means that Atlantic Area had already developed around 175 patents when Portugal entered in this process for the first time. It is positive that 5 of them were requested in the last year of the period, which means that Portugal companies are doing an effort to increase innovative capacities in Blue Economy.

Figure 6. Patent request in Portugal



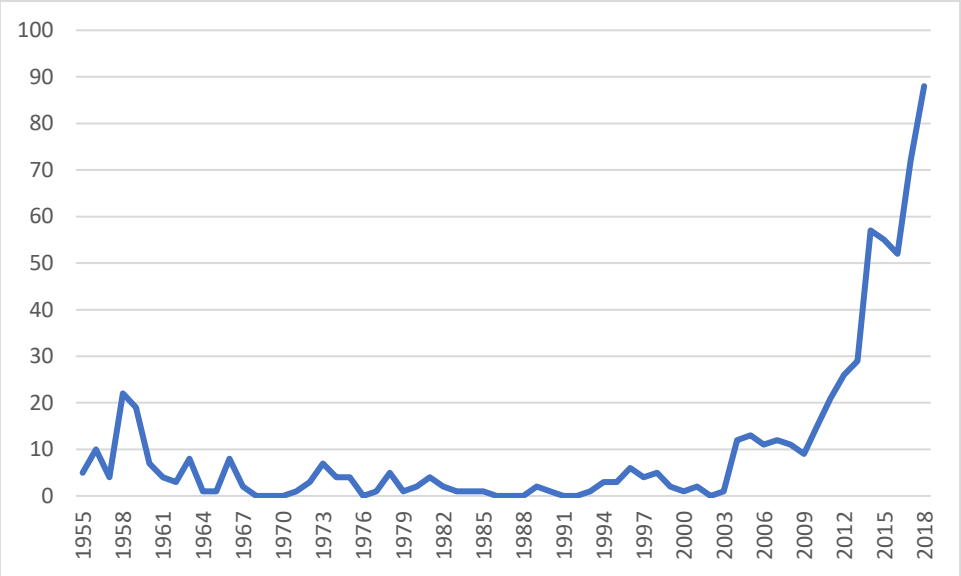
Source: Prepared by the author.

At the same time, patents are not highly concentrated, since 10 companies requested patents. That means that average patent property is inferior to two patents by company. Probably this situation shows us a small size of Portuguese companies, focused only in one technological upgrade due to the lack of resources to increase innovative capacities. At the same time, this also can show us that Portuguese companies are focused on activities with limited technological strength, which leads to a small innovative capacity.

4.2.3. France

France represents an example of positive evolution in terms of innovative and patenting effort. Even if France has some experience patenting on early stages of the period, a big change can be defined after the year 2000 and, especially, after the economic crisis of 2008. In this sense, we are analyzing a country with some specifications. Firstly, most of the patents were requested after the year 1999, the last two decades represent almost 92% of total patents of the French sample. At the same time, not many companies are innovative, since only 10% of them are requesting patents. That shows that R&D+i private processes are highly concentrated, but the ones that innovate have a strong capacity to do it.

Figure 7. Patent request in France



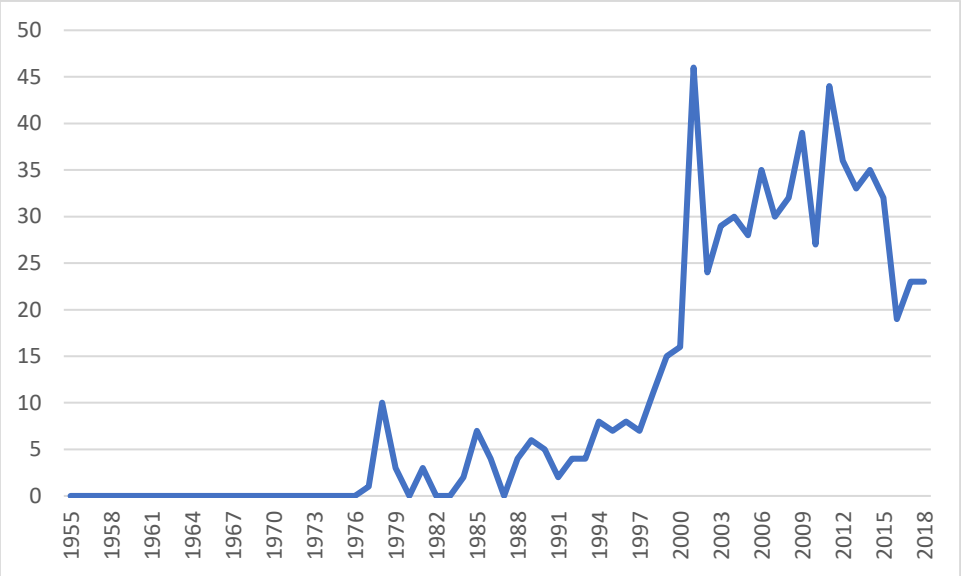
Source: Prepared by the author.

