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Exploratory spatial analysis of maritime clusters

For decades, maritime clusters have been relishing distinct attention from policy, practice, and academia. The regional phenomenon coined as a cluster has been found to provide an excellent framework for the formulation of a competitive advantage for not only the firms situated within, but also the region, and in many cases, the nation harbouring the cluster altogether. Despite the attention directed towards maritime clusters, their body of knowledge is still crystallizing. Within this body of research, a definitive allocation, categorization, and classification of the different geographical stances with reference to the strategic elements of clusters, is absent. This work introduces a topology of the governing constructs within maritime clusters and provides a rudimentary, yet conclusive, classification of the different locational approaches in the strategic maritime clusters of the world. In addition, this research provides indications as per the tone of regional culture that dictates the competitiveness of maritime clusters. These indications are fostered through exploratory factor analysis on a dataset compiled of Likert-type questionnaire data. Structure detection based on the locational origin of the responses is conducted, contributing to a pertaining research gap in the literature, as studies providing geographical classification of maritime cluster competitiveness' factors are scarce. Various reliability statistics calculated validate both the quality of the dataset and the methodology applied.

Keywords: industry cluster; factor analysis; cluster analysis; strategic management; competitiveness; Cronbach's alpha.

1. Introduction

Maritime clusters are indicative cases of the cluster concept, mainly due to the distinguishing characteristics of the maritime industry; an industry that manages to blend the empirical and the analytical very effectively and distinctly, towards its quest for sustainability. There are not many industries where "camaraderie, storytelling, and commercial espionage" (Hershman 1988) go hand in hand with cluster culture. The maritime industry is preoccupied with growth, efficiency, technological breakthroughs, sustainable/green shipping, and yet, the aspect of the *character of people* within the

industry remains predominant (Miller 2003; Sifneos 2013; Tuan 2013). As such, the maritime industry manages to encapsulate the romanticism of *the voyage* and of venturing to overcome the treachery of the Sea, within many modern technical and managerial concepts. The result is a dynamic industry that relinquishes interest to business practice and academia, alike. Shipping and maritime business pertain to an amalgam of many research facets that can provide a plethora of domains with a fertile ground to develop (Halpern et al. 2008) and assess (Hoque et al. 2019) theories and quantitative constructs (Pollnac et al. 2001), as well as abstract and factual concepts (Hilborn et al. 2004; Katsanevakis et al. 2011). One of the latter that has gathered much attention from academia and practice is the spatial agglomeration of industrial activity, coined as an industry cluster.

Among the plethora of industry cluster designations (Martin and Sunley 2003), Michael Porter's definition is prevalent in contemporary usage. Porter (1998) defines clusters as "… geographic concentrations of interconnected companies and institutions in a particular field." Thereby one could define maritime clusters as "geographic concentrations of interconnected companies and institutions in the *maritime* field." Cluster research is enduring, as clusters can provide the drive towards a competitive advantage that can benefit localities, regions, and even nations towards the much-pursued end of sustainable growth. It does not come as a shock that policy has garnished distinct attention towards these constructs of industry (Fjørtoft et al. 2020). Within a cluster, a collection of competitors can push through the scarcity principle and thrive simultaneously, through the vessel of innovation. At the same time, many elementary concepts of clusters do remain elusive (Doloreux 2017). This paradox provides a volatile opportunity for research, to develop and utilize theories and instruments that will document, analyse, and explain the phenomenon effectively; a

phenomenon that remains, geographical. The body of knowledge may pertain to diversity that harbours interdisciplinarity, but at its core, an industry cluster is a characteristic of geography. Therein, local culture and folklore, endemic habits and traditions, all provide the constructive determinants that will govern the fate of the cluster.

