Identification and Validation of the Maritime Cluster in Portugal

An Exploratory Analysis

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Abstract: In recent years, there has been a growing interest in the theme of clusters, mainly linked to the maritime cluster (Doloreux, 2017; Stavroulakis et al., 2020b; Stavroulakis et al., 2021; Li & Luo, 2021; Shi, et al. 2021), but also to the agri-food cluster (Franco at al., 2019; Franco et al., 2020), among others. The aim of this study is to analyse whether the Maritime Cluster in Portugal prefigures and presents a functioning structure as a cluster. In order to verify whether they fulfil the conditions of a cluster, the geographical concentration indicators will be used as a research methodology. From the results achieved for the different indicators, on the identification and validation of the Maritime cluster in Portugal, it was concluded that it fulfils the conditions of a cluster. Thus, in the selected NUTS III there is an agglomeration of these maritime activities in the region, with an increase and intensification of the specialisation of the maritime cluster as well as a clear contribution and strengthening of the maritime cluster in the region under study for the country. Hence, it can be concluded that European policies to support clusterisation have had positive effects on this cluster in Portugal.

Keywords: Maritime cluster; geographical concentration indicators; Competitiveness, European policy; public policies.

1   Introduction

In terms of European policies, support for clusterisation, as open innovation platforms, facilitating access to and sharing of knowledge and fostering collaborative practices (Ferreira et al., 2018), has been assumed as strategic to promote the competitiveness of member states. In this context, 8 clusters were recognised for Portugal (NSRF 2007-2013)1.

At the same time, in recent years there has been a growing interest in the theme of clusters, mainly linked to the maritime cluster (Doloreux, 2017; Stavroulakis et al., 2020b; Stavroulakis et al., 2021; Li & Luo, 2021; Shi et al., 2021), but also to the agri-food cluster (Franco at al., 2019; Franco et al., 2020), among others.

Indeed, the study of maritime clusters has gained popularity among academics and policymakers, becoming the focus of competitiveness policies (Doloreux, 2017). For Doloreux (2017), the maritime cluster can be defined in three perspectives: an industrial complex, an agglomeration of interconnected industries and a community-based network. Thus, its contribution to national or regional development should be emphasised, as it provides strong support for innovation in maritime industries (Shi et al., 2021).

In view of the above, the objective of this study is to verify whether the maritime cluster in Portugal fulfils the conditions of a cluster and to present the maritime cluster in Portugal. It begins with the discussion of the cluster concept, characteristics and performance, followed by the clusterisation policy in Europe and then the identification of the maritime cluster as well as the methodology proposed to verify whether it meets the cluster conditions. Finally, the discussion of the results in terms of its recognition as a cluster is presented.

2   Cluster Characteristics and Performance

Clusters mostly emerge spontaneously (Canto & Couto, 2019). The interest in clusters has to do with the advantages they have brought to the performance and competitiveness of companies and to the success of certain regions (Doloreux & Shearmur, 2009).

The concept of cluster is not static, it has evolved to contemplate different perspectives of analysis, to follow research and investigation trends and to integrate identified themes and mechanisms that justify the different performances. Thus, it is possible to find different definitions (see Table 1).

Porter (1994) introduced the concept of cluster considering as groups of entities, whose interrelationships enhance competitive advantage. They involve supplier, customer and related industries. Also, Enright (1996) presents a definition of cluster as the

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[1] http://www.pofc.qren.pt/areas-do-compete/polos-e-clusters

agglomeration of firms close to each other, to which Sölvell et al. (2008) add institutions that are related to each other for a certain product or service.

However, a broad definition of a cluster can be found in Porter (2003): Clusters encompass a set of connected industries and other entities important to competition. They include, for example, suppliers of specialised inputs such as components, machinery and services, and providers of specialised infrastructure. Clusters also often extend downstream to customer channels, and upstream to manufacturers of complementary products, and to firms in industries related by common skills, technologies, or inputs. Finally, many clusters include government and other institutions - such as universities, regulatory agencies, think tanks, vocational training providers, and trade associations - that provide specialised training, education, information, research, and technical support.