Concentration is not only about companies but activities. Only one company requested 156 patents, but at the same time some of the most innovative companies are related to ship building and naval sector, showing an important sectorial specialization in some activities of the Blue Economy in France.

4.2.4. Spain

Spain represents a country with an evolution similar to that of the Atlantic Area in several ways. As we can see in Figure 8 Spain starts its innovative process related to Blue Economy during the 70' but with little impact in the whole body of patents. It will be during the 90' and specially after the year 2000 when patenting becomes a relevant phenomenon, reaching 46 patents in the year 2001. After a decade of important patent activities, we can also observe a decline in the last ten years, probably because the economic crisis, which affected particularly southern Europe, difficulted innovative activities inside Spanish companies.

Figure 8. Patent request in Spain



Source: Prepared by the author.

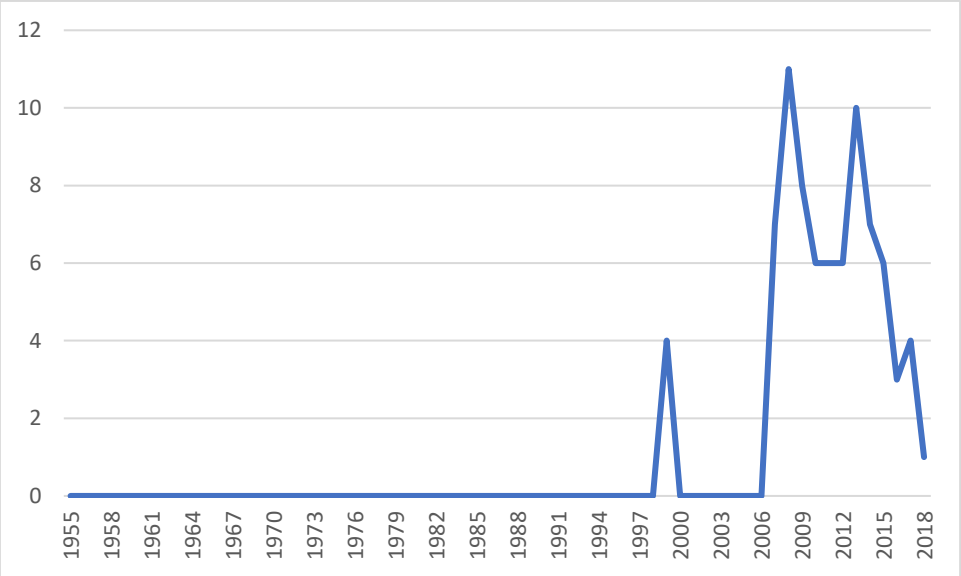
On the other hand, Spain developed more than 86% of its patents after 1999, close to the number of the European Union. Around 30% of companies of the sample requested patents, a little bit higher than European Union (25%), and clearly over other countries with a concentrated patenting process. At the same time, only one company that had patented before 1999 did not patent in the last two decades, which also indicates that senior companies related to Blue Economy that traditionally developed innovation are still filing patents.

Finally, Spain also shows concentration by firms, since most of the companies that patent have a little number of patents but a few of them accumulate a higher number, since the most important firm developed 226 requests, being a company oriented to health through marine products, fitting perfectly in Blue Economy Activities. After this incredibly active company in terms of innovation, we can observe a few firms related to engineering, technologies and feeding.

4.2.5. Ireland

The last country to be analyzed is Ireland, representing a similar situation than Portugal. The Irish patenting effort also starts late, in 1999, which shows an important difference with the European Union's evolution, where we can find patent requests four decades before. At the same time, we can watch that the evolution was positive during the 2000s, especially in the last years of the decade, but after the economic crisis, in a similar way to Spain, the number of patent requests declined again.

Figure 9. Patent request in Ireland



Source: Prepared by the author.

In terms of concentration, situation shows a negative position, since 53% of the patents were developed by the same company, related to naval industry, and closing in the year 2018. In this sense, the most important private initiative in the Irish Blue Economy sector disappeared. The next two companies with more patents also represent 20% of total patenting effort, being clearly part of the Blue Economy activities, related in this case to ocean management and technology solutions using polymers in marine activities.