On the one hand one arrives at the maritime industry with all its eccentric characteristics, sine qua non inherent with culture, folklore, traditions, and values: a maritime community (Bowen and Riley 2003; Pomeroy 1995). Whether referring to boating clusters, fisheries, shipbuilding, or shipowners' clusters, the community, rich with maritime spirit, must be present. If there is no maritime community, there is no maritime activity. Thereby shipping not so much has the tendency to cluster, as is itself a cluster. All of shipping, from its birth, is an agglomeration of activity. All matters maritime pertain effortlessly to clustering, as shipping, at its core, is exactly that – a cluster of individualism governed through strength in unity, to bathe in the Sea's bounty, from a range of perspectives. On the other hand, one witnesses the sustainable competitive advantages that can be relinquished within a region through the innovation -driven growth that an industry cluster can provide. The combination of maritime business and industry clusters surrenders the concept of maritime clusters, an indicative case of the cluster concept, with major spillovers for research, strategy, and policy.

Maritime clusters are a benchmark of the cluster concept, insofar that almost all maritime matters require an integrated and collective approach (Albotoush and Tan Shau-Hwai 2019; Kozhikkodan Veettil and Quang 2019; Marinho et al. 2019; Samoilys et al. 2019); this manifests itself in exactly the same manner that industry clusters comprise of an agglomeration of industrial activity, wherein networks of innovation and knowledge compete and cooperate towards the resulting benefits for the whole region.

The fact that maritime clusters are indicative of the cluster concept goes not to draw attention away from any other types of clusters, where indeed excellent cases of the latter are afar from maritime (Silicon Valley, Hollywood, and many others could be considered excellent cases of the concept). At the very least though one can conclude that maritime clusters are distinct and do provide a revealing case study of the cluster concept, from a plethora of perspectives. At the same time, the cluster concept is not without caveats and pitfalls. As mentioned, the generic industry cluster concept itself comes with more than ten definitions (Martin and Sunley 2003). Along with the plethora of definitions comes ambiguity in the determination of a distinct cluster. Some examples that outline these issues are as follows.

Figure 1 *Ulsan, South Korea (source: The satellite image has been extracted from* Google Maps™*).*

In Ulsan (Figure 1), Hyundai Heavy Industries prides itself in owning and operating the largest shipyard on Earth. The latter was transformed in the seventies from a shipping village due to the vision of one person, into a cluster of innovation, maritime education, corporate social responsibility, and operations focused on sustainable growth. The shipyard in Ulsan, from its humble beginnings, checks every prerequisite of a competitive maritime cluster, as within one site (regardless if the major shipyard is

under one parent firm) it has bloomed into several divisions of diverse operations and shares complementarities with many regional firms. Yet, the term cluster is not used with reference to the Ulsan shipyard and its satellite regional activities. Why not? The case of Ulsan is an excellent example of maritime cluster dynamics. Maybe it is because the lion's share of activity in the specific region belongs to one firm. Still, the parent firm has branched out into a constellation of activities that transcend even itself, as the region portrays several benchmark cluster specifics.

Mentioning clusters with origins from fishing villages, one would be remiss not to cite the maritime cluster in Møre (Amdam and Bjarnar 2015; Fløysand et al. 2012). Said cluster pertains to the Møre og Romsdal region (Figure 2) of Western Norway and has held dynamic presence in maritime operations for over a century. Today, it is home to a renowned cluster, as one of the most innovative specialized offshore vessel manufacturers of the globe (Global Centres of Excellence 2014). The cluster started out as a fisheries-oriented cluster, but the subsequent depletion of fish stocks led to a threatening environment for the industry. In other regions, this could mean cluster decline and successive eradication, but not for Møre. The cluster took advantage of its maritime expertise and diversified into specialized offshore vessels.

