

Structuring a Knowledge-based Maritime Cluster: Contributions of Network Analysis in a Tourism Region

Estructuración de un Clúster Marítimo basado en Conocimiento: Aportaciones del análisis de redes en una región de turismo

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ABSTRACT

The notion of maritime cluster encompasses a diversity of activities from fisheries, aquaculture, transports to coastal tourism or even science-based activities. This article debates the possibilities to consolidate the maritime cluster as one of the driving forces of the Algarve, a Portuguese region internationally recognized by tourism. This cluster did not emerge spontaneously and several policy initiatives to promote its formalization were being developed. The regional actors are not sure about the organizations that can be mediators in the cluster. Using social network analysis the maritime cluster is mapped, identifying central actors and possible structural holes. Policy implications are underlined.

RESUMEN

El concepto de cluster marítimo abarca una diversidad de actividades, desde pesca, acuicultura y turismo costero, transporte hasta actividades científicas. Este artículo discute posibilidades de consolidación del sector marítimo como una de las fuerzas motrices del Algarve, una región portuguesa reconocida internacionalmente por el turismo. El cluster no surgió de manera espontánea y varias iniciativas políticas para promover su formalización se están elaborando. Los principales actores regionales no están seguros acerca de las organizaciones que pueden ser mediadores en este sector. Utilizando el análisis de redes sociales se determinan actores centrales y posibles agujeros estructurales. Implicaciones políticas son subrayadas.

1. INTRODUCTION

In the last two decades cluster policies emerged as a central focus for territorial development decision-making processes. The benefits, especially in terms of collective learning, knowledge sharing and other types of agglomeration economies and spill-over effects, are well stressed in the regional science literature (Cooke, 2001; Torre and Rallet, 2005). Today the relevance of maritime activities and marine resources to economic development is acknowledged. For several European countries, the Atlantic Ocean is part of their common history, identity and potential to develop advanced economic niches of excellence. There is no surprise that several regions are trying to implement their strategies based in a broad maritime cluster notion that encompasses a diversity of activities from fisheries and aquaculture, marine transports to coastal tourism, or even economic activities based in marine sciences and maritime technologies. One of these regions is the Algarve, a Portuguese region located in the South of the continental territory of Portugal.

The Algarve regional economy is mainly based in tourism, retail commerce, real estate and construction. In the last years, the GDP level, that was rising in an incredibly pace since the 60's, has stopped. The region is falling behind other comparable European and Portuguese regions and the investments in traditional sectors like agriculture and fisheries, including aquaculture and agro-industry, were substituted in the region by investments linked with tourism with shorter economic return periods. Aligned with the Portuguese National Strategy for the Sea, the region is trying to consolidate its maritime economy potential as a way to overcome the limitations of the limited number of investments in the diversification of the regional economy. For this ambition it is crucial to understand who are the actors that constitute the maritime cluster and specially those who mediate relations and have a critical role in creating bridges over structural holes.

The article debates the possibilities to consolidate the maritime cluster as one of the driving forces of the economy in the Algarve. With this purpose the text is organized as follows. In the first section, theoretical approaches to clusters and specifically maritime activities are reviewed. Secondly, it explores the main added value that social network analysis can provide to the better understanding of the relations between the actors that constitute a cluster. The third section presents national and regional policy instruments, providing an overview about Algarve's maritime cluster. The section concludes with implementation of social network analysis to this regional maritime cluster. The last section concludes and underlines some policy implications.

2. CLUSTERING PROCESSES AND MARITIME ACTIVITIES

Second-tier regions have received limited attention from regional science, mainly because research focused leading technological regions and large urban areas. Second-tier regions, like Algarve, deserve regional science interest because they have a relevant role in the stabilization of sub-national dichotomies and are also viable options to localize industries that are constrained by metropolitan congestions. This kind of regions can be understood as territories where specialized sets of trade-oriented industries can root and flourish, creating employment and population-growth, generating vibrant knowledge advanced clusters (Markusen, Lee and DiGiovanna, 1999).

