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Social, Human Capital and Innovation: An Exploratory Study of European Atlantic Organisations

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ABSTRACT

At European Union level, territorial cooperation initiatives are aligned with operational programs focused in innovation as a policy target for socioeconomic development. The project HARVEST Atlantic is a project developed under the Atlantic Area Programme that intends to identify and exchange good practices and sustainable solutions based on innovation for the maritime and marine economy. Based in a transnational survey applied in Portugal, Spain, Scotland and Ireland, with a sample of 243 organisations, this article was structured in two empirical components. The first component, using the SPSS - Statistical Package for the Social Sciences (version 21.0), focused the descriptive analysis of selected key dimensions of the survey. A second component used structural equation model techniques (software AMOS program GRAPHICS) to create a model relating innovation with social (relational) capital and human capital. Results show differences between the four countries of North Atlantic in the impact that innovation activities have had on organizational behaviour in the period 2011-2012. We validated the model in which relational capital and human capital are significant for the impacts generated by innovation activities (and consequent improvements in the performance of organisations).

Key-Words: Atlantic Area, Innovation activities, Human Capital, Relational Capital, Social Capital, Structural Equation.

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INTRODUCTION

Why specific industries increase performance in their overall production over time, while in others, performance gradual declines? Innovation became an increasing important means of developing and maintaining industrial competitive advantage (Soriano & Huarng, 2013). Innovation is the business activity that most closely relates to economy growth. At European Union level, following the challenges of the Lisbon Agenda, member-states tried to introduce regional and national innovation strategies in order to make the European economy the most competitive knowledge-based economy in the world. The development potential of any kind of organization is embedded in its knowledge-based assets.

In the last decade, firms all over the world have implemented new knowledge and management systems. European countries of the North Atlantic Coast as for instance, Portugal, Spain, Scotland and Ireland (not forgetting France, but not part of this study) made a huge effort in trying to gain competitive advantage in the maritime and marine economy. It is widely believed that knowledge, in terms of human and social capital, is the main production factor in today's economic environment. Investments in intangible assets are viewed as the most important source of performance. Resources that are valuable, rare, and impossible to copy or replace are the key for long-lasting competitive advantage (Kozak, 2011).

This article integrates literature and an empirical study regarding human capital, social capital and innovation (in terms of impacts in companies due to the introduction of innovative activities), combining country level perspectives to understand cross-country differences on improvements in the North Atlantic (Portugal, Spain, Ireland and Scotland). It is also our intention to validate a structural model that incorporates the connection of relational and human capital with innovation.

Problem And Purpose

In the knowledge economy, the value of countries, regions, organizations and individuals is directly related to their knowledge and human capital (Edvinsson & Bounfour, 2004). The competitiveness of countries in attracting foreign investors is often determined by their specific and unique intangible resources. Intangible investments in research and development and innovation are viewed as the most important sources of performance. Educated and skilled workers who can continuously upgrade and adapt their skills to efficiently create and use knowledge. An effective innovation system of firms, research centres, universities, consultants, and other organizations should keep up with the knowledge revolution and tap into the growing stock of global knowledge and assimilate and adapt it to local needs. Innovation must be considered together with competence building and advanced training of individual skills through the complex interactions between formal and informal qualifications. Successful competitive industries depend on knowledge flows and integration of existing academic knowledge in the innovation process. To ensure long-term growth employment, communities in the Atlantic Area will need to cope with the decline in traditional industries, *e.g.* fisheries and shipbuilding and a decline in mass tourism. The policy document "Study on Deepening Understanding of Potential Blue Growth in the EU Member States on Europe's Atlantic Arc Sea Basin Report"[1] suggests actions at EU and EU member-state level: a closer interface between

[1] This study was used to illustrate several contextual statistics used in the presentation of countries. The full reference is: Study on Deepening Understanding of Potential Blue Growth in the EU Member States on Europe's Atlantic Arc Sea Basin Report FWC MARE/2012/06 – SC C1/2013/02. Client: DG Maritime Affairs and Fisheries. Rotterdam/Brussels, 19th December 2013.

regional clusters of maritime industries and educational establishments are seen as a way out of the economic slowdown, since local and regional agglomerations of companies and education institutes ensure a skilled workforce and to promote greater labour mobility within sectors. At EU level, territorial cooperation projects in line with the operational programs currently developed for the new ERDF programming period (2014–2020) aim at supporting these goals.

In this context, the project entitled HARVEST Atlantic was developed under the Atlantic Area Program to identify and exchange good practices and sustainable solutions based on innovation, in order to improve the socioeconomic situation of the Atlantic seaside territories. This article is a part of the global study of this project that tried to better understand the current state of the countries analyzed and think about the prospects for the future. This article shows the differences between the four countries of North Atlantic Coast - Portugal, Spain, Scotland and Ireland - in social and human capital, and in the impact that innovation activities have had on different organisations in the period 2011-2012. Secondly, we test a model in which relational capital and human capital influence the impact in innovation activities.

