Cooperation and the Emergence of Maritime Clusters in the Atlantic: Analysis and Implications of Innovation and Human Capital for Blue Growth

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Abstract

The so-called ‘blue economy’ is gaining emphasis in European policy making due to the expansion of its relevance beyond traditional economic sectors but also to new and developing ones that exhibit rapid growth. Much of the discourse has focused on the emergence and consolidation of maritime clusters. However, there has been less attention on the regional development aspect and this article provides a timely contribution to filling the gap in knowledge by presenting the findings and analysis of a survey applied to blue economy organisations in Portugal, Spain, Ireland and Scotland. Specifically, issues of innovation, human capital and social capital provide the basis of inquiry around the creation and consolidation of maritime clusters. The article uses the survey data to understand the determinants of the variety of cooperation dynamics. A key finding reveals that participation in innovation activities and absorptive capacity are critical factors in increasing cooperation. From the analysis it is clear that there are significant discrepancies in participation between sectors, such as tourism where participation rates are below average. The article concludes by defining the core activities that should feature in a maritime cluster.

Key-words: absorptive capacity, innovation, human capital, LOGIT, maritime cluster, proximity, social capital.

1 Introduction

The blue economy has an important contribution to make for the overall competitiveness of the European Union (EU) with sectors related to the exploitation of the sea representing between 3% and 5% of the EU regions’ gross domestic product (table 1). Maritime and marine activities feature prominently in many regional economies, and especially those with coastlines. Further, these activities contribute significantly to the creation of the Atlantic Area identity, not only from a socio-cultural and economic perspective, but also in its land and urban shaping beyond the size of their economic output. In the modern ecology, it is evident that several branches of the blue economy are facing considerable challenges in effecting increasing competitiveness, such as fisheries (European Union, 2014), whereas others, such as offshore renewable energy, offer opportunities for economic growth and employment (EWEA, 2014).

Table 1 around here!

At EU level, DG Mare ranks blue economy activities by current size, recent growth and future potential (European Commission DG MARE, 2012). The top activities in relation to size comprised coastal tourism, deep sea shipping, short sea shipping, offshore oil and gas, yachting and marinas, passenger ferry services, and fisheries for human

consumption. And in terms of growth, the rank order is offshore wind, cruise tourism, securing fresh water supply, short sea shipping, yachting and marinas, marine aquatic products, and protection against flooding and erosion. The activities with high potential for the future are identified as being blue biotechnology, offshore wind, protecting against flooding and erosion, ocean renewable energy, traceability and security of good supply chains, environmental monitoring, and marine minerals mining (table 2).

Table 2 around here!

In the Atlantic Area with peripheral coastal areas, some of these activities, such as biotechnology and ocean renewable energy, remain in the development stage of the industry lifecycle. While the creation of new activities in these value-chains is of strategic relevance, there is a critical need for the revitalization of existing sectors, such as fisheries, seafood and tourism. Both revitalisation and new economic activities are clearly linked to the implementation of innovation through development of new products, processes and markets.

Policy has played an important role in this process of development such as the introduction of the Atlantic Action Plan in May 2013 by the European Commission with the overarching objective of generating blue economy growth, fostering employment and stimulating growth in the coastal areas. This lends impetus to the development of emerging maritime sectors such as ocean energy, marine biotech and the exploration and exploitation of deep sea natural resources whilst simultaneously revitalising traditional industries such as aquaculture and coastal tourism. The Action Plan has four overarching priorities including the promotion of entrepreneurship and innovation; the protection, security and enhancement of the marine and coastal environments; the improvement to accessibility and connectivity; and the creation of a socially inclusive and sustainable model for regional development. The Action Plan does not have a dedicated EU funding instrument for its implementation, but rather relies on existing funding instruments defined by member-states in their partnership agreements.

This article reports on the findings of a survey carried out as part of the EU funded HARVEST Atlantic Area project that investigates regional and economic development in the Atlantic coastal area. The analysis provides a valuable contribution to current knowledge and the debate surrounding the role of the blue economy in the regional development of those areas. The work begins by clarifying the concept of maritime clusters within the broad context of socioeconomic structures within the environmental dynamics of the coastal areas. Maritime clusters exhibit varying degrees of complexity depending on such variables as competition in the markets and the cooperative behaviour between a variety of companies, suppliers, customers, knowledge producers and decision-makers within the blue economy. The results derived from a survey designed and implemented for the HARVEST project are presented and form the basis

for analysis and insights around issues of innovation and human capital in the blue economy. The data collected in this survey is explored to create an econometric model to verify the cooperation variety determinants of the blue economy's stakeholders. As part of the conclusions the article provides comment on the policy implications of the findings.

2 Blue Economy and the Emergence of Maritime Clusters

2.1 Clusters as a Policy Artefact

The notion of clusters in an industrial setting has received significant attention in the academic literature due to the important role that clustering dynamics play in the successful implementation of development strategies. In fact, the 'industrial cluster' concept has a long history and is a key feature of the classical school of economics, most notably in the writing of Alfred Marshall who refers to concentration of specialised industries in particular localities in his work 'Principles of Economics' (1890). The profile of clusters was enhanced by the contributions of Porter (1998, 2000, 2003) who viewed clusters as geographically proximate groups of interconnected companies, suppliers, service providers and associated institutions. The emergence of clusters is based on the fact that actors are located in a geographical context and are strongly influenced by externalities, mainly positive, that affect productivity. These positive externalities emerge through knowledge and workforce agglomerations that connect industries, technologies, skills, and purchased inputs.