Clusters had in the last decades a growing attention that derives from the fact that clustering dynamics can play a central role in the successful implementation of development strategies. The attention on clusters has particularly increased since the contributions of Michael Porter (2003) that understood clusters as geographically proximate groups of interconnected companies, suppliers, service providers and associated institutions, linked by externalities of various types. The presence of clusters is based on the fact that actors are located in a geographic context 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.

Even if in cluster theory, different types of proximity are relevant for inducing institutional and collective learning (Torre and Rallet, 2005) and cluster formation thrives on entrepreneurial talent, intellectual capital and tacit knowledge exchange, geographical proximity continues to play a key role (Cooke, 2001: 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"*.

A cluster requires effective governance in its implementation and consolidation. Cluster actors share similar barriers to 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. Firms can be more efficient, reacting quicker than when isolated, work with customers and other firms to develop new products and processes, to reduce the perception of risk and induce trust. Nevertheless clusters can create problems for regional development. The success of a particular cluster can produce an excessive concentration of resources, namely financial resources, creating difficulties for other sectors to develop and produce a type of 'Dutch disease'. The past success of a cluster can also create path dependencies that reduce opportunities for future development and adaptive capacity.

There is a variety of ways in which regional clusters can be organised. Markusen, Lee and DiGiovanna (1999) present three ideal types: the 'hub-and-spoke' industrial district, the 'satellite industrial platform', and the 'state-anchored' industrial district. Each specific region combines elements from these ideal types. The first ideal type 'hub-and-spoke' industrial district is based in a small number of central firms, often dominant and large, that act as anchors of the region. They 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. These 'hub' companies are highly connected to external actors, such as suppliers, competitors and markets. The local linkages of these companies are limited to a small number of suppliers. The second ideal type, the 'satellite platform district', describes a region hosting facilities of external companies. The 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. The third model is the 'state-anchored' industrial district, describing territories that benefit from the location of relevant public institutions. The development of this ideal type 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.

Many economic activities rely on to their physical location because of different kinds of needs, from access to raw materials to be closer to the markets. That is the case of what can be defined as maritime activities, largely located in coastal areas. In this way, Chang defines 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"(Chang, 2011:489). For this author the development of maritime cluster needs to be based on existing manufacturing industries. An example is the crucial relevance of ports within coastal areas and their role within the logistics chain of shipping and transport. Ports have become key locations for industrial activities but also tourism. Far from being dedicated to solely one activity, ports are becoming multifunctional. To conclude Chang assures that is crucial to recognise and assess the overall logistical requirements which the transport modes, in combination, are established to meet the goals of cluster development.

In this article, the concept of maritime cluster is even broader, encompassing all economic activities based in maritime, marine and coastal resources, from fisheries, aquaculture, to blue biotech, going to shipbuilding and coastal tourism (Pinto, 2011).

Doloreux, Shearmur and Chenard (2007) describe six different maritime regional clusters, 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). Besides the quite different structures of each regional cluster, the most relevant conclusion refers to the dichotomy of maritime 'spontaneous' clusters and maritime 'constructed' clusters. Spontaneous clusters grow without public intervention in response to specific local conditions and favourable markets, usually in metropolitan areas that are central regarding maritime transportation routes and markets. Spontaneous clusters are not subject to specific public intervention that differentiates it from other economic sectors in these regions. Public policies are in these cases mainly horizontal, focused on innovation and business development, depending on the vibrancy of local economies. On the contrary, constructed clusters exhibit explicit policies to support maritime activities. The analysed case studies showed that the bottom-down approach was necessary because these particular regions were experiencing problems of economic restructuring and remoteness from major economic centres. Policies addressed the lack of favourable conditions for the emergence of a real synergy between the stakeholders. Maritime clusters, whether 'spontaneous' or 'constructed', to develop need to be based on existing potential of maritime activities, scientific knowledge and traditional skills.

3. THE RELEVANCE OF SOCIAL NETWORK ANALYSIS FOR REGIONAL SCIENCE

Social Network Analysis (SNA) has emerged as a fertile field for the analysis of the involvement of regional actors and the inter-organizational linkages (Wal and Boschma, 2009; Fritsch and Monz, 2010). SNA is interesting to comprehend the interaction between actors and knowledge flows in the analysis of regional development. In this way, it is a useful analytical tool for mapping networks of relationships and actors that constitute the regional clusters.