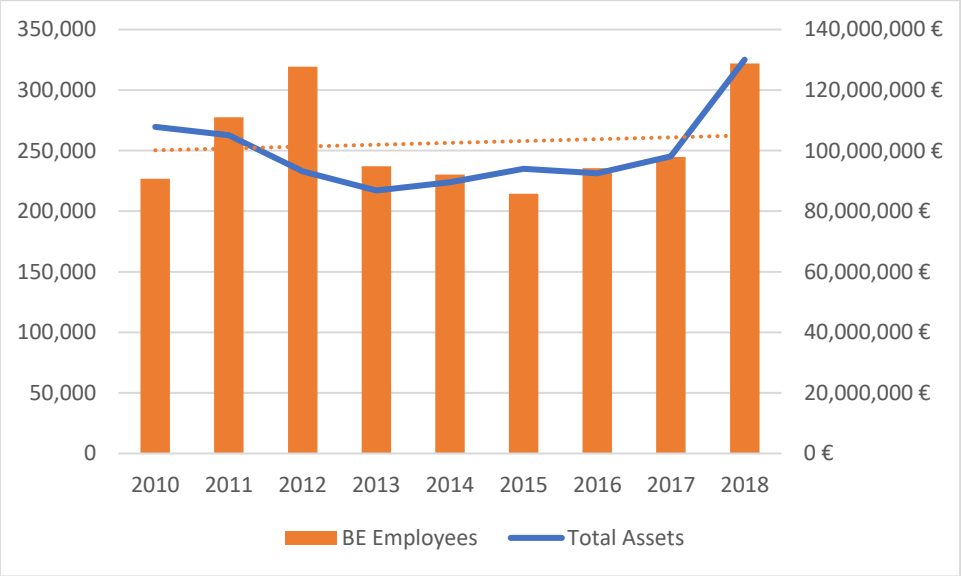
5. Financial Analysis

To complement the first innovation analysis this section will be focused on the financial evolution of companies that carry out BE activities, providing us valuable information about the potential of growth in the sector.

5.1. EU level analysis

As we can see in Figure 10, the total size of BE companies from the sample tends to increase. After an initial significant increase during the period 2010 – 2012, 2013 shows a breakdown in the trend which needed five years to be covered. The most positive aspect is that the last two years represents the biggest increase, measured by assets and employees. That means that Blue Economy grew in the Atlantic Area during the whole period especially from 2017. Even if the greatest decline in 2013 was measured by a reduction of employees, total assets also show this situation. In this sense, the evolution of employees and total assets is clearly similar.

Figure 10. Total size of BE companies (thousand €)

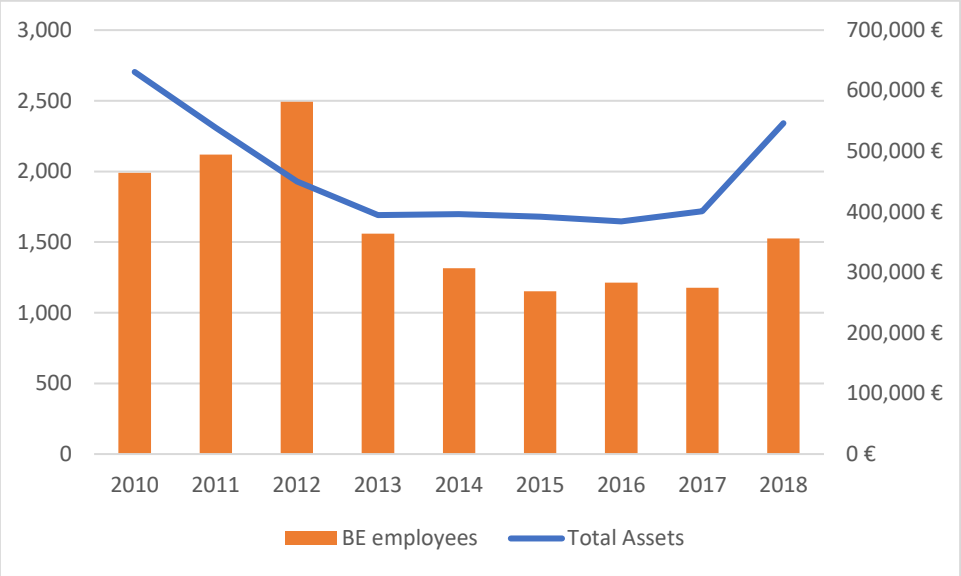


Source: Prepared by the author.

Continuing with size analysis, BE companies from the sample clearly represent big companies with the sector, since the average number of employees is high, with a maximum in 2012 of nearly 2500 employees, as we can see in Figure 11. After this year, the mean of employees tends to decrease, which means that more companies are getting into the Blue Economy, most of them SMEs, that induce a reduction of the magnitude of workers on traditional sectors, like shipbuilding, organized by big companies and very intensive in labor force.

Considering these elements, the evolution of the average number of employees and total assets are effects of the increase of the total number of companies more than that destruction of labor, since the number of total employees in the sector is growing, especially during the last years, although the average number of workers remained stable during the period 2013 – 2018.