REVIEW OF LITERATURE

Social and Human Capital as determinants of Innovation

Innovation is a result of a process of development and learning that goes beyond organizational barriers, from the scientific and technological developments to those that appear from the interaction with other sources of knowledge. These interactions have the capacity to make dynamic capabilities emerge (Senge, 1990; Eisenhardt & Martin, 2000; Teece, Pisano & Shuen 1997; Zollo & Winter, 2002) and this situation is directly related with the concept of relational capital and its positive influence over organizational innovation (Martín & Navas 2009). In this sense, we can stress that organizations in a certain environment can combine resources in order to establish networks that stimulate inter-organizational linkages, as it is proposed by the literature of regional and national innovation systems. In these systems, the identification of agents and relationships (Quintero-Campos, 2005) serve as a basis for the creation and spread of knowledge and greatly influences the development of innovation policies (Lundvall, 1992). Additionally, a number of recent studies have consistently found that human capital not only enhances the ability of a country to develop its own technological innovation but also increases its capacity to adopt technologies already developed elsewhere and thereby facilitates economic catching-up processes (*e.g*., Griffith, Redding & Reenen, 2004; Benhabib & Spiegle, 2005; Kneller & Stevens, 2006; Madsen et al. 2010, among others). Thus, relational and human capital may be seen as antecedents of innovation.

Human capital and innovation

Human capital represents the knowledge and skills that individuals bring to an organization (Dimov & Shepherd, 2005). It can be acquired and developed through education ('general' human capital) and professional experience/skills ('specific' human capital) contributing to both the explicit and tacit knowledge of the firm. It is necessary for performing the required Structural capital (organizational) that includes information systems, knowledge encoded in the form of databases, processes and organizational procedures (which are not in the minds of the employees, but on external means), trademarks, patents, and infrastructure required to support the application of the organizational strategies. The vast majority of the empirical works on human capital involve country level analyses, generally yielding positive results (*e.g*., Barro & Lee, 1993; Hanushek, 2013, among others), focusing on issues of economic growth (Wößmann, 2003; Teixeira & Fortuna, 2010) or rate-of-return analysis (Sianesi & van Reenen, 2003; Folloni and Vittadini, 2010). Empirical studies on human capital at firm or establishment

level are in much inferior number than those related to more aggregate analyses (Teixeira, 2002; Mendes, Nunes & Sequeira, 2012). Notwithstanding, in existing literature on firms and human capital there is a wide consensus that human capital leads to growth or increased performance of business ventures (Unger, Rauch, Frese & Rosenbusch, 2011). The model of Vandenbussche and colleagues (2006) defends that the growth of firms is associated to educated people. In the line with neo-Schumpeterian literature and the Resource-based view, one of the determinants of innovation propensity of firms is shown to be human capital (or skilled labour). In this context, human capital is considered as reflecting a firm's capacity to absorb, assimilate and develop "new knowledge and technology" (Bartel & Lichtenberg, 1987; Cohen & Levinthal, 1990). The more new knowledge and technology is absorbed, the more innovation propensity in the firm is expected (Crepon, Duguet & Mairesse, 1998; Hall & Mairesse, 2006).

Social Capital And Innovation

Social capital is the sum of the actual and potential resources embedded within, available through and derived from networks of relationships by an individual or social unit (Nahapiet & Ghoshal, 1998). Relational capital means external links with suppliers, customers and other stakeholders of the organization, which allows to buy and sell goods and services in an efficient and effective manner (through knowledge of customer preferences and of the factors that lead to a satisfactory relationship with them, and so on). Research on social capital highlights two main dimensions of the inter-organizational relationships: the structural dimension and the relational dimension (Granovetter, 1992; Nahapiet & Ghostal, 1998). The first one, the structural dimension refers to the overall pattern of connections between actors, that is, who you reach and how you reach them (density, connectivity and hierarchy are measures of the structural dimension). Social capital approach suggests that factors relevant to the generation of innovation include not only the number of partners and the structure of the network but also the level of commitment, cohesiveness and trust embedded in the inter organizational relationships (Adler & Kwon, 2002; Mu, Peng & Love, 2008; Tidd, 1995). The second one, the relational dimension, is the dimension that we are going to study in this article. It describes the kind of personal relationship people develop with each other through a history of interactions (respect, trust and friendship are usual aspects included in this dimension). This ability creates relational value with external elements that are part of the interested company, commonly called stakeholders (Joshi, Cahill & Sidhu, 2011), and centered in knowledge and in inter actions with various external parties: alliances, clients, investors, consulters, universities, distributors of networks, partners and suppliers. Even more, the relational dimension could better explain innovation performance (Moran, 2005), given that innovation mostly depends on the quality of relationships established between the people involved (relational dimension), rather than on the density, connectivity and hierarchy of such relationships/structural dimension).

This paper departs from the perspective that current levels of social capital are formed by historical institutions and investments, such as early literacy, past political institutions and universities. It suggests that innovation is an important channel by which social capital improves income growth. Therefore, the overall hypothesis of the social capital theory in the matter of innovation is that: *''Firms in communities with a large stock of social capital will (...) always have a competitive advantage to the extent that social capital help reduce malfeasance, induce reliable information to be volunteered, cause agreements to be honoured, enable employees to share tacit information, and place negotiators on the same wave-length. This advantage gets even bigger when the process of globalization deepens the division of labour and*

thus augments the needs for co-ordination between and among firms'' (Maskell, 2001, p. 7). The social capital framework provides an interesting perspective from which to explain the effect of inter-organizational relationships on innovation (Subramaniam & Youndt, 2005) in terms of magnitude of change, degree of novelty, or innovativeness (Gatignon, Tushman, Smith & Anderson, 2002). Since businesses are becoming more complex, dynamic and globally competitive knowledge (that an organization has) and intelligent workers (who know how to use and develop this knowledge) become valuable intangible assets (part of the intellectual capital of the organization) which increases the capacity of creating value for its members (Sumedrea, 2012).