Social network analysis is an interdisciplinary methodology that had a rapid development of formal techniques based on an assumption of the importance of ties among interacting nodes. Four central concepts are commonly used in network analysis to better understand network characteristics: density, centrality, betweenness and centralization (Coulon, 2005). Density is a measure of connectedness. It is defined as the actual number of ties in a network, expressed as a proportion of the maximum possible number of relationships. Centrality encompasses two levels: local and global. A node is locally central when it has the higher number of ties with other nodes. Local centrality only considers direct ties whereas global centrality also considers indirect ties. Local centrality measures are expressed in terms of the num-

ber of nodes to which a node is connected whereas global centrality is expressed in terms of distance among the various nodes. Relative measures of centrality have been developed to solve comparison limitations regarding differences in network size. Betweenness is particularly relevant because it explores the concept of centrality, measuring the extent that a specific node lies “between” other nodes in the network. A node with few ties may play an important mediating role and so be crucial to the network. The betweenness of a node measures the extent to which an actor plays the role of a broker or gatekeeper with a potential for control over others. This idea is often described as the existence of a ‘structural hole’ (Burt, 1992).

The article of Wal and Boschma (2009) is relevant in summarizing the interest in applying a social network analysis in regional science and the discussion around the opposition between “*space of places*” and “*space of flows*”. Even if several authors continue to centre their analysis in spatial dimensions because actors tend to concentrate near the source of knowledge, i.e., within the geographical boundaries of the cluster, these authors question the relevance of geographical proximity. Networks are the most important vehicles for the transfer and dissemination of knowledge flows and sometimes they are not spatially delimited. Therefore, questioning the thesis that knowledge networks are tied to geographic location, these authors claim that “*(knowledge) networks are not territorial but social constructs that may cross the boundaries of regions. Knowledge diffuses through social networks which can be denser among local agents, but may also span across the world.*” (Wal and Boschma, 2009: 741) This vision has important implications for the study of clusters limiting the relevance of ‘territorial embeddedness’ and giving prominence to ‘social embeddedness’.

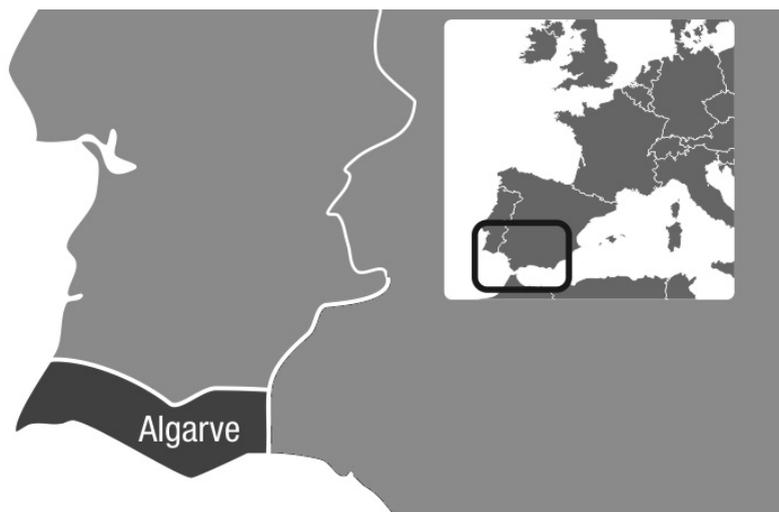
4. THE MARITIME CLUSTER IN THE ALGARVE REGION

4.1. *The Importance of Maritime Activities in Algarve’s Regional Economy*

The Algarve is the most southern Portuguese region of mainland Portugal, bounded north and east by the regions of Alentejo and the Spanish Andalusia, specifically the province of Huelva (Figure 1). The region comprises the district of Faro, the capital city, divided into sixteen municipalities, which represent about five percent of the Portuguese territory. The morphology gives the Algarve a peripheral character, the region has surpassed the last thirty years with an enormous structural change. From one of the poorest and lowest living standards in the country, mass emigration, economy based on agriculture, fisheries and traditional manufactures, the region has become the fastest growing region in terms of population in Portugal. The region is the Portuguese NUTS II, after Lisbon, with the highest GDP per

capita and purchasing power (Guerreiro, 2008). The Algarve's development reflects a dynamic tourism industry, boosted by Faro International Airport, encouraged by tourism related activities, construction and real estate. With around four hundred and fifty thousand inhabitants, the Algarve left the group of European structural funds 'convergence' regions, with the GDP lower than 75% of EU average in 2007-13. This phasing-out status brought significant reduction in European structural funds and an isolation effect compared to neighbouring regions that have maintained the level of financial support.