Figure 11. Average size of BE companies (employees, thousand €)

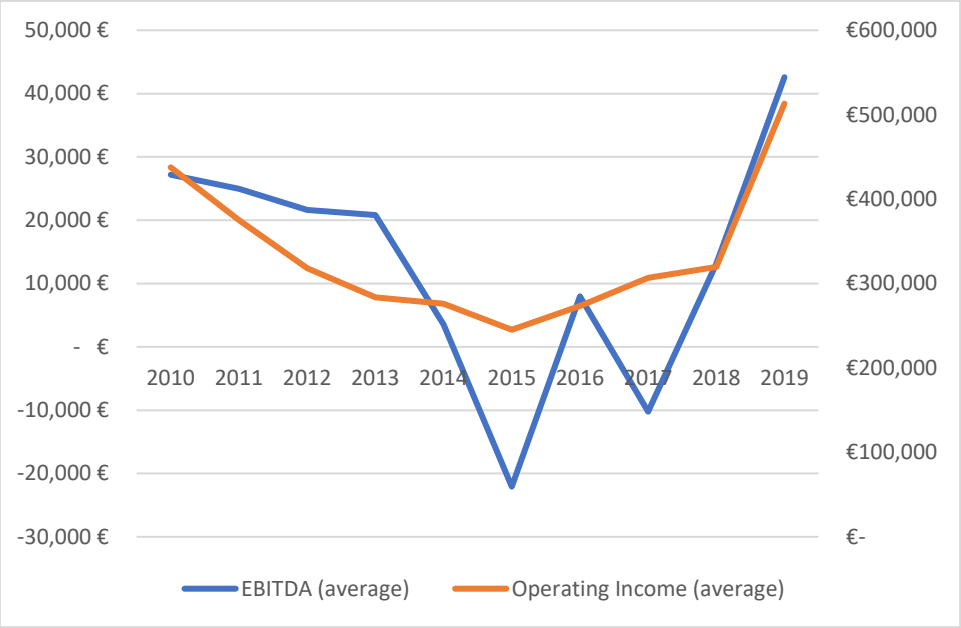


Source: Prepared by the author.

On the other hand, the economic-financial evolution of BE companies during the years 2010 – 2019 was variable during two periods of time. The first of them happened from 2010 to 2015, where the operating income tender to decrease, and the average EBITDA reach its minimal point becoming negative. After 2015, the evolution became positive, especially in the last two years of data, where 2019 represented the maximum point to both operating income and EBITDA.

Even if the EBITDA becomes negative in two moments (2015 and 2017) this situation is created because some companies suffer strong losses but most of the sample is still positive, since only 23% of the data shows negative results, which means that clearly most of the companies have profits. In this sense, the evolution of the operating income is better for representation than the evolution of the period, exhibiting a more stable trend.

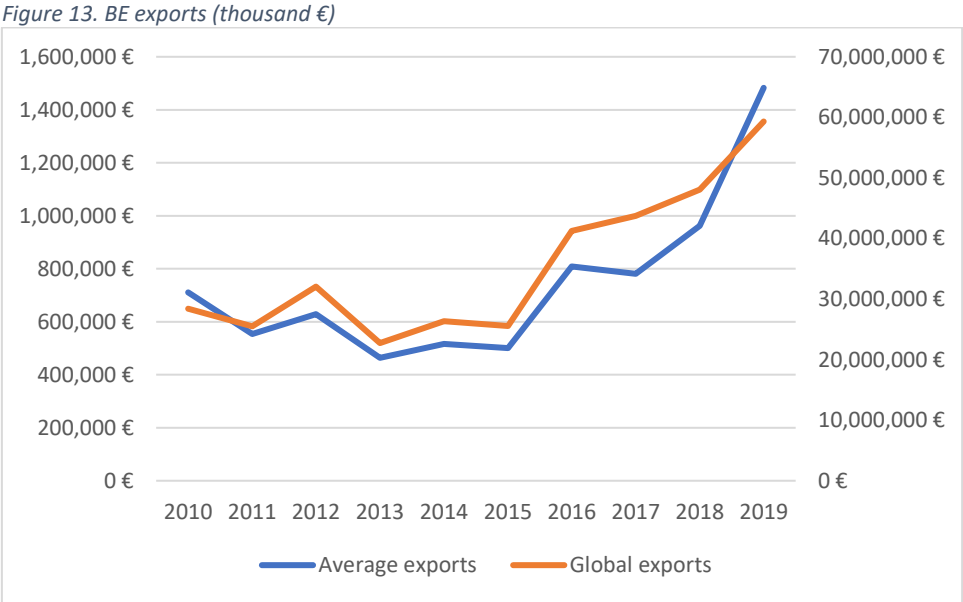
Figure 12. BE average evolution on EBITDA and Operating Income (thousand €)



Source: Prepared by the author.

Moreover, the greater evolution for BE companies come from the increase of exports. As we can see in Figure 13, global and average exports grow fast in the whole period, and especially in the second half, particularly after 2015. It is important to notice that exports do not suffer in the mid period (2012 – 2015) as much as EBITDA or operative income, and takeoff after 2015 is very important, increasing the global exports more than 130% and average exports near to 300%.