The Atlantic Coast

Five countries constitute the European Atlantic Area: Portugal, Spain, France, Ireland and the United Kingdom, sharing the same design they have extensive coastal areas, most of the population live in these areas and work in sectors related to the maritime and marine economy. Sea is the source of central economic activities and defines important directions for progress and economic development.

Portugal[2]

Po The coastline of Portugal measures approximately 1,860 km, thus including the continental territory (943 km) and the archipelagos of Azores (667 km) and Madeira (250 km). In total, this represents 2.7% of the total EU coastline. Portugal is undergoing a period of fiscal adjustments. In 2012, the GDP amounted to € 165 bn which represents a decrease of 3.2%, as compared to 2011[3]. In the first quarter of 2013 GDP further decreased with 3.9% in real terms (in comparison to the same quarter in the previous year). An important sector in Portugal is fisheries, representing slightly less than 2% of the country's GDP in 2012. In 2011, industrial production of fishery and aquaculture dropped by 2.2%. This was seen as a result of the structural adjustment of the economy produced by technological improvements in the first sector, and the subsequent diversification of the economic activity towards the industry and service sectors. Within the fisheries sector aquaculture has shown an increase and is now contributing around 5% of the total fish production. In 2011, 13,156 individuals worked in the fishing sector, representing 0.3% of the total employed population[4]. In the maritime and marine economy, tourism is another important sector showing an increase of GVA and employment contribution with coastal and nautical tourism, including yachting and marinas and cruise tourism, despite the economic crisis. Tourism is gaining an important weight in the economy and is currently representing 8.8% of the national GDP[5].

Spain

Spain has the longest coastline of all EU member-states, with a total of 7,876 km - of seas and oceans[6] bordering the Iberian Peninsula and the Canary and Balearic Islands. This equals

[2] Study on Deepening Understanding of Potential Blue Growth in the EU Member States on Europe's Atlantic Arc Sea Basin Report FWC MARE/2012/06 – SC C1/2013/02 .Client: DG Maritime Affairs and Fisheries.Rotterdam/Brussels, 19th December 2013

[3] Statistical National Office Portugal (INE), 2011, Website Data, Table A.1.1. Gross domestic product at market prices (annual) and Table A.1.1.8 - Gross domestic product at market prices (volume change rate; annual). Please note that the figure on GDP is a preliminary data calculation by Statistics Portugal (INE). Further information provided in Flash-sheet "Destaque" of 11th of March 2013 set the GDP for 2012 in €165.4 bn.

[4] Fishery Survey, 2012, Statistical National Office Portugal (INE)

[5] Yearbook of tourism statistics, 2009, Turismo de Portugal.

[6] Statistical National Office (INE), Spain, 2008.

12.1% of the European coastline[7]. The Economic Exclusive Zone (EEZ) covers 552,000 km^2 for the continental mainland and 455,000 km^2 for the Canary Islands. Its coastal population living at 10 km from sea amounts to 13,000,000 which represent 33.2% of total population. Spain borders two sea-basins: the Mediterranean and the Atlantic. Spain also has been heavily affected by the economic crisis, which marked a period of serious economic decline, reversing the economic expansion that was observed in the preceding period. In the first semester of 2013, an economic downturn of - 0.5% GDP was recorded (total GDP value of € 255 bn)[8]. Fiscal adjustments policies and the bank system restructuring process have had important consequences on the national demand, counterbalanced by a sluggish increase in exports. In 2011, around 1% of GDP in Spain stems from fishery activities, representing a GVA of € 2 bn. Compared to 2010, this presents a 9% increase. Aquaculture formed some 30% of these fishery activities. In addition, other sea related activities are reporting positive trends, such as maritime transport and the coastal tourism. Maritime transport and port activities represent for Spain around 1.1% of GDP[9]. Also the tourism sector, notably on the Mediterranean coast is an important source of income for the country.

Ireland

Ireland is a truly maritime nation with its coastline extending over 5,631 km (3,500 miles) when taking the land borders to the sea into account and 7,500 km when the entire sea area of Ireland (seabed territory belonging to Ireland) is taken into account. Despite the future economic outlook remaining uncertain and with some worrying signs for the Irish economy, the overall forecast is positive with a growth rate of 1% in 2013 and increasing to 3% in 2015. Unemployment has continued to decline since the peak at the start of 2012 (15%), a trend that is to continue, while employment has also started to increase in the second half[10] of 2012 and is expected to continue to show signs of recovery in 2013 (growth of 0.2%). The continued net emigration that has started in mid 2009 is expected to continue but at a decreasing rhythm. The main ports in Ireland are located in: Dublin, Howth (near Dublin), Drogheda, Rosslare, Waterford, Cork, Baltimore, Shannon Foynes and Galway[11] this also reflects the main employment locations in the Irish ocean economy. The sector is dominated by marine tourism and maritime transport. Together they account for 54% of the sector's direct GVA. They are followed by: oil & gas, marine manufacturing and fishing as the five major sub sectors in the maritime economy.