The cluster concept takes on different meanings depending on the sectors in which it is being examined and varies according to a spectrum that can range from geographical perspectives to socio-cultural factors or even territorial dimensions. Porter (1998) understands a cluster as a manifestation of the economy in which proximity amplifies all the existing constraints to innovation and the increase of economic performance. According to Monteiro et al. (2011), fundamental characteristics in the understanding of clusters include geographic concentration; specialization (focus in an activity in which all agents are related); multiplicity of actors (companies, universities, R&D centres, public authorities and other related institutions); competition and cooperation (characteristics of the relationship between the different actors of the cluster); critical mass (to generate internal dynamics) and innovation (cluster organizations should be involved in processes of technological, commercial and organizational change). There are also different ways in which clusters can be organised. Three types of clusters are the 'hub-and-spoke' industrial district; the 'satellite industrial platform'; and the 'state-anchored' industrial district presented in table 3 (Markusen, Lee and DiGiovanna, 1999). Each specific region combines elements from these types of organised clusters.

Table 3 around here!

Chorincas et al. (2001) present another typology of the four ideal-types based on size. This includes micro clusters, industrial clusters, regional clusters and mega clusters. A micro cluster, or local cluster, is represented by the number of companies and geographically close institutions operating in an identified field of activity that are connected by common and complementary aspects. An industrial cluster acts as a set of interconnected companies and associated institutions which operate in different fields and use different but complementary technologies. In this type of cluster the innovation generated by each agent generates benefits others, thereby ensuring that all members benefit from increased competitiveness. A regional cluster works in the same way that the industrial cluster does except that it does so within defined regional boundaries. In this case the geographical proximity has a crucial role in the dynamics of interaction between the actors that are usually led by regional governance bodies. This concept can be extended to include the 'mega cluster', that is, a set of distinct activities in which the complementary advantages of networking among cluster actors and other entities are explored.

A cluster requires effective governance in its implementation and consolidation. Cluster actors share similar barriers relating to the external environment that can be more easily reduced by coordinated action (Doloreux and Shearmur, 2009). A cluster emerges because there is an institutional context that creates advantages based on the physical proximity and existent social capital. In cluster theory different types of proximity are relevant for inducing institutional and collective learning (Torre and Rallet, 2005) where cluster formation thrives on entrepreneurial talent, intellectual capital and tacit knowledge exchange. Physical proximity plays a key role (Cooke, 2001a: 965) because "(...) it is well known that codified knowledge transcends space easily but not new knowledge that is often created by 'epistemic communities' of distinctively skilled people exploiting spill-overs in specific knowledge-intensive places". Firms can be more efficient by reacting more quickly than when isolated or when they work with customers and other firms to develop new products and processes, or when they reduce the perception of risk and induce trust.

These are the main reasons why the notion of a cluster is omnipresent in the modern world of policy-making (Ebbekink & Lagendijk, 2013) to the extent that Martin and Sunley (2003) described them as a 'policy fashion item'. Policy-makers often support cluster policy because the type of merits outlined above but also because it contributes to the successful marketing and 'brand' presentation (Palazuelos, 2005). The cluster concept's policy appeal relates to the use of accessible language of business engraved with the authority of expert knowledge that creates an 'echo' of the knowledge economy rhetoric that is focused on growth and addressing the interests of corporate and governmental elites (Taylor, 2010). Moreover, this appeal can be connected to the guarantee that one territory or sector can be responsible for its own destiny. As a consequence, cluster policy programmes have multiplied in Europe in an effort to emulate successful cluster experiences elsewhere.

Nevertheless, clusters can also create problems for regional development. The effects of clusters can be extremely ambiguous in economic performance specially due to the over-specialisation in a limited number of economic activities that transforms them in fragile systems to specific external shocks (Delgado, Porter, & Stern, 2014). For example, the success of a particular economic activity can produce an excessive concentration of resources, such as financial resources, creating difficulties for other sectors to develop and prosper (Cruz, 2014). Also, the past success of a cluster can create path dependencies that reduce opportunities for future development and adaptive capacity. Some clusters can even limit the opportunities to innovation to flourish. Makkonen et al. (2013) found little evidence of radical innovation and attitudes towards it in a study on innovation types in maritime clusters in Finland.

In the last years, related variety (Frenken, Van Oort, & Verburg, 2007) is being introduced as a critical characteristic of regional economies to prosper and clusters to develop. It tries to capture a delicate balance between cognitive proximity and distance across sectors in a region that is needed for knowledge to spill over effectively between economic activities. The more related variety across related sectors in a region, the higher the number of technologically related sectors, and the more learning opportunities there are for local industries (Boschma et al., 2012). The literature about related variety has often showed it as a positive attribute but today, with the effects of the crisis being analysed, this is often contested. In the context of the economic downturn, the high connectedness between sectors and firms, with excessive specialization or excessive relatedness, showed that negative impacts could disseminate easily in this type of industrial fabric. Some authors (Elli, 2015) argue that the diversification of regional economies should focus “unrelated variety”, i.e., a traditional diversification of the economic base to contain the impacts and limit the exposure to external shocks.

Clusters can generate innovation and growth but the adoption of one-size-fits-all policies needs to pay attention to local conditions and existing potential (Rodríguez-Pose & Comptour, 2012). However, the models developed are limited by their static nature that constrains their application in practice. The focus of attention is on how clusters can be organised rather than how they emerge. Consequently, as Motoyama (2008) notes, theory does not support the replicability of successful clusters in any practical sense. Only by recognising the past processes that supported the emergence of successful clusters can theory contribute meaningfully to practical application. Clusters vary in regional scope, economic activity, technological level, transaction costs, internal characteristics, knowledge networks, so policy-making needs to address all these different contexts.

2.2 Factors for Clustering: Innovation, Human and Social Capital

The role of innovation is key to fully understanding clustering dynamics and forms much of the discourse among the academic community. Innovation is intrinsically

connected to economic change and technological advancement (Oliveira, 2008). Schumpeter (1948) developed five key distinctions that operate as ideal-types of innovation. Thus, innovation can refer to the creation of new products, new processes, new sources of supply, the exploitation of new markets and/or new organizational forms. Companies, institutions of science and technology, knowledge transfer and the environment or the surrounding context are areas that delimitate the field of innovative processes. Furthermore, as the Oslo Manual suggests, these areas act as a map that reveal the properties to focus upon and function as a reference framework in the innovation policy formulation (OECD, 2005).