Table 1. Cluster definitions: an evolutionary perspective

Authors	Definition	Driving Forces
Enright (1996)	A cluster is a group of regional companies close to each other.	Location/ geographical proximity
Swann & Prevezer (1996)	Clusters are defined as an agglomeration of enterprises, within the same economic activity, located in a certain geographical area.	
Porter (1998)	Geographical concentrations of certain industries and organisations, specialised suppliers, customers and other networks of institutions.	
Silva (2004)	Geographical concentration of productive groups, whether of companies, industries, production chains, sectors or economic activities that aggregate knowledge, physical capital or human capital.	
Cotright (2006)	Group of companies that establish links with economic agents and institutions, located close to each other, being able to take advantage of this proximity.	
Redman (1994)	A cluster is a production chain for a similar product or range of products where institutions affect competitiveness.	Institutions
Porter (2003)	Clusters encompass a set of connected industries and other entities important for competition. They include government and other institutions - such as universities, standardisation agencies, think tanks, vocational training providers, and trade associations - that provide specialised training, education, information, research, and technical support.	
Sölvell et al. (2008)	Clusters are groups of companies and institutions located in a specific geographical region and related by the supply of a product or service.	
Porter (1994)	Clusters are groups of entities whose interrelationships enhance competitive advantage.	
OECD (1999)	Production networks of strongly interdependent firms (including specialised suppliers) linked together in a value-added	

	production chain and some integrate alliances between firms, universities, research institutes and customers.	**Networks/ Synergies**
Roelandt et al. (2000).	Clusters can be defined as networks of production and strongly interdependent firms linked together in a value-added production chain, and may integrate alliances with firms and universities, research institutes, knowledge-intensive business services, interface agents (such as brokers and consultants) and customers.	
Suzigan *et al.* (2003)	Local production systems, i.e. clusters of economic, political and social actors, located in the same territory, which have consistent links of articulation, interaction, co-operation and learning. They include not only enterprises (producers of final goods and services, suppliers of inputs and equipment, service providers, marketers, customers, etc. and their various forms of representation and association), but also other public and private institutions directed towards the training and specialisation of human resources, research, development and engineering, promotion and financing.	
Fernandes & Lima (2006)	Spatial concentrations of sectorally specialised economic activities that trade extensively with each other, expressing the importance of the spatial dimension for economic development. It is not merely a simple concentration of independent economic agents, as there needs to be a strong intensity of relationships between the firms within the agglomeration.	
Franco et al. (2020)	Clusters are inter-organisational networks that offer relevant opportunities to stimulate economic development and to enhance competitiveness based on the nature of the interrelationships of organisations.	

Source: Adapted from Ferreira et al. (2018) and Canto and Couto (2019).

The term cluster is used to define a geographical location (region) that has (i) a higher than average concentration of firms in a given field, (ii) research and education organisations active in a related field, and (iii) the presence of public support mechanisms operated by government and regional actors, through which stakeholders share a common vision of growth and innovation strategies. This last point is crucial: ultimately and given the difficulty of precisely defining a cluster, it is considered to exist if and only if there is some government involvement in its operation (Doloreux & Shearmur, 2009).

Cluster performance involves a number of key dimensions (and mechanisms) to drive innovation and competitiveness, most notably collaboration networks, knowledge sharing networks and innovation networks (Franco et al., 2020), smart governance (Paramio et al., 2013), co-opetition relationships (Dana et al., 2013) and public policy (Table 2).

3   Promoting Clusters in European Policy

The European policy to support the development of clusters was embodied in the approval in 2007 by the European Commission of the operational programme of technical

assistance for Portugal for the period 2007-2013, through the National Strategic Reference Framework (NSRF) and framed in the objectives of convergence, regional competitiveness and employment (Observatório do QREN, 2010).