FIGURE 1
LOCATION OF THE ALGARVE



Source: Own Elaboration

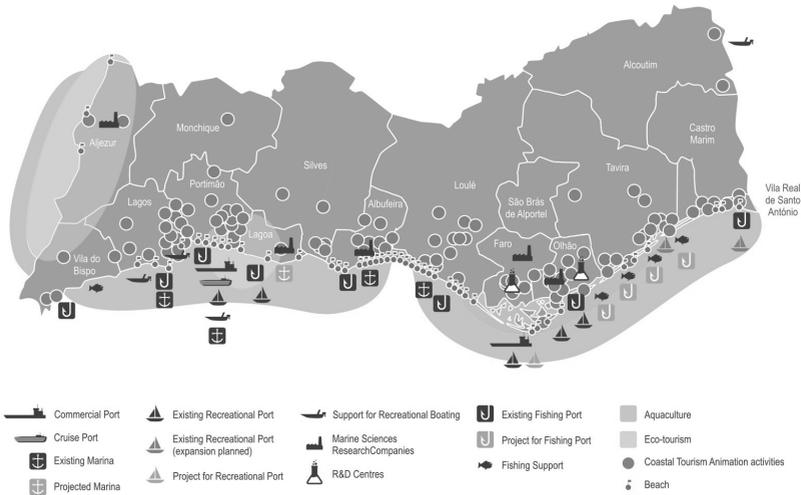
However, over-specialization in tourism-related activities, in particular the “sun and beach”, originated high opportunity costs of investing in other sectors, leading to the reduction of the regional economic base. The most relevant economic activities, in terms of employment and regional output, are induced by tourism, accommodation, restaurants and construction. The region showed a limited resilience with a major slowdown in economic growth rates and specially an increase in unemployment rates in the last years¹. In parallel, it is worth mentioning that the region countryside

1 In annex some relevant regional maritime figures can be found.

has undergone a process of abandonment, human desertification, with problems of aging, very low income and limited access to facilities and community services, in contrast to the high density of occupation of the coast, where about two thirds of population lives in about twenty percent of the land.

But the regional economy maintains some activities such as agriculture and fisheries with significant value in the collective memory. Tourism has gradually been diversifying its business in products as golf or nautical and cruise tourism. Knowledge-based activities begin to emerge especially related to marine science pushed by the strong emphasis of the regional university (University of Algarve) and research units in this scientific area. The Algarve gained a relevant capacity, even in international terms, in marine sciences. This scientific domain is in the genesis of the university where important centres coexist. It represents near a half of international peer-reviewed publications and it is well connected with external R&D units. This scientific activity is often associated with regional needs and it is the most significant area of advanced knowledge transfer in the region. Economic activities based in marine sciences have a great potential to affirm the Algarve as a competitive knowledge-based region.

FIGURE 2
DISTRIBUTION OF COASTAL TOURISM AND MARINE SCIENCES IN THE ALGARVE



Source: Pinto et al (2011)

The map (Figure 2) shows the geographical distribution of maritime activities. The coastline can be analysed with different infrastructures, from ports to marines, and services related with coastal tourism. Coastal tourism is concentrated in Lagos-Portimão, Albufeira and Loulé-Olhão. Marine research units are in Faro and Olhão, underlining the potential of these contiguous municipalities to structure this specific branch of the maritime cluster.

4.2 Maritime Cluster Policies in Portugal and the Algarve

The discussion around the maritime cluster consolidation has been increasing in Portugal. The country has for its coastline, maritime exclusive area and maritime tradition, strong ties to the Sea, and in recent years, the development of maritime economy has received more attention being part of the political agenda. When analyzing the economic value of sea-related activities, it is clear that the direct impact of these activities remain residual, representing only around 1.5% of GDP (Lopes, 2009). Recognizing this latent potential, in 2006 the national government set up for the first time a National Strategy for the Sea.