Innovation can also be separated from technological progress in relation to traditional methods or low technological intensity or can exist in industries with low or medium technology (Tunzelmann & Acha, 2005). Innovative capacities are developed through complex and cumulative learning processes and thus, innovation processes are constrained or facilitated by social contexts. In this way, innovation is a heterogeneous process that varies with time, industries and countries (Bruland & Mowery, 2005). The understanding of innovation has necessarily focused attention on innovation systems (OECD, 2005). This perspective has been used mainly at national and regional levels, although in many instances it is necessary to apply to sectoral and technological levels that create evident overlaps between these notions and the idea of a cluster. Although there has been significant efforts made to build integrated policies, innovation for cluster emergence cannot and must not provide excessive generalization due to their heterogeneous characteristics and the need to identify specificities to frame the social, cultural and economic context.

According to Asheim et al. (2005) there are two paradoxical features of the contemporary global economy. First, innovative activity is not randomly distributed across the geographical space. In fact, the more knowledge-intensive the economic activity is, the more likely it is to be geographically clustered. Secondly, the trend of uneven spatial concentration has taken on even more intense characteristics with the modernization of the economy. Indeed, in a world marked by global competition, in which the ability to achieve success largely depends on the ability to produce new realities and new or improved processes, tacit knowledge is an important basis for value creation based on innovation (Lundvall et al., 2005). This is due to the easy access to explicit knowledge. Tacit knowledge is a fundamental vector of the innovation activities geography and carries with it some difficulties in the process of sharing and transfer, especially taking into account spatial distances (Asheim et al., 2005). Tacit knowledge does not "travel" easily because their characteristics reside in the knowledge and culture of the social actors and, therefore, its transmission is more effective when performed between partners who already share some basic commonalities such as a common language, codes and conventions of communication and standards that have been prepared by a common institutional environment (OECD, 2005). Spatial proximity is a key to the production and transfer of tacit knowledge reinforcing the importance of the

emergence of clusters where the transfer of tacit knowledge can be undertaken in order to increase the competitiveness of territories.

The shift of focus from the physical capital to the intellectual contribution of employees is another central feature that generates innovation and helps create the conditions for clustering dynamics. In this context, human capital is important for representing all the knowledge and skills, aptitudes, attitudes and experiences accumulated by employees and their ability to generate creativity and new ideas that are critical to the firms' performance (Crook et al., 2011). Human capital is a business resource and an asset to generate future benefits for the firm. Closely associated with this notion is the idea of absorptive capacity (Cohen & Levinthal, 1990). Absorptive capacity can be understood as the ability of a firm to recognize the value of new and external knowledge, and then to assimilate and apply it. It is a function of the firms' prior knowledge that informs efforts to apply knowledge to learning and routines that accelerate absorption. Organizational absorptive capacity depends on the individual absorptive capacities and is crucial for facilitating interactions between different types of actors generating socioeconomic benefits from cooperation and thus stimulating the generation of 'industrial atmospheres'.

Innovation and human capital do not work alone in the process of clustering as the influence of social capital is also relevant. Social capital relates to the features of social organizations such as networks, norms of behaviour, and social trust that facilitate coordination and cooperation for mutual benefit (Putnam, 1995). Recognition of the importance of social capital has increased in the last two decades partly due to the expansion of the knowledge economy in developed regions and the increase in investments in collaborations and social exchanges that create economic value. Social capital can be considered the "missing ingredient" that stimulates resources acquisition for a cognitive dimension, in particular, information and learning, and a normative dimension featuring values and trust (Cooke, 2001b). Following this argument, the existence of strong and homogenous local communities with specific systems of values and norms has positive effects on cluster dynamics (Becattini, 2004). This is seen through the emergence of two interdependent forces, firstly, the social cohesion, trust and self-realization through intense entrepreneurship, and secondly, through the subordination of individual interest to the larger interests of the community, thus stimulating cooperation in parallel with competition among existing firms (Parrilli, 2004, 2009). Social capital is also a spatial phenomenon as it is dependent largely on the embeddedness of firms in localized social relations where shared norms and values facilitate collaboration for mutual benefit. As innovation is increasingly a collective effort, embeddedness and social capital also help to explain how and why clusters are more or less successful (Rutten & Boekema, 2007). However, it does not automatically follow that the emergence of clusters will derive added value from social cohesion. Social cohesion can be fragile, ephemeral and dynamic and will influence economically derived value differently in different times.

2.3 Boundaries of Maritime Clusters

Many economic activities rely on to their physical location to generate value and this is most obviously evident in the maritime sector where a coastal location is crucial (although there are some activities that are located in inland lakes and rivers). Proximity and geographical location are important features in the emergence of maritime clusters due, not only to the ability of networking and effectiveness of inter-relationships, but also the ease of access to supply chain needs, such as the procurement of raw materials. The maritime economy benefits from clustering in many ways including access to specialised labour, increased market awareness, close connections with R&D institutes, enhanced strategic cooperation with stakeholder groups and a host of inter-related maritime activities (Wijnolst, 2006). In the context of the maritime economy, Gailitis & Jansen (2012) use cluster theory to analyse economic value of the maritime resource in Latvia whereas Viederyte (2013) compares sector Associations and maritime cluster organisations to better understand structures, innovation and specialisations that emerge as value adding resources. Chang (2011) focuses attention on what can be learnt from the emergence of maritime clusters in the south west of England. Chang (2011:489) reflects on the activities' diversity by defining a maritime cluster as "a network of firm, research, development and innovation units and training organisations, sometimes supported by national or local authorities, which cooperate with the aim of technology innovation and of increasing maritime industry's performance". This author emphasises that the effective development of a maritime cluster needs to be based on existing manufacturing industries. An example is that of ports within coastal areas and their role within the logistics and supply chain of shipping and transport as well as tourist locations.