Table 2. Cluster performance: dimensions

Dimensions	Performance	Authors
Clusters as inter-organisational networks	The existence of interconnections between the various structures can provide the creation of new competitive products as a consequence of the synergies generated.	Franco et al. (2020)
Clusters as knowledge networks	Inter-organisational networking and interaction favour the creation of platforms to support the articulation, sharing and amplification of individual perspectives and ideas and also the building of shared understanding, i.e. for the creation, development and expansion of knowledge.	Franco et al. (2020)
Clusters as innovation networks	Clusters are a source of innovation. They promote the capacity to innovate through risk and knowledge sharing.	Franco et al. (2020)
Clusters as smart governance	It encompasses inclusive, global and targeted governance and public policy.	Paramio et al. (2013)
Clusters and co-opetition relationships	Governance is supported by technology and innovation for system sustainability.	Dana et al. (2013)
Public policies and clusters	Co-operation with competitors to access resources (such as knowledge) has proven beneficial for SMEs.	Roelandt & den Hertog (1999)

Source: Own elaboration

The priority areas of the NSRF were the reduction of the persistent skills gap of the Portuguese population; the promotion of greater territorial cohesion and more demanding standards in the environmental area and the promotion of the competitiveness of the Portuguese economy based "on the virtuous triangle of internationalisation, innovation and clusterisation" (Observatório do QREN, 2012, p.65).

In the implementation of the NSRF, among the different intervention priorities defined, namely in the framework of Collective Efficiency Strategies (EEC), the approaches of Competitiveness Poles and Clusters stand out, through the support system for collective actions (SIAC) as a support instrument. The consolidation of regional-based clusters was supported by the SIAC (Observatório do QREN, 2010). These Collective Actions for Business Development were thus framed in the Agenda for Competitiveness Factors of the NSRF (2007).

The initiatives within the scope of the Collective Efficiency Strategy "stimulate cooperation and networking between companies and between them and other actors relevant to the strategy - education and Research and Technological Development (R&TD)

entities, training, technological assistance, business associations, among others and lead to a change in the specialisation profile" of the Portuguese economy (Compete, 2009).

Public policies under the NSRF thus recognise the importance of clusterisation processes for strengthening competitiveness and industrial efficiency, promoting innovation and economic transformation (Ferreira et al., 2018).

Those designated by the NSRF for other clusters have a strong market orientation and are based on the promotion of competitive advantages through the sharing of assets and the creation of critical mass, through concentration/agglomeration processes, capable of inducing innovation dynamics and internationalisation. What is important is the functioning of the network and the dissemination of knowledge within this cooperation network.

However, it should be noted that, in national terms, the clusterisation policy is not recent, having its origins with the Porter study (1994) which identified for Portugal the main clusters to be promoted: forest products, textiles, clothing and furniture; and the developed and geographically concentrated clusters: cork, footwear, ornamental stones and moulds, to foster the country's competitiveness. Subsequently, in 2002, with the Integrated Innovation Support Programme (PROINOV), the clusterisation policy was strengthened to stimulate the development of particularly innovative clusters in key areas (namely food, habitat, fashion, leisure, mobility, health, personal services, information and entertainment) (PROINOV, 2002).

In the most recent national context, clusterisation processes in Portugal were framed in Collective Efficiency Strategies with their operationalisation through formal recognition, as mentioned above. In this sequence, 8 Clusters were recognised by COMPETE (Table 3).