Figure 13. BE exports (thousand €)

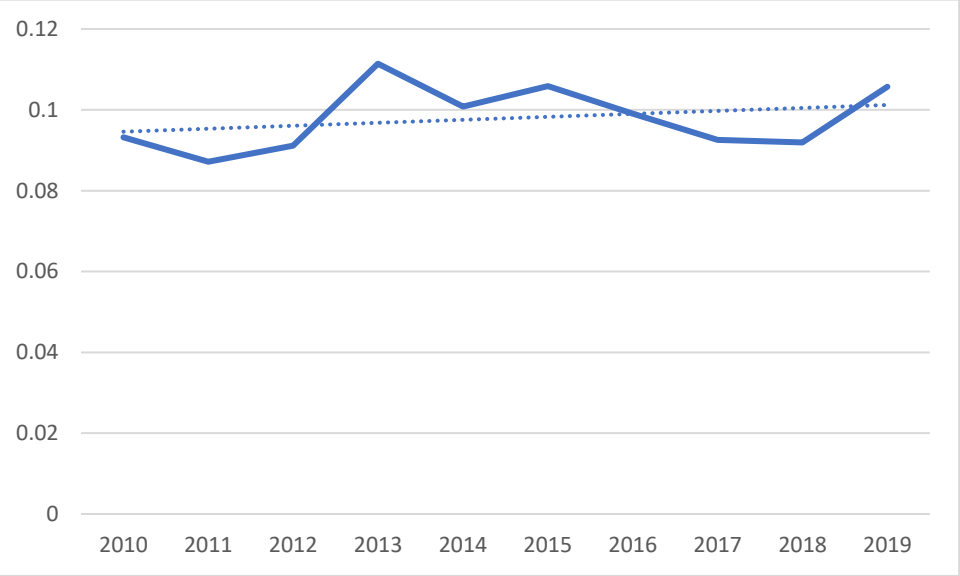


Source: Prepared by the author.

This situation shows that internationalization became an important way to solve internal market problems during the previous period. This is relevant because it shows the important capacity of the companies from the Atlantic area to adapt to the context and compete in international markets. In this way, European companies have opportunities outside their own markets, in Europe or even outside the continent.

Finally, we will use *intangible assets / total assets* as an indirect measure of innovation. Even if there is no perfect indicator of innovation from a financial point of view, the value of intangible assets in the company can provide information about how much importance innovative and technological aspects represent inside companies. As we can see, intangible assets tend to increase inside companies, which also indicates that the importance of technology is growing inside the Blue Economy.

Figure 14. Intangible assets / Total Assets



Source: Prepared by the author.

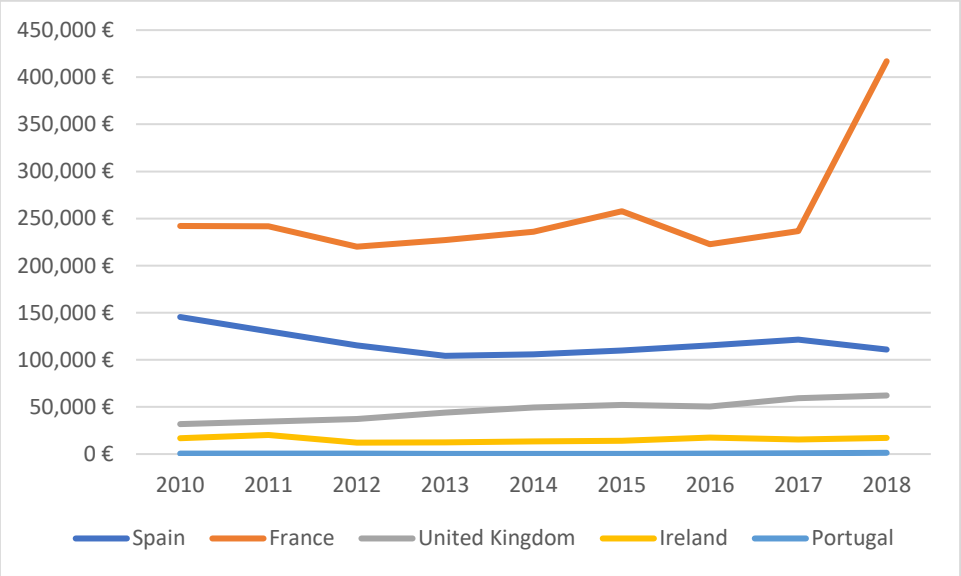
5.2. Country level analysis

The second part of the financial analysis will focus on differences between countries inside Atlantic Area. As we can imagine, each country has particularities on different levels as market, industry organization or even public policy, developing very different activities inside BE and marine economy. Moreover, it is important to notice that interpretations of this data should be done carefully considering that number of observations are low in some countries.

The first characteristic clearly different is size, where France, with a strong shipbuilding sector has bigger companies, measured by total assets. Using this measure provide information to reduce any distortion due to high labor intensity. On the other hand, Portugal and Ireland clearly have smaller companies than the other countries, while Spain and United Kingdom can be found in medium positions.