More recently a national agency was created for the maritime cluster coordination. Oceano XXI - Association for the Knowledge and Economy of the Sea is an organization supported by the national and European funds during 2007-13, National Strategic Reference Framework, that intends to intensify clustering dynamics and an effective exploration of maritime potential. It is an initiative from Norte and Centro regions with the support of COMPETE Operational Programme efficiency collective actions. This entity is a private non-profit corporate body whose main goal is to boost the marine economy and knowledge cluster by promoting cooperation among scientific institutions, enterprises and associations. To accomplish its objectives, Oceano XXI follows five priorities that guide its short and medium-term activities. The first is the development of research, technological development, innovation and training aimed at modernizing traditional activities and developing emerging activities related to the economy of the ocean and its sustainability. The second is the development of the quality and enhancement of the value of fishing products, aquaculture and salt production, as well as food health. The third priority points to the promotion, modernization and innovation of marine industries, port activities and logistics. The fourth is the support to recreational sailing and sailing tourism and to value material and immaterial marine heritage. Finally, Oceano XXI aims to promote internationalisation of activities, companies and R&D on maritime economy. Within Oceano XXI activities, eight anchor projects have been identified in a overall investment of nearly 71 million Euros (INEGI and Oceano XXI, 2012).

The Algarve has been trying to follow these national trends assuming itself as one of the regions with higher potential for a maritime cluster development. Thus,

in recent years some efforts have been made to help the region walk towards this ambition. In particular, policy instruments have been established emphasizing maritime economy capabilities.

In this context, the Algarve has assumed increasingly, the Sea as a central resource for the regional economy. Thus, major programs and strategic plans for the region have set a closer look to issues related to ocean and coastal areas, its potential and sustainability. Policy orientations are expressed in several documents, such as the Regional Development Strategy 2007-13 delivered to the European Commission (CCDR, 2006) where it is underlined the incredible potential of tourism if linked with other activities, stimulating the robustness of the economic base, the diversity of tourism product and the regional demand for local productions. A competitive region should not completely depend on a sector or economic activity augmenting the risk that external shocks are too difficult to overcome in the case of reduction of the relevance of this specific activity. The Regional Development Strategy recognized the opportunities arising from multiple marine resources and maritime activities. It is therefore possible to find in the territorial management planning (CCDR, 2007) the recognition of the importance of the Sea for the region, specifically that the strategy for the tourism sector must strengthen elements that bind to the Sea with an emphasis on coastal tourism as structuring element. These strategic documents were influential to the Regional Innovation Plan (UALG, 2007) and the Regional Operational Programme Algarve 21 (CCDR, 2008), that focused the Sea as one of the key-areas for oriented policy intervention. It was underlined the need to interconnect two traditional sectors, fisheries and aquaculture, with the knowledge production of regional research units. In parallel, also the Portuguese National Strategic Plan of Tourism (Turismo de Portugal, 2007) reaffirms the recognition of the potential of Sea in the Algarve, associated not only with "sun and beach" but with other products like nautical tourism and reinforcing the need to diversify the existing supply.

This regional vocation for Sea activities, identified in the strategic documents, was being pushed by the Regional Development Coordination Commission (CCDR), the regional authority in the Algarve, to formally establish a maritime cluster with the relevant stakeholders. To guide the creation of the cluster, the Algarve's Sea Agenda was prepared providing insights for the activities in the field of structural interventions in fisheries, aquaculture and salt production, the support of nautical recreation and scientific research (CCDR, 2009). This agenda originated the initiative Mar Algarve focusing the formalization of the cluster with the organization of stakeholders' meetings.

In July 2011 it was achieved the goal to create a non-profit association (Plataforma Mar do Algarve) that will try to assume the pivotal role in the regional cluster dynamics. This entity includes fishing, tourism and shipyard companies but also the municipalities and the University of Algarve. It aims to develop the maritime cluster

and to internationalize regional products. The platform has in the initial founding members five entities: two public and three private. The activities will focus on creating schools and training centres, organizing trade fairs and congresses related to the sea, providing technical assistance to members, promoting seafood products in foreign markets and to monitor and evaluate networking activities.