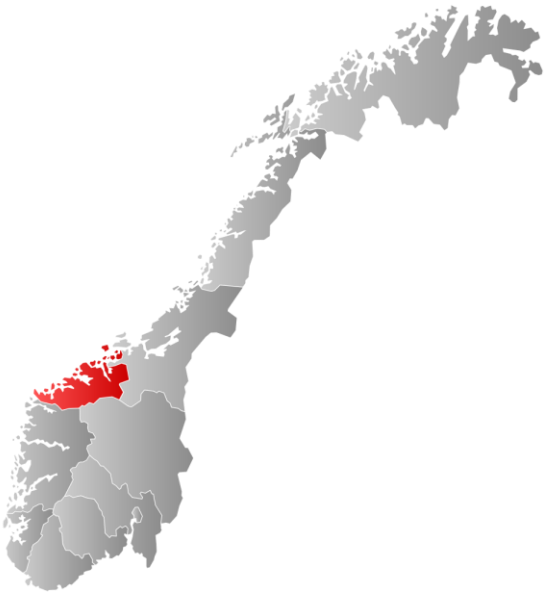

Figure 2 *Møre og Romsdal region of Western Norway (source: SteveJothen at English Wikipedia, used under CC BY-SA 3.0 license).*

Thus, the region that today is home to more than two hundred innovative firms, is in a dominating position within its operational maritime sector and can portray competitiveness on a global scale. Research has shown that the cluster culture within the region is one of mutualism, both within and between the cluster's members. Within organizations, the value system of the cluster is strengthened by striving for respect and innovation, through traditions that stand tall and abide to live in perpetuity; this context resembles ties, relations, and dynamics akin to those observed within a family, not a business (Bjarnar 2009). Between firms, the cluster's culture is exhibited through actively supporting mutualism, trust, and cooperation, all amidst the competitive nature of the industry. The maritime cluster of Møre is a fine example of collective prosperity and the embodiment of the threads of cluster theory. If one compares the activities and histories of Møre and Ulsan, many similarities become apparent, both in technical development capacity, innovation, specialization and diversification, and even more so, in the importance of regional drive, culture, and the character of people. Yet the former is an official cluster and the latter is not.