Scotland

The coastline of Scotland, part of the United Kingdom, is around 10,000 km (mainland). The Eastern seaboard faces the North Sea and the Western and South Western seaboard the Atlantic Arc. On the Eastern seaboard, the principal conurbations are Edinburgh in Scotland. On the Western seaboard, the principal conurbations are Glasgow in Scotland, Most of the aquaculture occurs along the West Coast of Scotland and catching fish is mainly based in Peterhead and Fraserburgh on the East Coast of Scotland. The North Sea is important for the

[7] European Union coastline is around 66,000 Km.
[8] Statistical National Office, Spain. Data: 1st quarter 2013.
[9] Source of information "Puertos del Estado".
[10] Employment figures recovered more slowly than unemployment figures.
[11] Please note: this listing of main ports in Ireland includes both shipping ports and fishery harbours. In: Marine Institute, Ireland, 2011: OUR OCEAN WEALTH: Towards an Integrated Marine Plan for Ireland Seeking Your Views on New Ways; New Approaches; New Thinking, P.12. Available here: http://www.ouroceanwealth.ie/Briefing%20Documents/Our%20Ocean%20Wealth%20Briefing%20Documents%20for%20Consul tation%20Part%20II%20Sectoral%20Briefs.pdf.

economy through the production of oil and gas, in particular the city of Aberdeen, and renewable energy is playing an increasing role, with substantial investment in offshore wind in the shallower southern part of the North Sea.

METHOD

We selected the strategic planning methodology known as ITSGA - Information Technology Strategic generic Actions (Andreu, Ricart & Valor, 1997), which aims to identify strategic actions produced by the collected information, whose application can deliver improvements in three variables: relational and human capital and innovation (activities' improvements). The sample of 243 organisations from the maritime and marine economy was collected during 2013 in the four countries (Portugal, Spain, Scotland and Ireland) by the HARVEST Atlantic project partners [six organizations with different and complementary knowledge and competences, Mancomunidad de Municipios Sostenibles de Cantabria (ES), Universidad de Cantabria (ES), South West Regional Authority (IE), Cork Institute of Technology (IE), Glasgow Caledonian University (UK), and Universidade do Algarve (PT)].

The processing and analysis of data was structured in two parts: a first part with the SPSS - Statistical Package for the Social Sciences (version 21.0), and using descriptive statistics allowed to present the differences between the four analyzed countries in relation to selected questions. In the second part, we applied an estimation procedure using the structural equation techniques, using the AMOS program GRAPHICS. In this study, we followed absolute, incremental and adjustment careful measures. We also presented the significance of structural relationships by the value of ANOVA as recommended by Hair and colleagues (2010) and Willow (2007, 2012), and the coefficient of determination (R^2) to identify the proportion of the variance of the dependent variable explained by the independent variables (Hair et al, 2010; Maroco, 2010).

RESULTS AN DISCUSSION

Impact that innovation activities have had on enterprise in the period 2011-2012

The concept of innovation has had, over the last years, a greater emphasis, penetrating not only in the scientific and political discourse but also become one of the companies' challenges in the competitive markets. In the HARVEST countries, in general, as it is possible to see in figure 1, the companies surveyed were highly engaged in innovation activities in 2012, except the Spanish companies (Report of the Harvest Atlantic program, in press, p. 22).

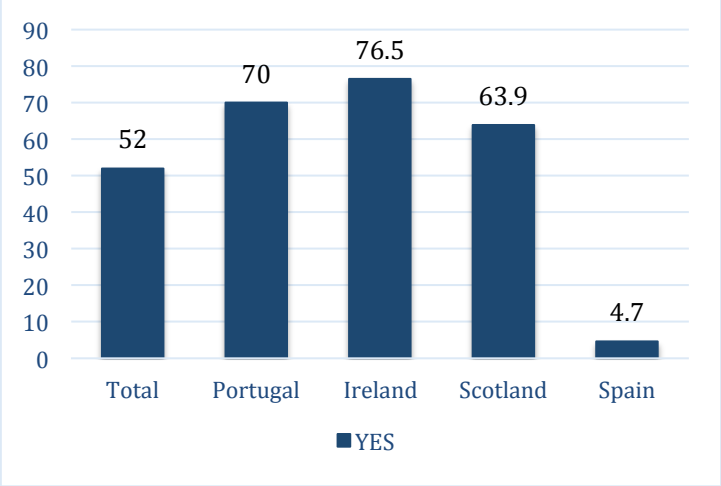

Figure 1 – Engage in Innovation Activities 2012 (% from total number of entities).
Source: Report of program Harvest Atlantic, in press, p. 22

Although, had different impacts of improvement in HARVEST regions (Table 1).

Table 1 – Improvement indicators (impact of activities) in Harvest regions in the period 2011/2012.

Improvement Indicators	Portugal	Ireland	Scotland	Spain	Asym. Sig
1. Increased range of goods	11,5%	30,9%	66,7%	10,4%	p=,000
2. Improved quality of goods or services	12,8%	24,7%	72,7%	8,3%	p=,000
3. Improved production flexibility	5,5%	17,3%	54,5%	0%	p=,000
4. Reduced unit labour costs	3,8%	13,6%	39,1%	33,3%	p=,000
5.Increased Capacity	5,1%	22,2%	41,7%	43,8%	p=,000
6. Reduced materials and/or energy produced per unit	1,3%	3,7%	30,4%	18,8%	p=,000
7. Improved environmental impact and safety aspects	3,8%	12,3%	52,2%	18,8%	p=,000
8.Met regulations or standards	6,4%	8,6%	41,7%	20,8%	p=,000

Portugal, Ireland and Scotland indicated the same first and second place for the impacts that innovation activities have had in the period 2011-2012: "Increased range of goods or services" and "Improved quality of goods or services". However, these differences are significant in both the first (X^2=37.7, p=, 0.000) and the second activity (X^2=42.62, p=0.000). That is, the two activities are more marked in Scotland, followed by Ireland and finally by Portugal (3rd place). Spain stands out in these three countries, since the most prominent impact in terms of innovation capacity is "Increased capacity" and the second one "Reduced unit labour cost" (in bold in table 1).