This first approach can show difficulties to Portugal and Ireland to increase profits, since smaller companies have fewer opportunities to export and capture innovations, being SMEs the core of BE sector. In this sense, it is important to notice that countries with smaller companies are also countries with fewer R&D+i activities measured by patents, which support the idea of the literature about connection between size and innovation.

Figure 15. Mean Assets by Country (thousand €)

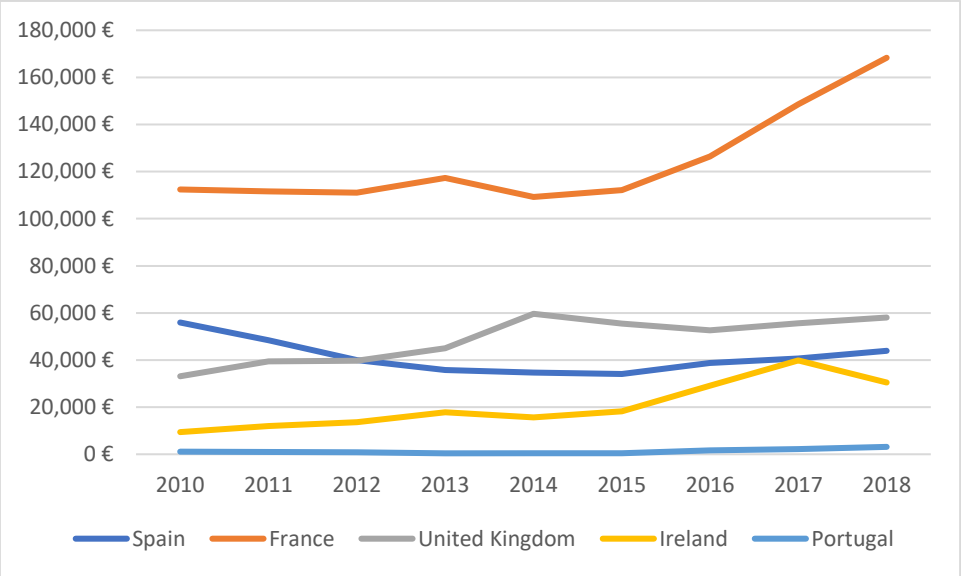


Source: Prepared by the author.

Following this analysis, as we can see in Figure 16, it is important to consider that mean sales are increasing in every country, which leads us to confirm the potential of growth of BE. Even if this situation is positive and can be observed in every country, differences between nations are also relevant, being, once again, French companies are the ones that captures higher sales volumes by company, with Portugal on the opposite side, being the country with fewer sales by company. Middle situation is found in British, Spanish and Irish firms.

Therefore, in terms of sales and markets clearly BE has a big potential, every country was able to absorb part of this growth but not every country had the opportunity to obtain the same increase, with important differences between them. In this sense, bigger sales also reinforce the idea that bigger companies are in France, Spain and United Kingdom, even British companies have better performance in term of sales compared to the Spanish ones.

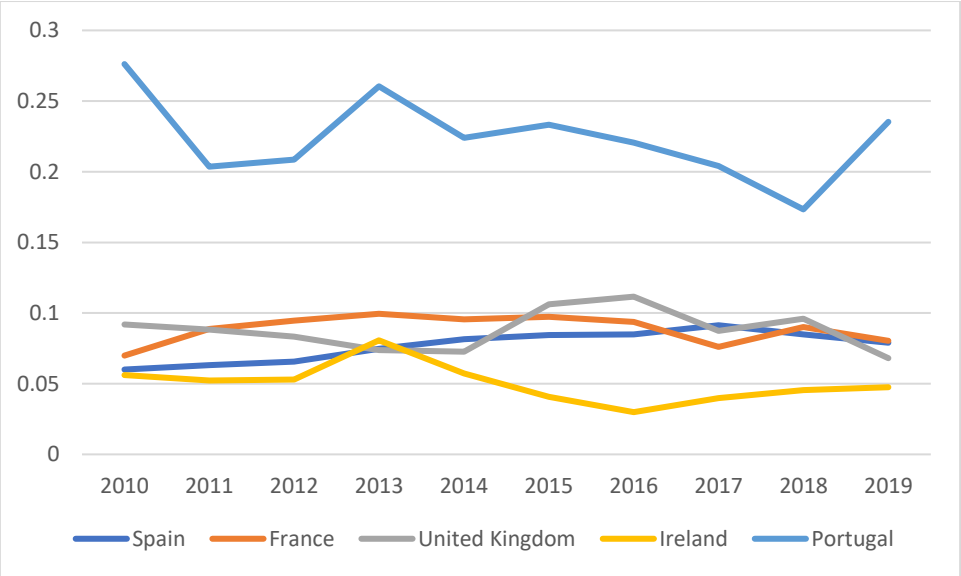
Figure 16. Mean Sales by Country (thousand €)



Source: Prepared by the author.