Due to the variety of activities that are encompassed, there is an existing debate on the definition and characterisation of the marine economy's activities and sectors. Surís-Regueiro, Garza-Gil & Varela-Lafuente (2013) provided a structure of marine sectors to facilitate the identification of specific activities. This organisation allows the comparison of the estimated weight and impact of the marine economy, both over time as well as among the different sectors of activity, countries and regions. Table 4 summarizes the structure suggested by these authors.

Table 4 around here!

Taking this broad vision of marine economy into account, it becomes clear that to study maritime clusters in the Atlantic, the mega-cluster concept is probably the most appropriate means of analysing the diversity of economic sub-sectors. The work for this article adopts the broad perspective of a maritime cluster that encompasses a wide range of economic activities. Decisively, the actors within the coastal regions participate on knowledge sharing and networking activities that combine to deliver benefits for the

community comprising the cluster (in some regions, such as in the fisheries industry in northern Spain, this extends to social welfare as well as industry economic benefits). Thus, the mega-cluster approach better reflects the broad diversity of activities, relationships and knowledge sharing that underpins much of the added value, both tangible and intangible, in the chosen coastal regions in the study.

Figure 1 around here!

The governance is also another critical dimension to the development of cluster. Doloreux, Shearmur & Chenard (2007) describe six maritime regional clusters including two Canadian (Québec's and St. John's, Newfoundland) and four European (Copenhagen in Denmark, Turku in Finland, Brest in France and Tromsø in Norway). Apart from the different structures of each regional cluster, the most relevant conclusion refers to the dichotomy of 'spontaneous' maritime clusters in contrast to 'constructed' maritime clusters, in other words "bottom-up" versus "top-down" approaches. Taking into account the specificities of the emergence of clusters in a given region, it is crucial to understand this dichotomy. Spontaneous clusters arise without public encouragement and as a response to the specific local conditions and emergence of favourable markets. In this case, public policies operate mostly in a horizontal configuration and focus mainly on innovation and market development, and are conditioned by the fluctuations in the local economies. On the other hand, constructed clusters are a consequence of intervention and produce specific policies to support particular activities. In both cases, in relation to the maritime sector, the cluster development should be anchored in the existing potential of maritime activities, scientific and traditional knowledge (Pinto & Cruz, 2012).

There are several cases of cluster emergence in EU but they vary in scale, breadth of activities, and origin (Simões, 2012). The Atlantic Area member-states face a complex situation. The formalisation of the French cluster focused the increase of dimension of the blue economy and the utilisation of the cluster as a pressure element. Its origin is bottom-up, constituted by research institutes, unions, representative committees of the maritime activities, federations of industries, assurance representatives, ports and maritime transportation, and representatives of the State. The maritime cluster in the UK has made a significant effort to mobilise the younger generation, in the cooperation among maritime activities, and in the diffusion of marine knowledge. Its origin is mainly bottom-up, constituted by maritime associations, companies, the Navy and research institutes. It strategically addresses aquaculture, shipping and shipbuilding, offshore energy, and resource management products and services. There are regional specificities in the maritime cluster. For example, the Scotland Marine cluster emphasises shipbuilding and suppliers to the oil and gas industry. The Spanish cluster presents a strong assimilation of external good-practices regarding planning, conception and management of the cluster. With bottom-up origin, but with strong top-down

support, it is constituted by maritime organisations, associations, research organisations, universities, unions and public organisations. The Irish cluster is based in a top-down approach mixing the ICT with several activities connected with the sea. The Portuguese cluster is mainly a top-down initiative. The cluster is being created with some regional initiatives driven by public stimulus, such as the creation of a cluster agency called OCEANO XXI, and localised initiatives by major companies in the maritime economy mainly located in Lisbon. The cluster pays attention to a variety of activities but giving emphasis to knowledge-based activities and tourism.

The emergence of maritime clusters can make a significant contribution to the capacity of EU regions to compete globally and overcome the myriad problems linked to economic downturn. However, the development of maritime clusters is necessarily complex and requires a shift in economic resources to support them as catalysts for economic prosperity. In this regard, the economic and financial crisis that engulfed the region in 2008 and continues to have negative impacts may have restricted the potential of EU maritime clusters due to the international nature of many blue economy activities. Nevertheless, the importance of the maritime economy to EU economic recovery has been recognised at the policy level through the implementation of the Atlantic Strategy Action Plan (European Commission, 2013) which seeks to protect marine environments while creating jobs. The plan is expected to derive Blue Growth in the decade and forms a key part of the EU 2020 Strategy to promote smart, inclusive and sustainable growth to lift Europe out of its economic crisis.

3 Innovation and Human Capital in the Atlantic Maritime Economy

3.1 Methodological Notes

This study is a result of one of the major outputs of the EU funded HARVEST Atlantic project developed under the Atlantic Area Programme 2007-2013. The project aims to identify and exchange of good practices and sustainable solutions based on innovation, diversification and marketing for the maritime economy and resources to leverage improvements in the socioeconomic situation of the Atlantic seaside territories through transnational cooperation.

The study is based on the findings of a transnational survey that focused on four subsectors of the maritime economy, namely, green maritime energy, biotechnology, repair and shipbuilding, and the seafood sector. The study was applied through an online questionnaire survey of companies operating in the above sectors in Portugal, Spain, Ireland and Scotland. The survey resulted in a sample of 243 enterprises in the maritime cluster and the processing and analysis of data was made using the software SPSS - Statistical Package for the Social Sciences (version 21.0).