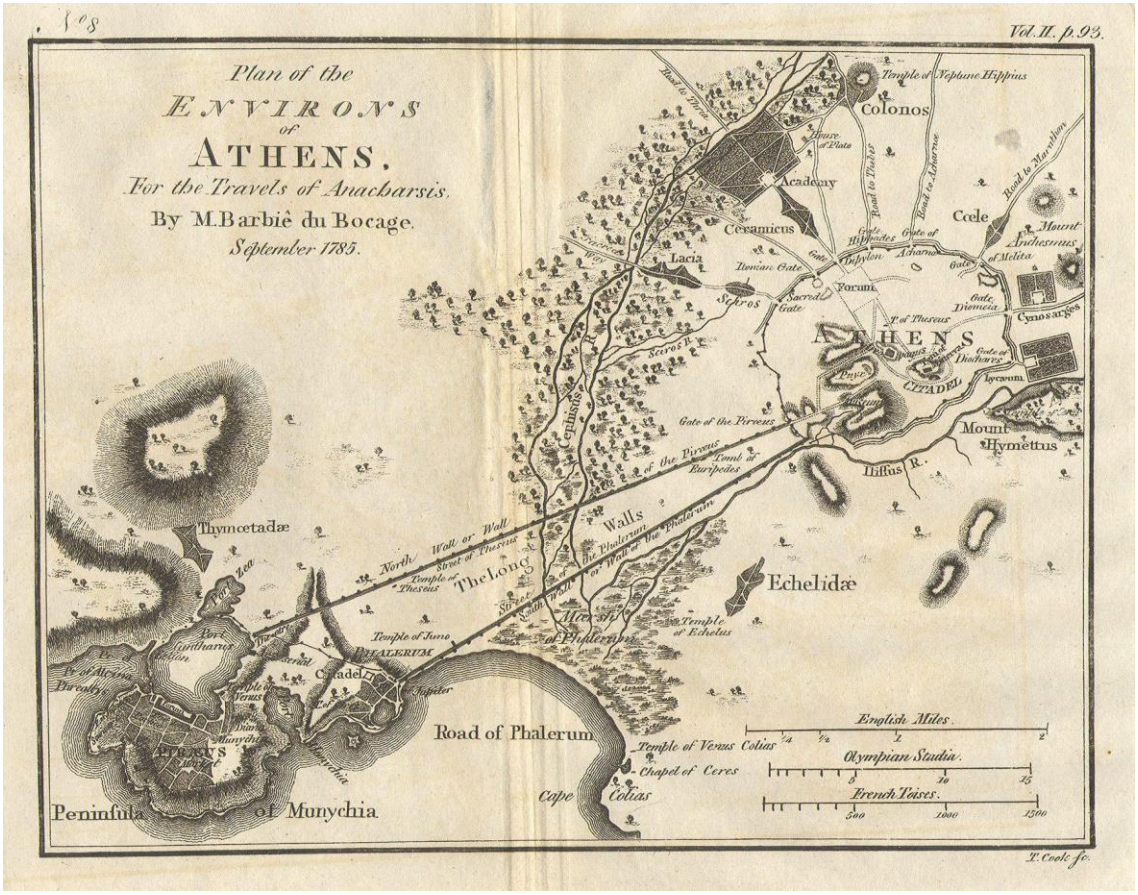

Figure 3 *Athens and environs in Ancient Greece, by M. Barbie de Bocage, circa 1785. Includes the Long Walls, built to protect merchants as they passed from Athens to the port city of Piraeus (source: Geographicus Rare Antique Maps, the file belongs to the public domain).*

The port of Piraeus (Figure 3), with maritime traditions that are lost in the roots of history, is considered an *unofficial* maritime cluster (cf. Zagkas and Lyridis 2011); and would be more likely classified as a maritime *ownership* cluster (in the same manner that London would be categorized as a maritime *services* cluster), yet this knowledge remains empirical. Research shows that although common knowledge pertains to the ownership aspect of the shipping sector in Greece, Piraeus stands as a paradoxical cluster, where on the one hand the shipping company thrives, yet the supporting firms are in decline (Pardali et al. 2016). Thereby Piraeus could be considered a cluster that benefits only part of its members; this fact maybe would push one to solely consider the ownership aspect as belonging to the maritime cluster of Piraeus. In Piraeus we therefore observe a legendary cluster, but a cluster that relinquishes its benefits upon a

very distinct aspect of its members.