Moreover, we will use intangible assets as indirect financial measure to observe the importance of non-material assets on the company structure. That can lead to some conclusions in terms of innovation but also in terms of sectorial orientation and size. As we can see, companies with bigger intangible assets in terms of total assets are Portuguese, which can be produced because Portuguese companies are the smaller ones and are developed with smaller fixed assets, leading to a higher weight of intangible assets. On the other hand, companies from Spain, France, United Kingdom and Ireland shows similar situation on this measure.

Figure 17. Mean intangible assets / Total Assets

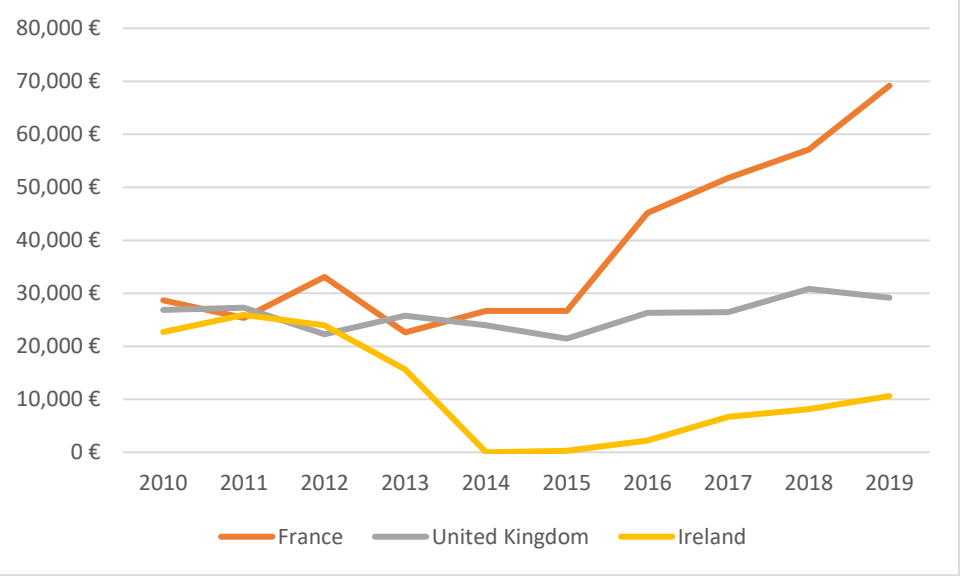


Source: Prepared by the author.

Finally, the last indicator will be the export capacity. Sadly, no data can be found for Spanish and Portuguese companies, but it is also interesting to briefly analyze Figure 18,

since exports become an important way to increase sales and profits. As we can see, Irish companies are the firms with more problems to internationalize their sales, showing scarce exports and even decreasing their numbers. United Kingdom companies of the sample are stable on their export's activity, with a small increase between 2010 and 2019. But the best position in terms of exports is found on French companies, since their exports, like Ireland and United Kingdom in 2010, were more than doubled in the next ten years, becoming by far the country with more capacity to export on BE activities. Probably growth on size and sales facilitate this evolution.

Figure 18. Mean Exports by country (thousand €)



Source: Prepared by the author.

6. Conclusions

Blue Economy has become one of the most interesting new sectors to boost development and economic growth. In the last years both academy and institutions have shown growing interest to analyze and promote activities related to Blue Economy on different levels. In this sense, the first characteristic of this novel approach to these activities is that the definition itself of BE is under discussion, particularly due to an important difference related to the impact of BE activities in ecosystems and the requirement to integrate environmental concerns into the economic activities related to the Oceans.

Considering this first element, what is obvious is that BE activities are growing irrespective of the definition of BE selected. In this way, different institutions such the European Union are involved to boost potential growth of these activities not only to increase economic growth but also to support local communities near the oceans that can take advantages of this sector while limiting environmental effects.

Another relevant element to understand the importance of BE is that some of the activities inside BE have strong needs of technology, which leads to innovation opportunities in the long term, increasing competitiveness of firms. Therefore, the growth of BE in the world, the need of innovation and an increasing competitiveness become important arguments to requires to institutions to develop specific programs to boost BE.

However, not every BE activity has the same potential for growth, since some of these activities are mature, making it harder to innovate. At the same time, some BE subsectors are dependent on labor force but not on technology, which means that inside BE there are also important differences. Therefore, BE supporting programs should also focus on the new activities with higher potential for growth in the long term, while the stablished sectors have more opportunities to evolve by themselves.

Following the data obtained, this document analyzes the innovative capacity and financial situation of BE sector in the Atlantic Area. On one hand, innovation has shown growth in the last two decades. Particularly after the year 2000, the evolution turned particularly positive in terms of new patenting activity, showing that BE is not only growing but also increasing the need of innovation.