The transnational survey, inspired by the Community Innovation Survey (CIS), focused on innovation and human capital and was applied in the last trimester of 2013. The

survey obtained answers from organisations operating in the following maritime domains: R&D and universities (17% of the answers), Coastal tourism (1.7%), Biotechnology (19.1%), Seafood (30.4%), Shipbuilding and repair (7.8%), Energy (8.7%), Environmental protection (2.2%), and Public authorities (3%). The responses obtained were from Ireland (33.3%), Portugal (32.1%), Scotland (14.8%), and Spain (19.8%). The sample is constituted by organisations that operate only at local level (15.9%), regional level (14.3%), national (27%), European (27%), and other international markets (29.4%). Regarding dimension, 40.8% of the entities have less than 10 employees, 44% have 10 to 50 employees, 8% 51 to 250, and 7.2% more than 250 employees. The annual turnover of 58.4% is less than 2 million Euros, 28.5% are between 2 million and 10 million, 7.3% are between 10 and 50 million, and only 5.8% had turnovers greater than 50 million Euros. Table 5 synthesises this information.

Table 5 around here!

3.2 Relevant Results from the Survey

The first dimension to analyse in the survey features innovation. The data reveals that the sample comprised a significant proportion of innovators. The data from CIS (Eurostat, 2015) for the equivalent period 2010-2012, reported that the percentage of firms that have developed innovation activities (product and/or process innovative enterprises) were 42.3% in Ireland, 36.7 in France, 41.3 in Portugal, 23.2 in Spain, and 34 in the UK. In this study, when asked if the organization had engaged in innovation activities in the previous year, 52% answered positively what shows that our sample is biased towards those more innovative. The most common innovative activities are internal new product or service development (34.5%), internal or external marketing activities aimed at the introduction of innovations (22%) and acquisition of machinery and equipment (20.2%).

The impacts of innovation activities on the organizations include the increased range of goods and services (23.3%), increased capacity for production (22.9%) and improved quality of goods or services (21.8%). Results relating to organisations engaged in cooperation activities show that consultants (19.4%) and clients or costumers (19.3%) are the preferred types of actors that engage in cooperative projects directed to innovation. Other relevant players are suppliers of equipment, materials, components or software (16.3%) and universities and other public research institutions (15.5%).

Table 6 around here!

A second dimension analysed by the survey featured human capital. Around 70% of companies referred to staff not possessing a PhD, MSc and/or a Bsc qualification. However, this appears not to be too significant as only 25% of companies responded that they experienced a shortage of qualified staff. Also, only 26.1% of companies noted skill shortages that third level institutions could meet. The outcomes reveal a low level of reliance on the contributions that third level institutions can provide to improve competencies of the staff. The area where a distinct lack of capacity is evident is in sales and marketing skills.

A third dimension analysed in the survey was factors relating to the location of the organization. Here, the main reason cited for location is the proximity to raw materials (33.6%), and is particularly relevant to companies based in marine and maritime resources. Another important justification for the choice of location is 'family' reasons (29.5%) – an outcome that directly aligns to the existence of social capital in the territory.

One aspect analysed in the survey related to the perceived benefits of locating in the Atlantic Area. The results show that 61.3% of the organizations agreed that its competitive position or market image benefited from being located in the Atlantic Area or from using Atlantic products or resources. The organizations considered that their activity, products or services were adding value to the image of their region and of the Atlantic Area because they were innovation leaders (33.8%), engaged in adding value to the territory through social responsibility (30.5%), and environmental leaders in the sector (26.3%).

A final dimension focused on the intervention that decision-makers could make to stimulate a favourable environment for businesses in the blue economy. The responses reveal that the priority to be address by policies was very clear with 45.1% of the respondents noting that a reduction in bureaucracy for undertaking economic activities was the primary policy priority. These results are summarized in table 6.

4 Econometric Evidence of Cooperation

Cluster emergence and consolidation requires both competition between firms in the markets, and cooperative behaviour. This section turns attention to the main determinants of the variety of cooperative behaviour. Analysis of the survey data helps understanding of the factors that induce cooperation. The dependent variable selected was the variable "COOP" - a construct that may vary from 0 to 9 depending on the extent to which an organization cooperates with other enterprises of the same group, such as suppliers, clients, competitors, consultants, commercial laboratories, HEIs, government organisations, or private research institutes. Figure 2 shows the distribution of "COOP". It assumes 152 times the value of zero, meaning that around 62.5% of the respondents do not cooperate at all. Cooperation with one, two and three types of actors

is similar (around twenty observations) and it diminishes with the increase in the variety of types of actors cooperating.

Figure 2 around here!

Selected independent variables intend to analyse specific dimensions that are relevant for cluster development. In this way we have selected three groups of variables. The first group directly focus innovation and human capital. It includes the participation in innovation activities (INNO), uncertainty and economic turbulence as the main restriction to innovation (UNC), the main justification for location is geographical proximity to qualified human resources (PROXHR), human capital measured PhD, Msc, Bsc staff (HUMCAP). Several studies show that the engagement in innovation activities is commonly connected to the development of cooperation activities with a variety of other actors. Studies using CIS data commonly had shown this situation (de Faria, Lima & Santos, 2010; Iammarino, Piva, Vivarelli & Von Tunzelmann, 2012). The economic crisis has had impacts in the innovation activities (Eurostat, 2015). These impacts were asymmetric, while several companies were abandoning their projects (Paunov, 2012) others were able to increment their innovative efforts (Archibugi, Filippetti & Frenz, 2013). We want to test the impact of crisis in cooperation. One of the key determinants to cluster formation is the proximity to a relevant pool of qualified human resources (Porter, 1998). Thus this availability should be positively associated with cooperation activities. We will test the statistical significance of this assertion within our sample of maritime organisations. The qualification of the human capital is critical for the absorptive capacity of the firm, the way it perceives the value of external knowledge and its interest in cooperating with others (Albors-garrigos & Hidalgo, 2012; Pinto & Fernández-Esquinas, 2013).