4.3. Searching the Core of the Maritime Cluster in the Algarve

The evaluation of the innovation actors in the Algarve's maritime activities showed that the branches of coastal tourism and maritime services, including research, are crucial for the vitality of this regional cluster (Pinto et al, 2011). This first sub-sector was considered the central economic activity in the Algarve and the second is the one with greater economic potential in terms of knowledge production.

This analysis follows a qualitative approach based on 45 semi-structured interviews with key actors within the Algarve's maritime cluster using a case study approach (Yin, 2003). These innovation actors were selected according their importance for the regional maritime cluster. The first group of interviewees were chosen based in expert knowledge and policy documents. A second group was selected by snow-ball sampling. Actors interviewed were companies, development agencies, public regional authorities, university departments, research units and intermediary organizations. In these interviews, respondents were asked to refer in detail the organizations that they were linked and cooperating in the context of maritime activities².

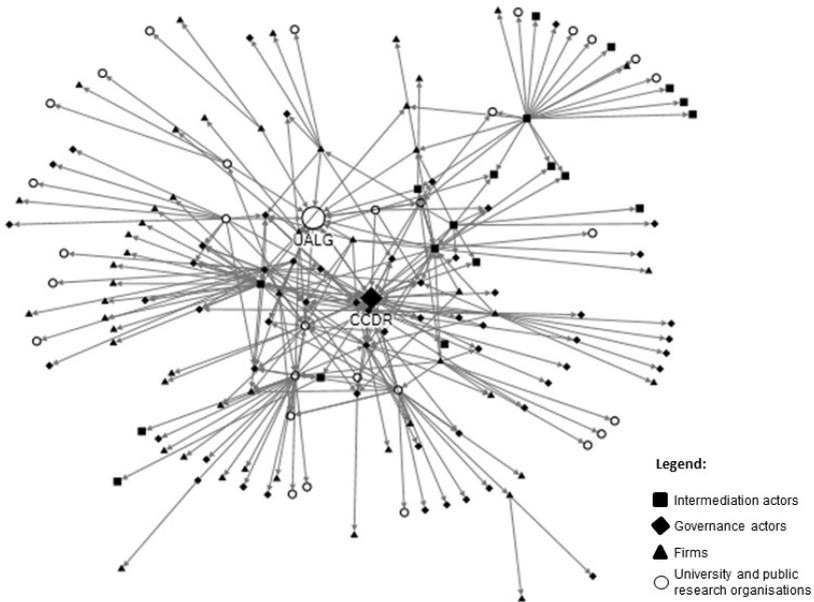
From this study two important issues emerged repeatedly. The first regarded the relevance of mutual learning and sharing knowledge in the cluster. Which organization was the main mediator to bridge science to market? The other issue was related with the idea that, once the cluster did not emerged spontaneously and the latent potential in maritime activities remains largely unexplored, the innovation actors agree in the need for a top-down approach. The idea that it is crucial to formalize the cluster in the form of an organization that could assume the pivotal role in the process of cluster formation is a common consensus. But who is the existing actor that is in a better position to assume the incubation of the cluster association? In parallel, one of Porter's issues about clusters concerns interdependences among the different actors which are co-located in the cluster and the role of these interdependences among knowledge related industries on innovation. This is an interesting issue to address in this empirical setting. The following section provides an answer to both questions

2 The complete results of this qualitative analysis are presented in Pinto et al (2011). An inter-regional comparison of European maritime clusters, including the Algarve, is discussed in Cooke et al (2011).

using social network analysis. The analysis of a cluster initiative, or a cluster policy, may benefit from an approach based on SNA, in identifying the actors on which public policy should bet in order to boost the development of the cluster.

The 45 semi-structured interviews conducted facilitated the organization of relational data. The connections were defined when a specific interviewee referred to have collaborated, in any sort of formal and informal project with other actor. From the transcriptions and audio records it was possible to systematize nodes and ties in the Algarve’s maritime cluster³. We have found 158 nodes that represent organizations that were cited in the interviews⁴.