One possible explanation for this result is that the Spanish maritime market is already saturated and therefore activities found the best way for this country to increase the return are to reduced unit labor costs and increased capacity. In the other hand, Portugal, Scotland and Ireland due to its smaller size maritime market are unable to have a big industries and therefore wager more on the diversity of small businesses and on the quality of its products. Regarding the **third impact of innovative activities** taken in the four countries, we can say that Portugal and Spain had the same actions: 8. "Met regulations or standards". A plausible reason for these results can be due to the later entrance in the EU of these two countries and the fiscal adjustments policies and the bank system restructuring process also have had important consequences in these two countries. Diverging from the two previous countries, the third most referred impact in Ireland is: "Increased capacity" and in Scotland "Improved production flexibility". Probably due a structural questions of these countries which could be explored.

Social capital: cooperated of enterprises with any of the following to drive innovation activities in the period 2011-2012

The most advanced organisations have established a higher stock of social capital and innovation as an important channel by which social capital induces improvements in performance. In the HARVEST countries, in general, as it is possible to see in Table 2, the percentage figures given by four countries in the first and second place are bolded.

Table 2 – Cooperated with any drive innovation activities in Harvest regions in the period 2011/2012.

Cooperated with	Portugal	Ireland	Scotland	Spain	Asym. Sig
1.Other enterprises within your enterprise group	5,5%	14,8%	15,4%	8,3%	0,174
2.Suppliers of equipment, materials, components or software	5,1%	14,8%	23,1%	33,3%	0,000
3.Clients and consumers	9,0%	23,5%	19,2%	31,3%	0,015
4.Competitors	2,6%	4,9%	8,0%	12,5%	0,136
5.Consultants	6,4%	23,5%	28,0%	29,2%	0,004
6. Commercial laboratories/R&D enterprises	10,3%	16,0%	4,0%	12,5%	0,393
7.Universities or other higher education institutes	15,4%	21,0%	24,0%	2,1%	0,020
8.Government research organizations	10,3%	14,8%	12,0%	14,6%	0,829
9.Private research institutes	9,0%	4,9%	4,0%	14,6%	0,222

As we can see in the table 2, Portuguese organisations preferably cooperate with universities and research institutions. Similarly to what happens in Portugal, Scottish entities also cooperate with universities but already extend their cooperation to consulting ("Consultants"). In turn, Ireland uses the same principle of universities' resources but extend these contacts to consults "Consultants") and clients ("Clients and consumers"). Spain stands out for not resorting to university institutions and research and showing preference for suppliers and clients, probably due to its mature state of competition in a more aggressive market.

Table 3 indicates firstly, a low rate of acquisition of external R&D for the four countries analyzed without no significant differences between countries (p=0.897) (in bold in the table).

Table 3 – Type of activities innovation was done in Harvest regions in the period 2011/2012.

Activities	Portugal	Ireland	Scotland	Spain	Asym. Sig
Internal or external marketing activities aimed at the introduction for the enterprises' innovation (including market research and advertising of new innovations but exclude routine marketing activity)	11,5%	29,6%	44,1%	10,4%	p=,000
Internal or external training for the personnel directly related to innovation activity	7,7%	16,0%	44,4%	0,0%	p=,000
Internal New product or service development	15,4%	29,6%	61,1%	55,8%	p=,000
Acquisition of external R&D	11,5%	13,6%	16,7%	12,5%	p=,897
Acquisition of machinery and equipment (including computer hardware) in connection with product or process innovation	6,4%	21,0%	52,8%	16,7%	p=,000
Acquisition of other external knowledge (such as licenses to use intellectual property (e.g. Patents, know-how; or specialized services e.g. consultants universities)	7,7%	8,6%	30,6%	31,3%	p=,000
All design functions (including industrial, product, process and service design and specifications for production or delivery	3,8%	12,3%	47,2%	14,6%	p=,000

Of all the analyzed countries, Scotland proved to be the presenting higher percentage rates on all type of innovation activities' indicators (see the bold column), except in "Acquisition of

other external knowledge" in which Spain takes the first-place, achieving an relatively higher rate (31.3%) than Scotland (30.6%). Both countries (Scotland and Spain) perform significantly more than the remaining countries evaluated. All countries indicated as first type of activities was done in the period 2011/2012, "Internal New product or service development". There seems to be a consensus on the part of the organisations in the four countries in greater investment in internal development of new products and services. This seems the best way to realize that these companies to add value to existing products and services need to find a differentiation character within the sector.

Human capital: Percentage of staff in organization holds the following qualifications

In European societies characterized by knowledge, companies make a continuous effort to improve and generate new forms of knowledge, skills and experience in an attempt to make an effective management of their intellectual capital, in order to succeed and thrive in the competitive environment of the markets (Report of programme Harvest Atlantic, *in press*, p. 25) (Fig. 2).

According to the survey implemented in the HARVEST project, taking into account the organisations inquired, the work teams are highly qualified: more than 60% of staff holds an MSc and/or a PhD; less than 50% holds a certificate/diploma or none (qualification and about 55% of the collaborators of the firms surveyed holds a BSc or other type of qualification (Report of the Harvest Atlantic program, in press).