A second group includes structural variables, the dimension of the organisation, measured by turnover greater than 50M€ (TURNOV) and the competition in external markets (EXP). The size of firms is ambiguous in relation to cooperation in innovation and innovation activities (OECD, 2009). Bigger firms are often more connected with external players but less embedded with territorial nodes. Nonetheless, it is important to control the effect of size. Firms that compete in external markets are more prone to cooperate in innovation (Halpern & Muraközy, 2012; Iammarino et al., 2012).

The third group includes three sectoral dummies for tourism (TOUR), seafood (SEAF) and biotechnology (BIOT). Tourism is commonly regarded as less innovative and cooperative sector (Pinto & Cruz, 2012). We want to test if this hypothesis has an empirical ground as coastal tourism is assuming a relevant role in policies regarding maritime clustering. Seafood encompasses traditional industry branches with highly innovative activities. The model verifies the significance of this sector. Biotechnology is often assumed as an emergent field in the context of knowledge economy, one of the

areas of higher potential growth within the maritime economy. It is a field that is regarded as highly connected (Fornahl, Broekel & Boschma, 2011). The model verifies if this remains true in our sample.

All independent variables are binary variables that assume the value 1 if the qualitative characteristic under analysis is present. Variables and related exploratory hypotheses are presented in Table 7.

Table 7 around here!

The correlation table for all variables is presented in the table 8. It shows the high positive linear association between cooperation, human capital and innovation activities. It is worth mentioning that human capital correlates positively with the proximity to qualified human resources. Innovation is also associated to organisations that operate in external markets.

Table 8 around here!

As “COOP” is an ordinal variable, it was necessary to estimate a different ordinal LOGIT model for understanding the cooperative behaviour. Thus, a general model was estimated (aggregated data for all types of entities). This allowed the separation of data for cooperation with suppliers, cooperation with clients, and cooperation with HEIs. However, no significant statistical difference was evident. Data was also controlled by country, but again there was no significant difference. Table 9 presents the estimation results of the global model.

Table 9 around here!

In relation to the hypotheses elaborated with the results, the outcomes confirm H1. That is, the participation in innovation activities induces a variety of cooperation based on a positive and statistically significant coefficient. There is no clear result for H2. The sign is negative but not significant enough to provide sufficient evidence that firms affected by uncertainty and economic turbulence are less cooperative. The coefficient associated with the fact that firms are localized in pools of qualified human resources is not significant (H3). It too registers a negative outcome thereby suggesting ambiguous effects of this variable in cooperation. H4 is clearly confirmed with evidence to suggest that firms with qualified human capital are more willing to cooperate. The coefficient

associated with export activity is positive but is not significant in statistical terms (H5). It is not clear if the dimension of firms affects its cooperation patterns (H6). The coefficient relative to the association of bigger firms is positive but, again, statistically it is not significant. Regarding the sectoral dummies, there is clear confirmation that tourism firms are less cooperative than the average (H7). It is not possible to draw conclusions regarding whether or not seafood firms are less cooperative (H8) but it was found that biotechnology firms are less cooperative than the average (H9). This is contrary to the original hypothesis that this emergent high-tech sector was more open to cooperation.

5 Conclusions

Regardless of its importance to regional development, clusters are omnipresent in the world of policy-making. The maritime cluster is being transformed into a strategic ambition in the Atlantic regions as a means of driving positive dynamics of development. Blue growth is centred on fostering more jobs and growth in coastal areas and in the maritime economy by giving a substantial push to emerging maritime sectors (ocean energy, marine biotech and the exploration and exploitation of deep sea natural resources) and by revitalising traditional industries such as aquaculture and coastal tourism. This is a topic that deserves more attention from future research.

This article has discussed the emergence of clusters linking these phenomena with innovation, human capital, and social capital. Using a transnational survey applied in 2013 to 243 actors operating in the Atlantic Area in Portugal, Spain, Ireland and Scotland in maritime sub-sectors (R&D and universities, coastal tourism, biotechnology, seafood, shipbuilding and repair, energy, environmental protection, and public authorities), the research has presented insights into innovation and human capital. The empirical study presents evidently several limitations. The major one regards, in our perspective, the size of the sample, its sectoral and regional focus, which does not permit the representation of what is an Atlantic maritime cluster. Other evident limitation is the quantitative character of the study. Deeper information about cooperation and its enablers and constraints could be collected using other approaches of a more qualitative character. Nonetheless the results of the survey show that actors in the blue economy participate in innovation activities to increase productive capacity, gain more quality and deliver a wider range of products. Actors participate in innovation activities investing in new products and processes, marketing innovations and the acquisition of machinery and equipment. Key sources of innovation include clients, consultants and suppliers. It was also revealed that location choice is mainly justified by the co-location of social capital (family networks) and by the utilization of coastal products and resources in the organization's value-chain. The market image of the Atlantic is commonly explored as a differentiation characteristic. More than seventy percent of actors do not have third-level educated employees but only a quarter identify their educational shortages, specially affecting marketing and sales skills. Excessive

bureaucracy and complex legislation are identified as policy problems that need to be addressed in a multi-level governance perspective for the emergence of the maritime cluster. The analysis and discussion clarified the determinants of cooperation variety by estimating different ordinal LOGIT models. Here it was revealed that cooperative behaviour depends mainly on the capabilities of the firm – absorptive capacity – as well as previous experience in participating in innovation activities. It was also noted that tourism is a less collaborative branch in the maritime cluster.