**FIGURE 3
ALGARVE’S MARITIME CLUSTER NETWORK**



Source: Own Elaboration with Haren-Korel Fast Multiscale representation in Node XL (Smith et al, 2010).

- 3 The network structure described in figure 3 is evidently limited by the choice of these 45 interviewees. This implies that these interviewees (and their organizations) are represented and connected in the cluster but that other organizations that were not interviewed or referred by other actors are not represented.
- 4 The software used was the NodeXL Version 1.0.1.160. In annex additional information and statistics of the network are presented.

In figure 3 it is possible to observe that there is a set of well connected actors of which CCDD is the most central. CCDD is the regional authority, responsible for developing and implementing regional strategies in the Algarve. It is also the manager of the European structural funds allocated to the region, in particular the Operational Programme Algarve 21 that regards to the European Regional Development Fund financial support. This graphical evidence confirms the structural relevance of this actor, pointed often in the interviews as the one who was in the best position to assume a pivotal role in consolidating the maritime cluster in the Algarve.

Linking companies and science is a crucial aspect of regional development and for the emergence of competitive and innovative clusters. The graphical representation underlines that the University of Algarve assumes the most relevant mediating role between companies and research units in the region. Even if the connections of the university are in this analysis fragmented by the diversity of its functional units it remains a central actor.

Table 1 identifies the eight most central actors in the network. After these first eight cases betweenness centrality falls rapidly. The structure of the network, based in public actors show that this cluster is not for sure a 'spontaneous' cluster. The scarcity of firms in the cluster underlines that the Algarve's maritime cluster can only be a state-anchored 'constructed' maritime cluster.

TABLE 1
NODES WITH HIGHER BETWEENNESS CENTRALITY

Vertex	Betweenness Centrality
CCDD	6590.19
University of Algarve	4978.56
Marine sciences public research centre	4769.49
University's technology transfer office	4004.43
Coastal action group	3979.47
Marine sciences public research unit	3117.03
Maritime transport institute	2346.58
Public research laboratory	2316.38

Source: Own elaboration

Identifying the regional authority and the university as central to the cluster is important but by their size and access to European funds it was an almost a self-evident conclusion. Private companies are poorly represented in the network structure and low connected with the core of the cluster. For the maritime cluster to become self-sustaining in the Algarve the role of private actors should be improved and turned more relevant.

5. CONCLUDING REMARKS

The valorisation of the maritime resources in Portugal has been increasing. Affirming the National Strategy for the Sea was a possibility for regional actors to organize themselves around the sustainable development of maritime economy. The Portuguese maritime cluster was formalized at national level through a specific agency named Oceano XXI. The Algarve has been trying to benefit from the marine resources and maritime potential to overcome limitations and constraints that the region faces in development. Therefore, the consolidation of a maritime cluster is central for the region being able to diversify tourism supply, giving new life to more traditional activities and making economically valuable the scientific knowledge available. The regional actors, pushed by the CCDR, are trying to integrate the national “Knowledge Economy and Sea Cluster”. The creation of an entity, in the format of a non-profit private association, the *Plataforma do Mar do Algarve*, which is supposed to be the operational unit of the cluster, will only be successful if it includes public and private actors. This association can be the engine for sharing information and improving cooperation if it obtains the institutional support of regional actors and takes into account the informal regional cluster dynamics that is already operating. In a period where the regional actors are launching the *Plataforma*, this research confirms that is the CCDR that is in the adequate position to assume the central role in the process for the formal consolidation of the cluster. The University of Algarve also plays a crucial role that should be specially taken into account for the mediation and bridging scientific knowledge to market.

This research underlines the interest of social network analysis in dealing with regional aspects of development and cluster formation. This approach is illustrative of the explicative potential of network concepts in regional dynamics. The tools of SNA are in development and better measures and richer interpretation of results are still required. In this research we have found additional limitation of understanding what a node is in the real world. In theory, thinking in each organization as a node is sufficiently adequate but in practice sometimes it is not the best solution to map the diversity, heterogeneity and relevance of a specific actor. A clear example of this situation in the current study is the case of the University of Algarve. We found more adequate to take into account in the analysis different university departments, faculties, schools, research units, and other entities, as referred by the stakeholders’ interviews. Taking the university as a whole biases the analysis creating in our opinion an excessive importance of the public university. In fact a higher education institution is itself a group of nodes with a significant dimension in the region that the analysis should not eliminate.