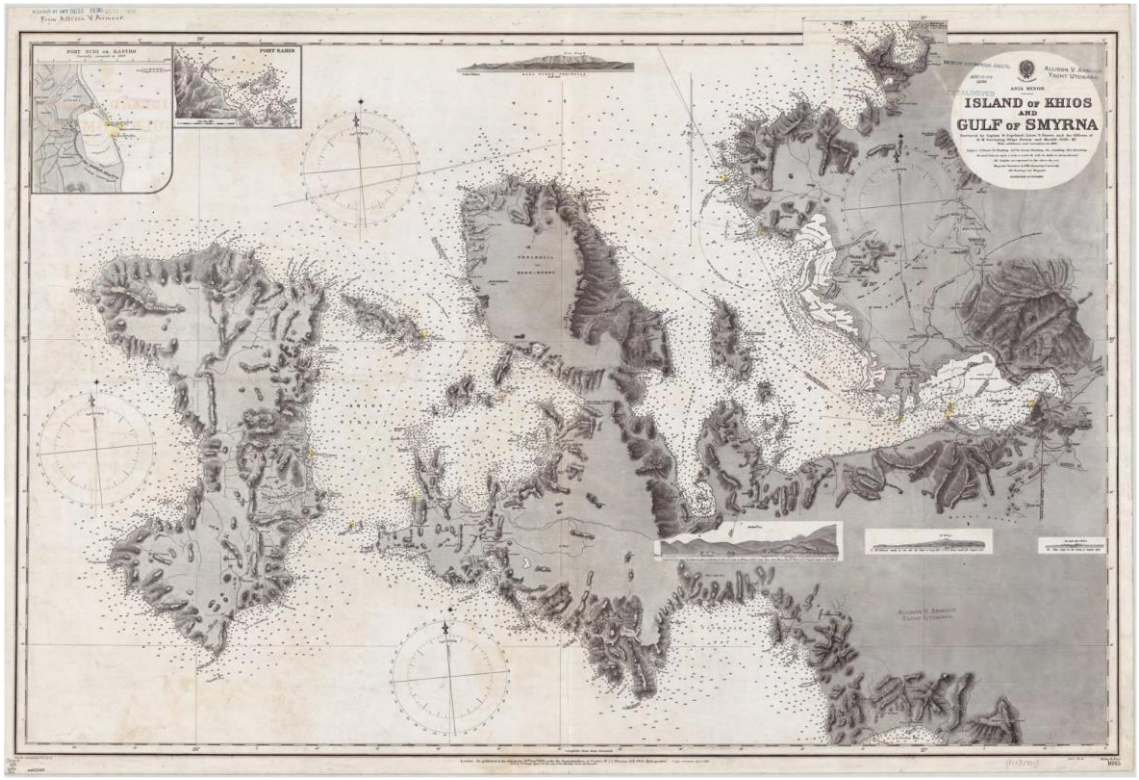

Figure 4 *Nautical chart of the Island of Chios (Greece) and Gulf of İzmir (Turkey), circa 1893 (source:* Wikimedia Commons*, the image belongs to the public domain).*

But a much more interesting fact about Greek shipping would maybe concern the maritime cluster of Chios (Figure 4). Oinousses island (belonging to a cluster of small islands Northeast of Chios), concerns a quaint region of population of less than one thousand inhabitants. It could be like any other rustic place in Greece, yet unofficial accounts register the shipowners' clusters there at an extreme concentration. Anecdotal evidence settles for proverbs: One fifth of the world fleet is in the hands of the Greeks; and a quarter of that, in the hands of Oinousses (cf. Gage 1979). A village in Chios has given rise to an exemplary amount of shipowners' concentration, pertaining to an indicative case study for the maritime cluster concept. All this, with no documented explanation, nor analysis, nor statistics. Maritime mysteries at their best, full of maritime cluster dynamics, nonetheless.