Table 3. Clusters in Portugal Recognised by COMPETE

Designation	Managing Entity
Cluster of Furniture Companies in Portugal	Association for the Centre of Excellence and Innovation of Portuguese Furniture Companies
Agro-industrial Cluster of the Centre	InovCluster - Association of the Agroindustrial Cluster of the Centre
Cluster of Creative Industries in the Northern Region	ADDICT - Agency for the Development of Creative Industries
Sustainable Habitat Cluster	Platform for Sustainable Construction Association
Cluster of Knowledge and Economy of the Sea	Oceano XXI - Association for the Knowledge and Economy of the Sea
Natural Stone Cluster	Valor Pedra Association
Ribatejo Agroindustrial Cluster	Animaforum - Association for the Development of Agroindustry
Douro Demarcated Region Wine Cluster	ADVID - Association for the Development of Douro Viticulture

Source: Adapted from Ferreira et al. (2018)

Thus, the relevance of topics such as the sea and the structuring of a regional cluster in this area, the creative industries and the understanding of the Douro as a specific asset of the Region stand out, among others. In the maritime cluster, the analysis of this dynamic shows that the initial constitution model, based on the animation exercised by CCDR-Norte, was later extended to include initiatives originating in the Centre region (Observatório do QREN, 2010).

The Knowledge and Economy of the Maritime Cluster aims to promote maritime research, seeking innovative methodologies and instruments in this vast and diverse activity, including the valorisation and integrated coordination of resources; and activities such as fishing, aquaculture, sea salt extraction, offshore energy, transport, shipbuilding, port operations and fish processing, as well as maritime tourism (Compete, 2009a).

The European Policy has also supported at national level the economy of the sea through the Operational Programme (OP) MAR 2020[2], materialised through the European Maritime and Fisheries Fund (EMFF). This OP MAR2020 has assumed itself as the primary financing of measures that seek to respond to economic, environmental and social demands and challenges in the period 2014-2020, focusing its action on six priorities (Table 4).

Table 4. Priorities under OP MAR 2020 and 2030

Priorities of the OP MAR 2020	Priorities of OP MAR 2030
1. Promote competitive, environmentally sustainable, resource-efficient, innovative and knowledge-based fisheries;	1. Promoting sustainable fisheries and the restoration and conservation of aquatic biological resources;
2. Promote competitive, environmentally sustainable, resource-efficient, innovative and knowledge-based aquaculture;	2. Fostering sustainable aquaculture activities and the processing and marketing of fisheries and aquaculture products, thereby contributing to the Union's food security;
3. Foster the implementation of the Common Fisheries Policy by improving and providing scientific knowledge and enhancing data collection and management, as well as by providing support for monitoring, control and enforcement;	3. Promoting a sustainable blue economy in coastal, island and inland regions and fostering the development of fishing and aquaculture communities;
4. Increase employment and territorial cohesion by promoting economic growth, social inclusion and job creation and providing support for employability and labour mobility in coastal and inland communities dependent on fisheries and aquaculture;	4. Strengthening international ocean governance and promoting safe, secure, clean and sustainably managed seas and oceans.

[2] https://portugal2020.pt/wp-content/uploads/mar_3_resumo.pdf

5. Promote marketing and processing by improving the market organisation of fisheries and aquaculture products and encouraging investment in the processing and marketing sectors; and
6. Foster the implementation of the Integrated Maritime Policy.

Source: Own elaboration based on https://portugal2020.pt/wp-content/uploads/mar_3_resumo.pdf

The Mar 2020 operational programme had 6377 approved projects involving an investment of 731.5 ME of which 501.9 ME of public support spread over the 6 priority axes.

For the multiannual framework 2030 one of the 12 programmes is the Sea programme, funded by the EMFAF. The MAR 2030 programme, with 4 priorities (Table 4), aims to contribute to the implementation of the Common Fisheries Policy and the Union's maritime policy. The objective of the programme is to leverage investments in the area of the Sea and to maximise the impact of public resources to be mobilised with co-financing from the EMFAF, in pursuit of the Union's strategic objectives with a particular focus on Specific Objective 2 "A greener, low-carbon Europe, in transition to a net zero carbon economy, and resilient, by promoting a clean and fair energy transition", green and blue investments, the circular economy, climate change mitigation and adaptation, risk prevention and management and sustainable urban mobility" and in Specific Objective 4 "A Europe closer to citizens by fostering the sustainable and integrated development of all types of territories and local initiatives" through the intervention of Local Action Groups of fishing communities. It operates throughout the national territory. With a total funding of €379 million. The public support foreseen in the programme amounts to EUR 540.67 million, of which EUR 392.57 million from FEAMPA[3].