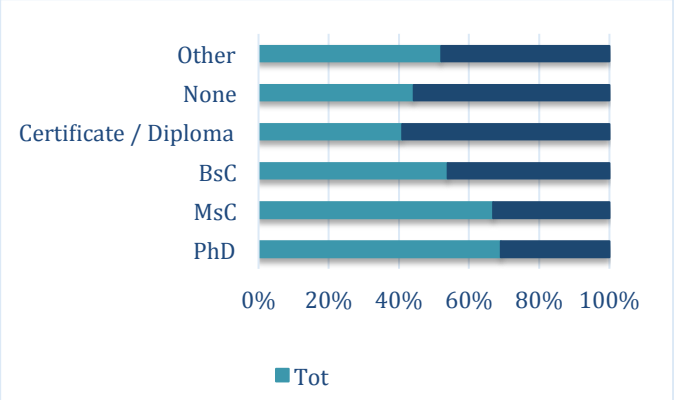

Figure 2 – Staff Qualifications (% from total number of entities interviewed).
***Source**: Report of programme Harvest Atlantic, in press, p.26)*

As we show in Table 4, Scotland and Spain are significantly ahead either in PhD or in Msc employment.

Table 4 – Differences of percentages between countries (Portugal, Ireland, Scotland and Spanish) on staff qualifications in organizations.

Qualifications in…	Portugal	Ireland	Scotland	Spain	Asym. Sig
1.PHD	12,8%	19,8%	100%	81,0%	,000
2.Msc	12,8%	23,5%	100%	59,5%	,000
3.Bsc	11,5%	32,1%	33,3%	16,7%	,018
4.Certificate/Diplom	12,8%	35,8%	33,3%		,003
5.None	--------	23,5%	100%	14,3%	,000
6.Other	6,4	-------	100%	16,7%	,000

Scotland still makes reference to 100% of "None" e "Other". Regarding this aspect, we can simultaneously measure personnel who have no skills, and therefore with high contrast with de staff with great qualifications.

Before identifying the qualifications of the companies' collaborators, the organizations surveyed were asked about their qualifications shortages that could be met by third level institutions. In average, about 60% of the companies surveyed stressed that they have qualification shortages Figure 3 shows that the majority of the companies operating in the sectors under study in the HARVEST project do have qualification shortages that third level institutions could meet. These shortages are more evident in the dimensions of BSc and certificate or diplomas, where almost 80% is reported. Almost 60% of the totality of the companies inquired underline that their staff has qualification shortages regarding MSc and other qualifications. The area where the qualification shortages are less evident is PhD (Report of programme Harvest Atlantic, 2014 in press).

The areas where staff shortages are more manifest are "Operations management skills" and "Market/business development skills". The country who feels most staff shortages evident is Spain, particularly in the areas "Sales and marketing skills", "Operations management skills" and "Finance/administration skills", followed by Ireland and Portugal with the same type of staff shortages ("Market/business development skills" and "Product/service innovation or development". Scotland indicates only "Operations management skills" deficits (see table 5).

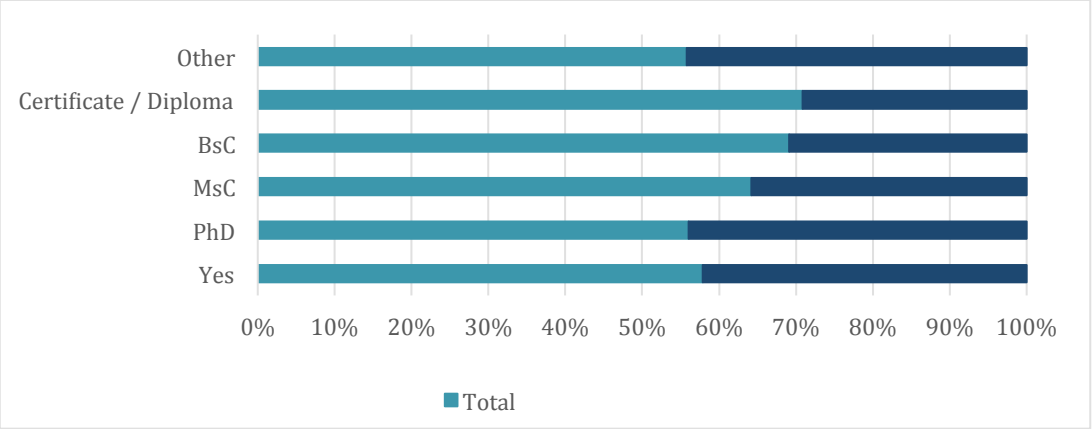

Figure 3 – Qualification shortages that third level institution could meet (% from total number of entities interviewed).

***Source**: Report of programme Harvest Atlantic, in press, p.27)*

Table 5 – Percentage areas shortages.

Areas shortages	**Portugal**	**Ireland**	**Scotland**	**Spain**	**Sum**	Asym. Sig
1.Market/business development skills	5,1%	8,6%	0,0%	16,7%	30,4	,240
2.Product/service innovation or development	3,8%	9,9%	0,0%	0,0%	13,7	,153
3.Sales and marketing skills	5,1%	8,6%	0,0%	23,3%	37	,002
4.Operations management skills	3,8%	6,2%	3,1%	17,5%	30,6	,031
5.Finance/administration skills	2,6%	2,5%	0,0%	20,8%	25,9	,000
6.Other	-----	-----	-----	-----		------
Sum	20,4	35,8	3,1	78,3		

Structural Model

In this section we present a recursive model with the following three variables: relational

capital (RelCap), human capital (HmCap), and innovation (Innov). The independent variables are relational capital and human capital; the dependent variable is innovation. As we can see, the analyzed model has a total of 21 items: 8 items in relational capital, 6 items in human capital and 7 items in innovation (Figure 4).