The policy implications for blue growth as a consequence of these results are clear. For instigating the emergence of a maritime mega-cluster, policy-makers must induce cooperation. Currently, it is evident that cooperation remains at a low level as the majority of organizations do not participate at all in cooperative activities. Programmes that focus directly the collaboration such as networking and knowledge exchange between firms and other types of organizations, such as universities and other public research organisations or governance bodies, are of major importance. Two other types and interventions are also relevant. The first relates to the direct stimulus to participation in innovation activities due to actors who participate in innovation tend to be more willing to cooperate with others. A second is the improvement of human capital in the organisations. Through enhancement of competencies, qualifications, and skills, organisations can increase their absorptive capacity and acquire an ability to recognize the potential and value of cooperation for their own advancement and economic benefit.

Finally, it is important to refer to some particular activities that should not be considered as part of the core of the maritime cluster as they reveal a cooperation-adverse profile such as in the case of tourism. Although coastal tourism attracts the attention of policy makers in the context of maritime cluster emergence, there is a lack of collaboration between organisations in this sector that prevents the development of initial dynamics and consolidation of a more transversal maritime cluster. The sector to be selected by policies as the core of a maritime cluster should be relevant in terms of competitiveness but should also be cooperative in its essence.

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Tables

Table 1: Weight of Maritime Economy in Atlantic Area Countries

Country, Zone	(%) of GDP	Author and year of publication
United Kingdom	4.2	Pugh (2008)
France	1.5	Kalaydjian et al. (2010)
Ireland	0.8	Morrissey et al. (2011)
Spain	2.9	Innovamar (2011)
Portugal	2.4	Simões (2012)
European Union	4.0	European Commission DG MARE (2012)

Source: Adapted from Surís-Regueiro, Garza-Gil, & Varela-Lafuente (2013: 116)

Table 2: Top-7 sub-functions ranking in order of size/growth/scores in Maritime Activities at EU level

Top-7 current size	Top-7 recent growth	Top-7 future potential
Coastal tourism Deepsea shipping Shortsea shipping (incl. RoRo) Offshore oil and gas Yachting and marinas Passenger ferry services Catching fish for human consumption	Offshore wind Cruise tourism Securing freshwater supply (desalination) Shortsea shipping & deepsea shipping Yachting and marinas Marine aquatic products Protection against flooding and erosion	Blue biotechnology Offshore wind Protection against flooding and erosion Ocean renewable energy (wave, tidal, OTEC, thermal, biofuels, etc.) Traceability and security of goods supply chains Environmental monitoring Marine minerals mining

Source: European Commission, DG MARE (2012)

Table 3: Ideal types of clusters

Ideal-type	Origin	Internal dynamics	Local linkages
'hub-and-spoke' industrial district	small number of central firms, often dominant and large, that act as anchors of the region	generate the necessary critical mass demand for specialized human resources and business provision, creating the stimulus for the creation of additional smaller entrepreneurial companies in their close environment	are limited to a small number of suppliers
satellite platform district	a region hosting facilities of external companies	capacity of the 'satellite platform district' depends on specific decision-making processes made in the headquarters of the company and the degree of interconnections and networks with other regional actors	it can evolve to deeper stages of regional integration, attracting suppliers or even competitors, stimulating clustering dynamics
'state-anchored' industrial district	territories that benefit from the location of relevant public institutions	depends mainly on public budget allocation	supplier chains may develop and new entrepreneurial firms assume relevant roles in regional economy if universities and other public research organizations are able to transfer and exchange knowledge with regional actors through the adequate channels

Source: Inspired by Markusen, Lee and DiGiovanna (1999).

Table 4 The Structure of the Marine Economy

Group	Marine Sector	Marine Industry
Completely marine	1. Living resources	1.1. Fishing 1.2. Aquaculture 1.3. Seafood processing 1.4. Seafood markets
	3. Ship and boat building	3.1. Ship building 3.2. Boat building 3.3. Repair and maintenance
	5. Transportation	5.1. Marine passenger transportation 5.2. Marine freight transportation
Mainly marine	2. Non-living resources	2.1. Oil and gas exploration and production 2.3. Extraction of gravel and sand 2.4. Extraction of salt
	4. Construction	4.1. Marine construction
	5. Transportation	5.3. Service activities to transportation
Partially marine	1. Living resources	1.5. Animal production 1.6. Other food products
	2. Non-living resources	2.2. Mining of metal ores 2.5. Renewable energy 2.6. Water collection 2.7. Waste and decontamination
	3. Ship and boat building	3.4. Manufactures for shipbuilding 3.5. Other manufactures and services
	4. Construction 4	.2. Marine related construction
	5. Transportation	5.4. Support activities for transportation
	6. Tourism and recreation	6.1. Accommodation 6.2. Other tourism and recreational services
	7. Public administration	7.1. Administration of the State 7.2. Provision of services Foreign affairs 7.3. Social security
	8. Education and R&D	8.1. Education 8.2. Research and development
	9. Others	9.1. Office support activities 9.2. Membership organisations 9.3. Other activities not elsewhere classified

Source: Based in Surís-Regueiro, Garza-Gil, & Varela-Lafuente (2013).

Table 5 Descriptive statistics (sample of Atlantic Area Stakeholders)

<i>Domains</i>			<i>Countries</i>		<i>Dimension – employees (N)</i>	
R&D	and	17%	Ireland:	33.3%	< 10 employees:	40.8%
universities:			Portugal:	32.1%	10 to 50:	4%
Coastal tourism:		1.7%	Scotland:	14.8%	451 to 250:	8%
Biotechnology:		19.1%	Spain:	19.8%	>250 employees:	7.2%
Seafood:		30.4%	<i>Markets</i>		<i>Dimension – turnover (M€)</i>	
Shipbuilding	and		Local:	15.9%	> 2:	58.4%
repair:		7.8%	Regional:	14.3%	2 to 10:	28.5%
Energy:		8.7%	National:	27%	10 and 50: <50:	7.3%
Environmental			European:			5.8%
protection:		2.2%	Other international			
Public authorities:		3%	markets:	29.4%		

Source: Own elaboration.