4   Maritime Cluster

4.1   Methodology for the Identification of the Maritime Cluster in Portugal

Taking into account Porter's (2000, 2008) definition of cluster, which refers to the geographical concentration of a group of companies in a given territory or unit of analysis, it is considered that the cluster approach requires an approximation to the analysis of empirical studies on its recognition based on the study of indicators that constitute measures of geographical concentration: namely the location quotient, the modified Hirschman-

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[3] This fund amount consists of the amount allocated to Portugal, EUR 378.57 million, plus EUR 14 million from Portugal's initiative under the Partnership Agreement, which aims to better respond to the identified needs by raising the EMFF allocation to the same, or even slightly higher, values as in the programming period now ending (in 2014-2020, under the Mar 2020 programme, the EMFF allocation was EUR 392.485 million).

Herfindahl index, the relative participation index and the specialisation coefficient as well as the shift-share analysis and the Input-Output analysis (Pereira, 2011; Ferreira et al. 2018).

The identification of clusters by the analysis of demographic indicators, although criticised for being simplistic (Malmberg & Maskell, 1997; Vom Hofe & Chen, 2006) and not contemplating the interaction between agents in the value chain (Natário et al., 2011), is an adequate exercise for their recognition in a first phase. Porter (2003) and Delgado and Porter (2021) use location quotients (LQ) as the primary measure of regional cluster specialisation to examine the impact of regional cluster strength on the growth of regional industries.

For the identification of the maritime cluster, the proposed methodology is to verify both the agglomeration and concentration of activities and the interaction between the different actors (Natário et al., 2011). Thus, it starts with the cluster specialisation measures, namely the location quotient, the modified Hirschman-Herfindahl index, the relative participation index and the specialisation coefficient (Table 5).

Table 5 summarises the characterisation, the calculation method and the conditions of the geographic concentration measures that will be used for the identification of the Maritime Cluster in Portugal.

Table 5. Measures of geographical concentration

Measures of geographical concentration	Characterisation	Calculation Formula	Conditions
Localisation Quotient (LQ) **Costa (2002), Natário *et al.* (2011), Pereira (2011) e Ferreira et al. (2018)**	It allows to compare the weight or importance that a variable has in a given activity or sector of a given region with its relevance in the standard spatial area. It allows to verify the degree of concentration of the sector k in the territorial unit i.	$QLik = \dfrac{\frac{Xrj}{Xri}}{\frac{Xpj}{Xpi}}, QLik \geq 0$	LQ = 1, the weight of the variable in sector j in region r is equal to the weight of that variable in that sector in region p. LQ>1, the variable in sector j has a greater weight in region r than in region p, and can therefore be interpreted as a specialisation of the region relative to region p. LQ<1, the variable in sector j has a lower weight in region r than in region p. (Costa, 2002).
Modified Hirschman-Herfindahl Index (HHm) *Crocco et al. (2006) Simões (2006), Rodrigues et al. (2009), Carvalho*	It allows to determine the weight of the sector in relation to the industrial structure of the region. This is the difference between the total of the variable in sector *j* in region *r* and the total of the variable in the same sector in the country.	$HHm = \left(\dfrac{Xrj}{Xpj}\right) - \left(\dfrac{Xri}{Xpi}\right)$	HHm> 0, means that there is a specialisation of sector j in a given region, i.e. sector j in the standard region contributes significantly to sector j in Portugal; HHm<0, there is no specialisation of sector j in a given standard region, indicating that the contribution