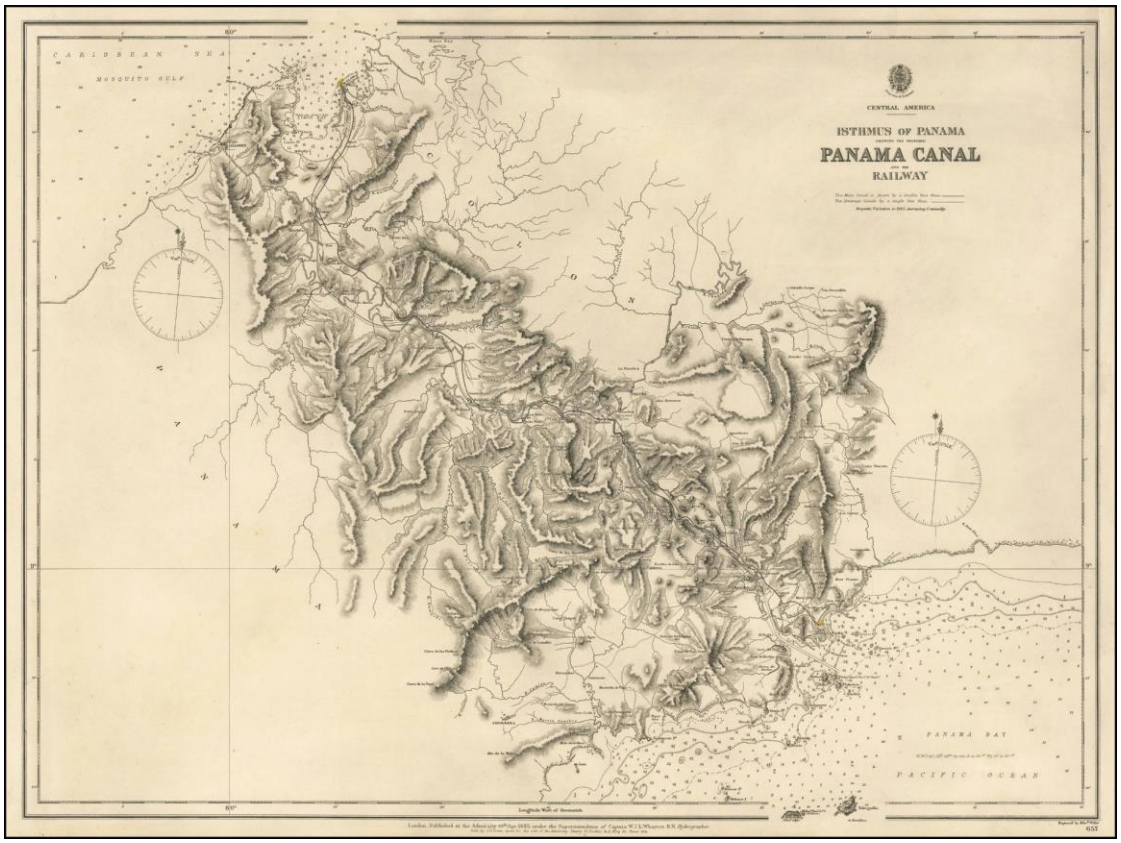

Figure 5 *Admiralty chart of the Isthmus of Panama showing the proposed Panama canal, circa 1885 (source: Wikimedia Commons, the file belongs to the public domain).*

On the antipode, Panama is home to a vibrant maritime cluster that resides in harmony with the trends and behaviours of the canal (Pagano et al. 2016). Due to its unique strategic location, the region has fostered diverse activity beyond the maritime scope. Novel industrial and logistics parks have found the opportunity to blossom in either side of the canal. Not only this, but the geography benefits the extended region as well, giving way to maritime clusters beyond the scope of Panama, such as the Caribbean Transhipment Triangle, that encapsulates many logistics and maritime clusters, in many countries very far from Panama. The latter provides exceptional benefits to the extended Panama region that derive solely from the Panama maritime cluster, thereby providing an instance of a maritime cluster impacting not only its region, but other countries' industries as well. This observation is within itself a paradox, as clusters create value for their region, not a constellation of regions. So here one observes an official maritime

cluster, with paradoxical manifestations that spillover far beyond the geography of the cluster.

All the case studies presented thus far are linked by cluster dynamics on the one hand, and cluster paradox on the other. Some are official clusters, and some are not, some pertain to a diverse range of activities, and some to a core activity. The common thread is that of a dynamic society active in maritime affairs, carving global excellence and sustainability in its endeavours. The maritime cluster concept has many pitfalls but maybe one can agree that regardless of status and technicalities, what matters to define a cluster is its value creation potential, that is derived through trust, innovation, and cooperation. And this exact concept can transcend from technical definitions to a more profound dispositional understanding of why maritime clusters are so attractive, at least from an analytical standpoint. Within this understanding, further research is required so that regional threads of the culture and perceptions within maritime clusters can be exposed.