Wal and Boschma (2009) conclusions underline that knowledge and interaction networks may be a-spatial. This idea, that networks may not be territorialised is a

crucial one, rapidly gaining importance in the literature on clusters, innovation and regional development. It is relevant to discuss in future research how this may in fact limit the usefulness or importance of cluster development from a policy perspective. This consideration may place a key limitation on this specific study: it does not invalidate the study, but it must be recognised that the analysis departs from looking at local actors and connections. This may be adequate from a policy perspective which has already chosen to focus on the local, but may limit the effectiveness of the policy itself for cluster development.

To conclude, the participation of the Algarve region in the national cluster is important to grant regional stakeholders an increased possibility for cooperation and benefiting from cluster economies. But a worrying note should be still underlined. Important organizations, mainly private companies, were not engaged in the cluster formalization as the process was not of their interest or felt being put aside. This is an issue that deserves attention from the actors leading the cluster development to guarantee that the Algarve's maritime cluster can flourish.

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ANNEX

TABLE A1

STATISTICAL PROFILE OF THE ALGARVE [UNEMPLOYMENT DATA: RATES FROM *INSTITUTO NACIONAL DE ESTATISTICA*, TOTAL AMOUNTS FROM *INSTITUTO DE EMPREGO E FORMAÇÃO PROFISSIONAL*; GROWTH IN NOMINAL GDPPC, CALCULATIONS BASED IN INE DATA); SOURCE: PINTO ET AL (2011)

Population 2010	458 (thousands)
GDP pc 2008	16.2 thousand euros
Unemployed 2008 (%)	7% (15 076)
Unemployed post-2009 (%)	13.6% (28 831)
Education Level of labour market - No Higher Education (%)	85.4
Higher Education (%)	14.6
High Skill Employees (%)	33.9
Low Skilled Employees (%)	66.1
Economic Performance of region over time 1960- 1970	64.2% (e)
Economic Performance of region over time 1970-1980	58.8% (e)
Economic Performance of region over time 1980-1990	102.2% (e)
Economic Performance of region over time 1990-2000	31.8% (e)
Economic Performance of region over time 2000-2010	21.8% (e)
Size of Region (sq. Mi)	1928.96 (4996 Km ²)
Algarve's economic contribution to the country? (%)	4.2 (2007)

TABLE A2
**MARITIME CLUSTER ANALYSIS, (E) ESTIMATED VALUES, SOURCE:
 PINTO ET AL (2011)**

Crucial Sectors for the Algarve's maritime economy consolidation	Coastal Tourism, Maritime Services (including Research)
Other Relevant Maritime Sectors	Fisheries including Aquaculture
Present economic value of maritime economy	3 019 M (e)
Economic value of marine economy - 2007	3 017 M (e)
People employed in marine economy of region - 2010	114 (thousand employees) (e)
People employed in marine economy of region circa 2007?	116 (thousand employees) (e)
Current contribution of maritime economy to regional economy	45% (e)
Contribution of maritime economy to regional economy - 2007 (%)	47% (e)
Current economic contribution of each sector (listed above) in marine economy to whole marine economy in region (%)	Coastal Tourism (85.4%) and Maritime Services including Research (>0.5%) (e)
Economic contribution of each sector (listed above) in marine economy to whole marine economy in region circa 2007(%)	Coastal Tourism (86.7%) and Maritime Services including Research (>0.3 %) (e)
What is the marine economy's in the region economic contribution to the country?	~2.1 of national GDP (e)

TABLE A3
NETWORK INFORMATION, SOURCE: OWN ELABORATION

Graph Metric	Value
Graph Type	Directed
Vertices	158
Unique Edges	280
Edges With Duplicates	4
Total Edges	284
Self-Loops	0
Connected Components	1
Maximum Vertices in a Connected Component	158
Maximum Edges in a Connected Component	284
Maximum Geodesic Distance (Diameter)	6
Average Geodesic Distance	3.39
Graph Density	0.01