(2009), Pereira (2011) **e Ferreira et** *al.* **(2018)**			of Total Economic Activities in that region to Total Economic Activities in Portugal is greater than the contribution of sector j in that region to sector j in Portugal.
Relative Participation Index (PR) **Britto & Albuquerque (2002), Rodrigues et al. (2009), Carvalho (2009) e Ferreira et** *al.* **(2018)**	It allows us to verify the importance of sector j in region r relative to the same sector in region p.		The closer the IPR score is to 1, the greater the contribution of a given sector in a region, in the total of the same sector in Portugal (Pereira, 2011).
Coefficient of Specialisation (CE) **Santos (2007), Pereira (2009) e Ferreira et** *al.* **(2018)**	It allows to obtain the degree of specialisation of a given region, that is, it measures the degree of concentration that a region contains in relation to the sectors of economic activity that are inserted in it. Its expression is the sum of the module of the deviations of importance that a sector assumes in a given region and the importance that this same sector assumes in the standard region Portugal.	$$CEi = \frac{1}{2} \sum_{j=1}^{k} \left\| \frac{X_{rj}}{X_{ri}} - \frac{X_{pj}}{X_{pi}} \right\|,$$ $$(0 \leq CEr \leq 1)$$	CE=0, means that sector j in the region under analysis is equivalent to sector j in the standard region, i.e. there is no specialisation in the region studied relative to the standard region, Portugal. The closer the CE is to 1, the more specialised the region r is in the sector under study compared to the standard region. The CE thus makes it possible to assign a specialisation value to each region under analysis.

Source: Adapted from Ferreira et al. (2018)

Notes:

r: indicates the region - (All NUTS III of Continental Portugal of the Coast);
p: indicates the standard region - Portugal;
j: indicates the sector - activities of the maritime cluster recognised by the NSRF;
i: indicates the sector - Total Economic Activities
Xrj: total of the variable of the sector (activities of the maritime cluster recognised by the NSRF) in (All NUTS III of Continental Portugal of the Coast);
Xri: total of the variable (Total Economic Activities) in (All NUTS III of Coast Continental Portugal);
X: variable - Enterprises/ persons employed;
Xpj: total of the variable in the sector (activities of the maritime cluster recognised by the NSRF) in Portugal;
Xpi: total of the variable (Total Economic Activities) in Portugal.

According to several authors (Pinheiro et al., 2008; Carvalho, 2009; Pereira, 2009; Pereira, 2011; Ferreira et al., 2018 and Delgado & Porter, 2021, among others) the Location Quotient (LQ) plays a central role in the identification of clusters. Also Doloreux et al. (2016) use this indicator to study the maritime cluster in Canada. The numerator LQ measures the relative concentration of the variable in sector j (The economic activities of the Knowledge and Economy of the Maritime Cluster by CAE REV.3 recognised by the NSRF[4]) in the region (all NUTS III of the coast of mainland Portugal) while the denominator measures the relative concentration of the variable, of the same sector, but in relation to Portugal. This indicator presents limitations, as already mentioned, since it is not defined how much above the average the quotient will be considerable to assume in order to identify the presence of a possible cluster.

It should also be noted that the location quotient can take different reference values as shown in Table 6.

Table 6: Diversity of the reference value in the localisation quotient

Indicator	Reference Value (Threshold)	Studies
Localisation Quotient	1.00	Held (1996)
	1.25	Bergman & Fraser (1999, 2020); Miller *et al.* (2001)
	1.30	Braunerhjelm & Carlsson (1999)
	2.00	Sölvell *et al.* (2008)
	3.00	Isaksen (1996)
	1.25 e 5.00	Kumral & Deger (2006)

Source: Adapted from Ferreira et al. (2018)

The indicators that constitute measures of geographical concentration, the Shift-Share analysis and the Input-Output analysis are also highlighted, but it was decided not to present them since they will not be used in this study.

The variables used to calculate the above measures were employment[5] and number of firms[6]. It should be noted that in their study Delgado and Porter (2021) also used employment and firms, to which they added patents (to explore agglomeration channels and calculate alternative measures of cluster strength: specialisation based on the number of firms, on employment in upstream industries, downstream industries or industries with similar labour occupations, and based on patenting (Delgado & Porter, 2021)).