Within the body of knowledge concerning maritime clusters, there is much attention pertaining to their development (Kavtaradze et al. 2020), their spatial concentration and its dynamics (as is evident in the research body of generic industry clusters as well, cf. Klepper 2010), although studies that aim to extract structures and constructs that govern the diversity, culture, perceptions, and mentality of maritime clusters are sparse. There is considerable agreement in the discourse of maritime clusters that models (and frameworks) are indeed required to study, analyse, and recreate the phenomenon, and yet when referencing spatial determinants of maritime clusters, the evidence is limited. This paper tends to this exact gap in the body of research. As such, the results of this study are important, as they facilitate a better

understanding of the dispositional characteristics of maritime clusters. Through these, benchmarking can be executed, and pertinent policy directions can be pursed.

The paper is organized as follows. After the present introductory section, a literature review is conducted that validates the objectives and rationale of the research. The review is followed by an analysis of the quantitative instruments utilized, as included in the methodology section. The presentation of the results follows the latter and the paper concludes with a discussion.

2. Literature review

Contemporary theory of cluster research has many times stemmed from the Marshallian agglomeration economies (Marshall 1920), although the formulation of location theory should be acknowledged as a starting point. Therefore, a step deeper in the analysis would be to include von Thünen's (1826) centralized construct as the first model of a regional cluster; and a step even further would be to regard Smith's (1776) 'invisible hand' as a core cluster element, although Adam Smith is not generally regarded to have contributed to industry cluster theory. Smith though does analyse the regional stakes that will be aligned implicitly through the manifestation of a local industry (i.e. a regional cluster?), whereas Marshall notes with a fairly cryptic and mesmerising notion that the mysteries of trade within an industrial locality "… become no mysteries; but are as it were in the air and children learn many of them unconsciously."

It is of some value to compare these historical threads of cluster theory to current competitive maritime clusters, such as the Møre maritime cluster, as presented in the previous section. In the Møre og Romsdal region of Western Norway it seems that Adam Smith's 'invisible hand' has indeed guided a decentralized district of fifteen thousand square kilometres and quarter of a million residents, into global excellence;

where (cluster dynamics standing in for the invisible hand) " … promote an end … for the public good." Through the case study of the Møre maritime cluster, the invisible hand can rest in societal dynamics between firms that understand that sustainable operations rest in the pursuit of excellence through mutualism. And that is why this cluster is so competitive. It does not seek growth through appalling dynamics and impressions management, but rather through facilitating cooperational ties and bonds of trust, within all the firms that make up the cluster. The invisible hand at its best.

Apart from the invisible hand, the other infamous quote mentioned above from a pioneer of economic thought, Alfred Marshall, also has a resonating capacity within the Møre og Romsdal region, as truly, the mysteries of the maritime industry seem to be 'as it were in the air,' of Møre. Not only this, but Møre's children seem to learn many of these mysteries subconsciously and put them into practice that in turn blossoms into sustainable competitiveness for the whole cluster. The invisible hand, the mysteries of (the) trade, are fused into a culture that laughed in the face of adversity when the fishing stocks of Møre disappeared, and instead of crying over spilled milk, put the expertise of the region into good use, diversifying into exemplary innovation. Thereby, even if the invisible hand was originally meant to portray free market dynamics, its resonance in driving the culture of a region towards sustainable cluster operations, is apparent.

Further referring to the baseline of industrial cluster theory, Adam Smith's impact on the birth of location theory is documented (Pinto 1975) and von Thünen himself recognizes this influence (Clark 1967). In the same manner that von Thünen's contributions can be traced back to Adam Smith, so do Marshall's (1920) 'economies of agglomeration' (a local pool of skilled labour, local supplier linkages, and local knowledge spillovers; cf. Potter and Watts 2012) resonate with von Thünen's 'isolated state.' It would be interesting to note that in none of these works does the term 'cluster'

appear. Although, bearing on materiality, one should not focus on semantic usage, but rather on the continuous interest exhibited towards the cluster concept, that manifests itself as the agglomeration of innovation, knowledge, and trust within a certain industry, materializing around a focal point driven by geography.