Table 6 Key findings of applied survey (Values in percentage of total sample)

Innovation activities							
Internal or external marketing activities	Internal or external training for your	Internal New Product or Service	Acquisition of external R&D	Acquisition of machinery and	Acquisition of other external knowledge	All design functions	Other (Please specify)
22	14.6	34.5	13.2	20.2	16	15.2	9.1
Impacts of innovation activities							
Increased range of goods or	Improved quality of goods or	Improved production	Reduced unit labour costs	Increased capacity	Reduced materials and/or	Improved environmental	Met regulations or standards
23.3	21.8	16	17	22.9	8.7	14.8	13.9
Cooperation to drive innovation activities							
Other enterprises within your	Suppliers of equipment.	Clients or customers	Competitors	Consultants	Commercial laboratories/R&D	Universities or other higher education	Government research
10.3	16.3	19.3	6	19.4	12.1	15.5	12.9
							Private research institutes
							8.2
Areas of evident staff shortages							
Market/business development	Product/service innovation or	Sales and marketing skills	Operations management	Finance/administration skills			
6.1	5.7	9	6.9	5.9			
Reasons for the selection of location							
Family reasons	Proximity to markets	Proximity to raw materials	Proximity to specialized	Proximity to other companies	Regional or local incentives	Opportunity to exploit an	Availability of / access to higher
29.5	18.3	33.6	21.2	22	21.2	21.6	16.6
							Other (please specify)
							27.7
Priorities for policy-makers							
Reduce bureaucracy for undertaking	Simplify legislation for undertaking economic	Increased productivity supports	Promote maritime education policy	Create an effective channel of information	Improve access to finance supports	Promote awareness and involvement in	Promote linkages between industry and
45.1	15.9	2.3	7.7	12.5	13.3	5	4.2
							Promote entrepreneurship and
							Promotion of training and skills development
							Market support
							4.1

Source: Own elaboration.

Table 7 Correlation table

	HUMCAP	BIOT	COOP	EXPOR	INNO	UNC	PROXHR	SEAF	TOUR	TURNOV
HUMCAP	1.000	0.162	0.566	0.189	0.271	0.076	0.409	-0.160	0.350	0.073
BIOT	0.162	1.000	0.078	0.134	0.112	0.041	-0.032	-0.299	-0.166	-0.027
COOP	0.566	0.078	1.000	0.209	0.563	0.285	0.156	-0.023	0.063	0.211
EXPOR	0.189	0.134	0.209	1.000	0.311	0.180	-0.008	0.119	0.000	-0.043
INNO	0.271	0.112	0.563	0.311	1.000	0.436	-0.051	0.088	-0.159	0.268
UNC	0.076	0.041	0.285	0.180	0.436	1.000	-0.023	0.067	-0.121	0.241
PROXHR	0.409	-0.032	0.156	-0.008	-0.051	-0.023	1.000	-0.216	0.364	-0.038
SEAF	-0.160	-0.299	-0.023	0.119	0.088	0.067	-0.216	1.000	-0.225	0.086
TOUR	0.350	-0.166	0.063	0.000	-0.159	-0.121	0.364	-0.225	1.000	-0.065
TURNOV	0.073	-0.027	0.211	-0.043	0.268	0.241	-0.038	0.086	-0.065	1.000

Source: Own elaboration.

Table 8: Independent variables

Independent variables	Nr of 1s	Hypotheses
INNO - Participation in innovation activities	78	<i>H1: participation in innovation activities induces cooperation (+)</i>
UNC - Uncertainty and economic turbulence is the main restriction to innovation	52	<i>H2: firms affected by uncertainty and economic turbulence are less cooperative in these activities (-)</i>
PROXHR - Proximity to qualified human resources is the main justification for location	51	<i>H3: firms localized in pools of qualified human resources are more willing to cooperate (+)</i>
HUMCAP – Human Capital measured by if firm has PhD, Msc, Bsc	77	<i>H4: Firms with absorptive capacity cooperate more (+)</i>
EXP - Firm compete in the external markets	54	<i>H5: Firms that export are more cooperative (+)</i>
TURNOV - Turnover greater than 50M€	8	<i>H6: Bigger firms are more cooperative than smaller firms (+)</i>
TOUR - Sectoral dummy for Tourism	44	<i>H7: Tourism firms are less cooperative than the average</i>
SEAF - Sectoral dummy for Seafood	70	<i>H8: Seafood firms are less cooperative than the average</i>
BIOT - Sectoral dummy for Biotechnology	27	<i>H9: Biotechnology firms are more cooperative than the average</i>

Source: Own elaboration.

Table 9: Global Model for Dependent Variable COOP

Independent variables	Coefficient	Std. Error	z-Statistic	Prob.
INNO	2.975***	1.0055	2.9589	0.0031
UNC	-0.351	0.7197	-0.4873	0.6261
PROXHR	-0.0296	0.8030	-0.0369	0.9706
HUMCAP	3.3871**	1.3265	2.5535	0.0107
EXPOR	0.1978	0.7019	0.2818	0.7781
TURNV	2.2870	7.1438	0.3201	0.7489
TOUR	-39.710***	2.4310	-16.335	0.0000
SEAF	-0.6006	0.5789	-1.0375	0.2995
BIOT	-1.8836***	0.5884	-3.2011	0.0014

Akaike info criterion: 11.398 Schwarz criterion: 11.642 Log likelihood: -1367.80

Hannan-Quinn criterion: 11.496 Avg. log likelihood: -5.629

*** Significant at 0.01, ** significant at 0.05.

Source: Own elaboration.

Figure 1: Maritime cluster and sub-sectors

Source: Own elaboration inspired in Lopes (2009).

Figure 2: COOP – Number of organizations cooperating with 0 to 9 types of entities

Source: Own elaboration.