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[4] See http://www.pofc.qren.pt/ResourcesUser/2012/PCT/Cluster_Economia_Mar_ProgAcao.pdf.

[5] Employees (No.) of Enterprises by Geographic localisation (NUTS - 2013) and Economic activity (Subclass - CAE Rev. 3); Annual (3) Source: INE.

[6] Enterprises (No.) by Geographical localisation (NUTS - 2013) and Economic activity (Subclass - CAE Rev. 3); Annual (3), Source: INE.

In fact, the number of enterprises and the number of persons employed by economic activity were used, according to the Classification of Economic Activities Revision 3 (CAE Rev.3), for all the activities of the maritime cluster recognised by the NSRF (See http://www.pofc.qren.pt/ResourcesUser/2012/PCT/Cluster_Economia_Mar_ProgAcao.pdf.), located in the Nomenclature of Territorial Units for Statistics (NUTS), having as reference standard Portugal and the NUTS III of the Coast of Portugal. The NUTS III considered were then: Alto Minho, Cávado, Área Metropolitana do Porto, Oeste, Região de Aveiro, Região de Coimbra, Região de Leiria, Área Metropolitana de Lisboa, Alentejo Litoral and Algarve.

Data were taken from National Statistics Institute (INE), System of integrated company accounts, in January 2022[7] for two periods 2008 and 2019, to check if there is any influence of the clusterisation policies of QREN (and according to the data available in the Database for these NUTS III and these CAE Rev. 3 the oldest and the most recent year).

4.2   Identification and Validation of the Maritime Cluster: Recognition and Results

In order to identify and validate the existence of the Maritime Cluster, a cluster recognised under the NSRF, it was decided to use the Location Quotient, the modified Hirschman-Herfindahl Index, the Relative Participation Index and the Specialisation Coefficient, for the variables and territorial space previously defined. Table 7 summarises the results obtained for these measures of the calculation of the various indicators for the Maritime cluster in Portugal, for 2008 and 2019.

Table 7: Concentration indicators for the Maritime cluster: results

Indicators	Variable	2008	2019
Localisation Quotient (LQ)	No. of Enterprises	1,06	1,09
	No. of Employees	0,98	1,03
Modified Hirschman-Herfindahl Index (HHm)	No. of Enterprises	0,04	0,07
	No. of Employees	-0,02	0,02
Relative Participation Index (PR)	No. of Enterprises	0,78	0,79
	No. of Employees	0,75	0,78
Coefficient of Specialisation (CE)	No. of Enterprises	0,19	0,25
	No. of Employees	0,38	0,40

Source: Own elaboration based on data from the National Statistics Institute (INE) (INE, 2022).

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[7] Disponível em
https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_indicadores&indOcorrCod=0008512&contexto=bd&selTab=tab2

As can be seen in Table 7, in 2019, the Location Quotient is higher than 1, both in the variable number of enterprises and in the variable number of persons employed (employment) for the Maritime cluster. These results show that the number of enterprises and employment in the activities of the Maritime cluster recognised by the NSRF has a greater weight in the region (in the NUTS III identified) than in Portugal. We can conclude that these values are in line with those of Held (1996) who argues that the reference value must be higher than 1.00. It is also verified that in 2008 the Localisation Quotient is lower than 1 for the variable number of persons employed (employment) for the Maritime cluster. It should be noted that from 2008 to 2019 there was an improvement in this indicator in both variables, showing an increase in the agglomeration of these activities in the region (in the selected NUTS III).

The results of the indicator, according to Costa (2002), can be interpreted as a specialisation of the region (NUTS III Coast of Portugal) in relation to the country (Portugal).