At the same time, the increase of patenting activity is higher than the increase in the number of firms, showing that the intensity of innovative activities is stronger in existing companies. This situation also reflects that, in the long-term, the effects of innovation will have a greater impact on the financial situation of the firms given that new technologies and products are being developed in the last years. We can partially see this situation since sales of BE companies are grown, in a similar path from patenting growth.

Regional level of analysis is critical to develop correct public policy, having found important differences between countries. In particular, Ireland and Portugal show a low level of patenting activity, restricting their capacity to innovate. Some factors have contributed to this situation: sectorial orientation of activities related to BE in these countries, less oriented to innovation, and smaller size of companies.

On the other hand, the financial analysis is also interesting to understand BE firms in the Atlantic Area. Firstly, the most important point is that EBITDA is growing, which means that BE companies have had the tendency to increase their profits during the last years. In this sense, BE provides an interesting field to invest and create employment.

The study also concludes that the size of the companies is determinant to innovate. Data clearly shows that countries with smaller companies also have smaller innovative capacity and at the same time profits and sales are more reduced. This economic relationship is a strong reason to support scale up activities and promote the growth of the companies thanks to different mechanisms.

In a similar way, exporting becomes key to expand markets. Companies from countries with better performance on exports also keep better performance on other variables like profits. Particularly sales are going to be boosted by exports, opening new markets and facing more competition on international markets, forcing companies to reduce costs and, at the same time, improving management activity.

As we have seen, not every country captures this positive situation in the same way. Particularly countries with smaller companies are facing problems to obtain good results in innovation and exports, which lead us to believe that there is a need to develop public policies oriented on regional terms. Clearly Portugal and Ireland are the two countries facing stronger problems to establish bigger companies, based in a business metabolism constituted not only by SMEs but fundamentally small companies related to BE. This business metabolism affects innovative capacity on the private sector due to lack of resources not only to patent but also to carry out any project of R&D.

At the same time, another interesting point can be drawn from the data collected: BE represent activities with strong growth potential due to the continued increase of sales for Atlantic Area companies. In this sense, this evolution represents a major argument to support Blue Economy activities since long term opportunities for European companies are important. These opportunities are not only in our own markets, since exports become a key element to understand growth of these firms, opening companies to internationalize and seeking new markets. Globalization of BE markets and increase of demand represent two key aspects to support BE firms that want to start the process of internationalization.

Finally, this work is not exempt of limitations. Building a sample on Blue Economy companies has problems, since BE is formed by multiple activities, and some of them can also be done inland, which limits the capacity of using existing sources. On the other

hand, excluding Universities and research centers was necessary to build a consistent database but limits the focus of the research only to private companies. Future research should take this into account to include also public entities on the scope.

7. Recommendations

We would like to develop a few recommendations to increase BE potential for the Atlantic Area firms.

Firstly, size plays a key role on firm characteristics to ensure increase in value-added products, where smaller companies have bigger problems to obtain significant profits. Considering that most of the Atlantic Area companies are SMEs, strategies of scale up should be developed to increase competitiveness in the business metabolism related to BE.

Secondly, not every BE activity has the same potential for growth. The maturity of activities is clearly different, and this element limits the potential to grow in the most mature of them. Characterized activities based on their potential for growth becomes crucial for institutions and companies to send signals to the market that are oriented to focus on capital and efforts in the most novel ones, as a tool to develop a consistent sector in the long term. This element also drives the importance of innovation as a tool to boost growth of BE in Atlantic Area. Innovative activities in most cases result in better firm financial position, driving higher survival and profits in the long term. In this sense, public policy should focus their efforts on R&D activities through public institutions and public-private partnerships.

Thirdly, not every BE activity has the same innovative potential, which means that competing through technology becomes difficult. In this sense, public policy should be directed not only to the novel activities but also to BE technology intensive sub-sectors, as the best way to compete in global terms. It is difficult to compete in low value-added activities or products since competition will be higher from other countries with lower costs. At the same time, considering this element, traditional marine activities have fewer needs of innovative public policies, since the market and the size of companies allow more tools and expertise to continue developing their activities. However, these activities are also labor intensive, so public policy should be oriented in terms of jobs to avoid other macroeconomic problems related to aggregated demand.

Fourthly, differences between countries are also strong. If it is important to develop policies adapted to BE activities, it is also fundamental to develop regional policies adapted to a vast variety of contexts. In this sense, national and regional level should play a key role to develop instruments to boost BE adapted in their territories. This idea also works in terms of innovation. Innovative policies should be adapted in two ways: considering differences on the regional innovation system but also structure of the BE companies in the region. It is particularly important to analyze the regional business metabolism to understand the real capacity of companies to innovate, since a metabolism based on SMEs would request direct support from public institutions, while strong private innovation system requires more public-private collaboration.

Last, internationalization of companies is a good policy inside companies to boost growth, since it creates new market for firms and increase income and profits. As we noticed that, countries with deeper internationalization processes are also countries with better performances from their BE companies.

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