The results of the confirmatory analysis revealed that there are items with a communality smaller than 0.50 which led us to eliminate these items: relational capital (4 and 7), human capital (5 and 6) and innovation (3 and 7).

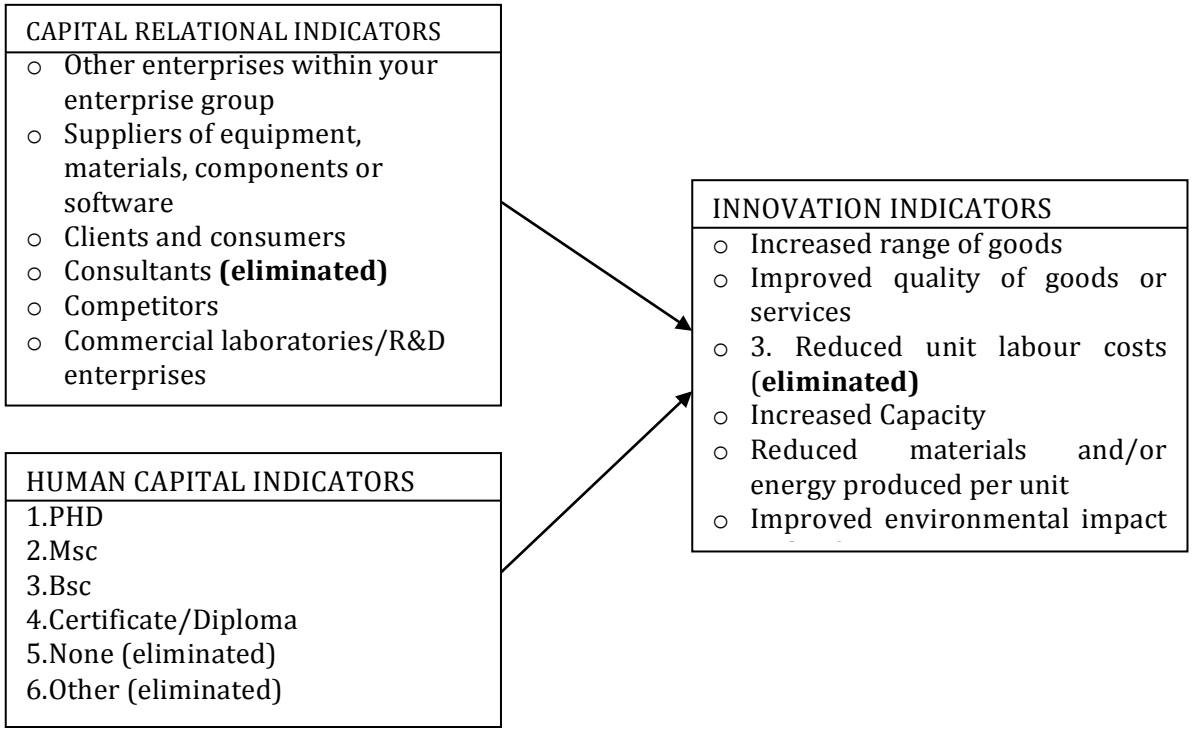

Figure 4 – Equation Model evaluated.

Figure 5 illustrates the evaluated model with the selected items we need consider for obtaining an adequate model.

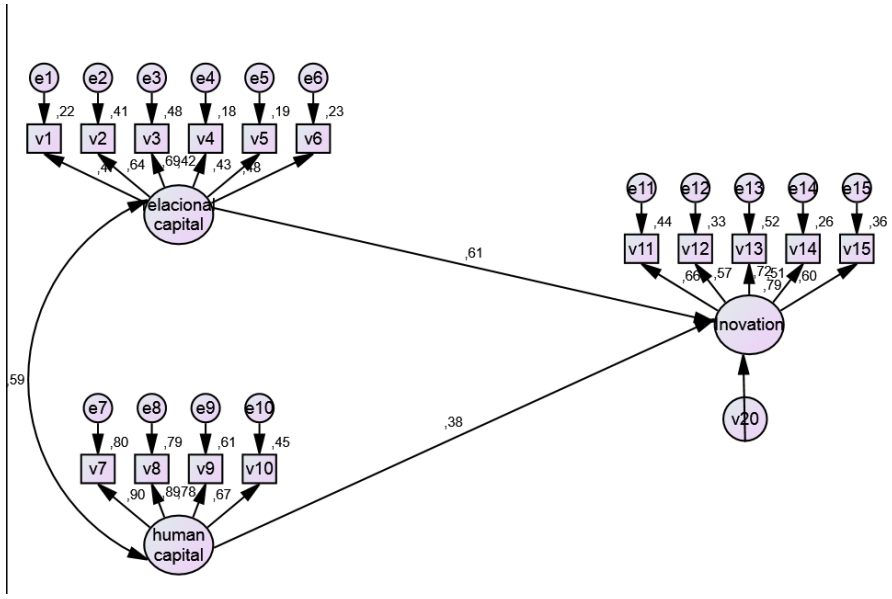

Figure 5 – Diagram of the validated model.