Now analysing the results obtained for the modified Hirschman-Herfindahl index (HHm), it appears that, in 2019, both variables studied have values greater than 0, which means that there is a specialisation of the sector under study (activities of the maritime cluster recognised by the NSRF) in the region (NUTS III of Coast of Portugal). It can be concluded that this sector in these NUTS III contributes significantly to the activities of the maritime cluster recognised by the NSRF in Portugal. Also, in this index, in 2008, it is verified that the HHm presents values below 0 in the variable number of personnel employed and an improvement from 2008 to 2019. These results show that from 2008 to 2019 there was an intensification of the specialisation of the maritime cluster (of the activities of the maritime cluster recognised by the NSRF) in the NUTS III of the Coast of Portugal.

As for the Relative Participation Index, it indicates the contribution of the Maritime cluster (of the sector under observation) in the NUTS III of the Coast of Portugal (in the region under study), when compared to Portugal. From the analysis of Table 7, it can be seen that this index has values close to 1, in the variable enterprises and in the variable personnel employed, both in 2008 and in 2019 and also registered an improvement from 2008 to 2019, thus showing a clear contribution and strengthening of the maritime cluster in the region under study for the country.

Regarding the Specialisation Coefficient, the closer it is to 1, the more specialised the region r is in sector j compared to the standard region. The Specialisation Coefficient thus makes it possible to assign a specialisation value to each region under analysis. For this coefficient, the results obtained (Table 7) do not reach 0.5, although with an improvement from 2008 to 2019, and it cannot be concluded that the NUTS 3 of the Coast of Portugal are more specialised in the maritime cluster.

4.3   Discussion of Results: Recognising the Maritime Cluster

In order to recognise the Maritime Cluster, this first approach considered the study of indicators that are measures of geographical concentration, namely the location quotient,

the modified Hirschman-Herfindahl index, the relative participation index and the specialisation coefficient (Pereira, 2011, Ferreira et al. 2018).

In order to recognise the Maritime Cluster, this first approach considered the study of indicators that are measures of geographical concentration, namely the location quotient, the modified Hirschman-Herfindahl index, the relative participation index and the specialisation coefficient (Pereira, 2011, Ferreira et al. 2018).

The recognition, in a first phase, that this cluster prefigures and presents an operating structure framed in the cluster approach, through the agglomeration and concentration of activities linked to the maritime sector, is thus verified. The Maritime cluster thus fulfils one of the two conditions necessary for cluster classification, i.e. it shows significant values in the analysis of geographical concentration indicators. The analysis of the interaction/cooperation links is missing to conclude whether it is fully functioning as a cluster.

An essential aspect to take into account in any methodology proposed for the identification of clusters is to verify both agglomeration and interaction as already mentioned. However, most studies in this field neglect the interaction between agents, focussing almost exclusively on the aspect of geographical concentration (Vom Hofe & Chen, 2006).

5   Final considerations

In this article, an attempt was made to study the maritime cluster in Portugal. The objective was to characterise the Sea Economy Cluster and to verify whether the maritime cluster in Portugal meets the conditions of a cluster. After the identification of the maritime cluster and, considering the theoretical framework of cluster by the different authors, in a first approach it was recognised that the measures of geographical concentration, through the study of indicators, were indicated for the recognition and identification of the cluster.

It was concluded from the results achieved for the different indicators, on the identification and validation of the Maritime cluster in Portugal, that it fulfils the conditions of a cluster. Thus, in the selected NUTS III there is an agglomeration of these maritime activities in the region, with an increase and intensification of the specialisation of the maritime cluster as well as a clear contribution and strengthening of the maritime cluster in the region under study for the country. Hence, it can be concluded that European policies to support clusterisation have had positive effects on this cluster in Portugal.

Thus, it is recognised that the maritime cluster in Portugal prefigures and presents an operating structure framed in the cluster approach, through the agglomeration and concentration of activities linked to the maritime sector. The Maritime cluster thus fulfils one of the two conditions necessary for the classification of cluster, i.e. it shows significant values in the analysis of geographical concentration indicators.

In order to conclude whether it is fully functioning as a cluster, it is still necessary to study and analyse the interaction/cooperation links within the cluster, which will be done in the future.

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