Table 6 shows the validated model has reached a solution with a χ^2 = 197.592, df = 99 (p = 0.000) with a = 1.996 χ^2/df (clearly below the value 3). The GFI and CFI those all indexes above 0.90 and the RMSEA value of 0.067 is markedly below the expected values (≤ 0.08). 67.4% of the variance is explained by the two independent variables, relational capital and human capital. The significance of the structural relationships between the independent variables "relational capital" and "human capital", with the dependent variable "innovation" showed good absolute values (F = 16.39, p = 0.000 for relational capital - innovation; F = 20.36, p = 0.000; for human capital - innovation).

Table 6 – Measures of goodness of fit of the model validated.

Measures of model fit	Acronym	Reference value	Validated Model
Absolute adjustment measures			
Chi-square	χ2	---	197,592
Degrees of freedom	df	-----	99
Quality index adjustment	GFI	>0.90	.91
Root Mean Square of waste	RMR	----	,007
Root Mean Square Error of Approximation	RMSEA	Between 0.05 e 0.08	,067
Adjustment incremental			
Incremental adjustment Index	IFI	>.090	.93
Adjustment Normalised Ratio	NFI	>.090	.90
Adjusted goodness of fit index	AGFI	>.090	.92
Adjustment Thrifty Measures			
Measures Index Adjustment Normalized Thrifty	PNFI	---	0,42
Normalized chi-square	χ2/df	<3	1,99

The three subscales have acceptable reliability (Relational Capital: α = 0.79; Human Capital: α = 0.83; Innovation: α =0.72), with a reasonable Alpha the Cronbach.

The validated model shows that Relational Capital has a positive influence on Innovation, in

comparison with previous research, our results are consistent with Subramaniam and Youndt (2005) and Gatignon and colleagues (2002) as social capital has a direct positive effect on innovative capability of enterprises. Organizations have a pool of techniques which can have a bearing on the social environment of the company, and managers should pay attention to this particular side of their responsibilities. As Addler and Kwon (2002) suggest, in order to fostering social capital in organizations, managers need to do more than merely encourage social interactions among employees, both must nurture and provide resources aimed at a greater connection between the internal and external knowledge in order to facilitate discussion of processes, innovations, technology, distribution channels and other vectors of development across the range of activities. We believe than an important part of these resources comes from relational capital, which contribute to improve social capital.

Similarly, Human Capital had a positive effect on Innovation. These results support the model of Vandenbussche and colleagues (2006) in which as they move closer to the educated people and in the line with neo-Schumpeterian literature and the resource-based view, one of the determinants of innovation propensity of firms is Human Capital. Unger and colleagues (2011) also assume that human capital leads to growth or increased performance of business ventures.

The maritime and marine economy presents complex technologic problems based in most of its development vectors that require the involvement of a highly qualified workforce. The recognition, maintenance and improvement of professional skills are critical to ensure specialized staff in maritime organisations. In this context, firms and other relevant actors must have a strategic vision to employ qualified human capital, as active and important participant in the production and management. This new process vision has led many organizations to adopt methods and techniques not only to attract but also to retain their employees. Finally, our results indicated that Relational and Human Capital should be related to influence innovation. These findings support the model of organizational performances and added value of Sunedrea (2012) in which we could say that the potential value of human capital – stored in the form of the degree of employees – becomes product innovation just if this knowledge has been extended to the social relations. Meanwhile, the existence of human capital alone is not enough. It is decisive to join highly skilled workforce, in a genuine way, to establish and develop contacts, relational capital, as a differential strategy to handle with competition and prosper within innovative activities.

CONCLUSIONS AND IMPLICATIONS

A holistic perspective facilitates a deeper understanding of how to combine external social capital and human capital of employee's in order to improve innovation. Based in a survey applied to 243 organisations of the maritime and marine economy in Atlantic countries in Europe (Portugal, Spain, Scotland and Ireland), our results show that human and social capital represent explanatory facts of business development under economic turbulence. In the period between 2011 and 2012, these organisations perceived innovation and persisted in innovation activities, although, with lack of investment in R&D. Therefore, maritime companies must make a greater effort to promote closer linkages between tacit (especially emergent from the sector) and scientific knowledge (from universities and research) through the formation of 'translators' which form the bridge between academia and industry. It will also be necessary to develop scientific/academic and applied research focused on specific problems of the regions and that the governments activate the role of regional centres of research in order to promote entrepreneurship and technology transfer, in contact with businesses.

The large investment made by these maritime organisations between 2011 and 2012 had a greater focus on new products and services. Lord (2000) refers that new products play several roles for the organization; they help to maintain growth and thereby protect the interests of investors, employees, suppliers of the organization. Patrick (1997) defends that new products help to keep the firm competitive in a changing market because the investment community values new products. New products affect the top line and, therefore, enhance the value of the firm and shareholder value.

The structural model validated shows the potential value of human capital – stored in the form of qualification of employees – to become product innovation if this knowledge is extended to additional social relations. Our results suggest that, only under these conditions, organizational capital contributes to innovation performance. Given the fact that we have used a convenience sample, considered a limitation of this study, a proposal that we leave for future research is the extension of the study to a larger sample of organisations in the North Atlantic coast. We hope that these results contribute for the body of knowledge of firm innovation and its determinants.

To conclude, it is essential to create a modern maritime and maritime economy bet on improving professional and relational skills without neglecting the value of traditional activities. The recognition, maintenance and improvement of human and relational capital is crucial to maintain and ensure specialized contacts in the whole range of activities related to the sea and it is essential to the internal development of products and services as a strategic tool to move forward in the concretization of the sea's economic potential.

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