The term ‘cluster’ as a qualifier of competitive regional agglomeration was introduced through the work of Michael Porter (cf. 1998; 1990) and much of contemporary research stems from his contributions. Porter has provided a widely utilized framework for the analysis of clusters (the Diamond Model) and introduced the ‘location paradox’ (Porter 2000), noting the paradoxical importance of localities in a continuously globalized economy, perfectly summed up in the phrase “paradoxically, the most enduring competitive advantages in a global economy seem to be local.” The foundation of industry clusters could be considered to be economic geography, though the former is progressively treated with a multidisciplinary approach, expanded and embellished to include strategic management (Koliousis et al. 2019; Stavroulakis et al. 2019), policy (Brett and Roe 2010; Nursyamsi et al. 2018; Shinohara, M. 2010; Sjøtun and Njøs 2019), and regional strategy (Doloreux and Shearmur 2018; Doloreux and Shearmur 2009; Pinto et al. 2015), among others, thus carving multilateral attention and interest in the field (Hassink 1997), both from academia and practice.

As evidenced in the body of research, maritime clusters provide an excellent baseline for the formulation of models (Stavroulakis and Papadimitriou 2017; Zhang and Lam 2017; Zhang and Lam 2013), frameworks (Doloreux 2017; Koliousis et al. 2018b; Koliousis et al. 2017; Lagoudis et al. 2019; Monteiro et al. 2013; Rupo et al. 2018; Stavroulakis and Papadimitriou 2016; Zagkas and Lyridis 2011), as well as synergies of the two (Othman et al. 2011). In addition, research provides a plethora of pertinent case studies that address the theory from many different perspectives

(Fløysand et al. 2012; Pagano et al. 2016; Pardali et al. 2016; Qingmei and 2020; Salvador 2015). Maritime clusters can be researched with reference to sustainability (Ashrafi et al. 2020; Rupo et al. 2018; Shinohara 2010), lifecycles (Shi et al. 2020a; Shin and Hassink 2011), upgrading (Shi et al. 2020b), innovation potential (Pinto et al. 2018), and thus extract many relevant typologies (Makkonen et al. 2013); many studies allow for the understanding that maritime clusters are set apart by a culture that manifests through the cluster community (Bjarnar 2009).

As would be expected from a theory based on regional merits and situational manifestations, location is a distinct and important variable for industry clusters, to the point that the 'industry-shaping power of spatiality' (Soja 2000) has been referenced. Notwithstanding, from notions such as this, one can observe that location by itself can be considered as the catalyst for cluster spawning. An aspect with much potential to further contribute within the body of research is the capability exhibited for spatial analysis (Monasterio 2006), from many different perspectives and standpoints that may include spatio-temporal evolution and regional structure (Sharma 1993). The instruments employed for spatial analysis of industry clusters range from exploratory spatial data analysis (Chen et al. 2015), stochastic frontier analysis (Lall et al. 2001), exploratory factor analysis (Kadokawa 2011), input-output methodologies (Feser and Sweeney 2000; Guo et al. 2019), regression analysis (Fowler and Kleit 2014; Yoon and Srinivasan 2014), QGIS visualization (Kranjac et al. 2017), functionalism (Athiyaman and Parkan 2008), to bibliometric analysis (Chain et al. 2019), industrial landscape analysis (Cai et al. 2010), spatial econometrics (Goetz and Rupasingha 2002), the spatial scan statistic (López and Páez 2017), and many combinations among these methods (Cruz and Teixeira 2015; Hutton 2006; Kaygalak and Reid 2016; Kies et al. 2009; Lv et al. 2008; Wang et al. 2012; Zhao et al. 2012; Zhu et al. 2013).

One can observe that spatial analysis is prevalent with reference to industry clusters, yet there are not many studies analysing maritime clusters from a geospatial perspective (cf. Djoumessi et al. 2019). This pertains to the research gap tended to with the present work, as per the spatial analysis of maritime clusters. As such, it would be pertinent to extract locational agglomerations with reference to maritime clusters and this study provides same. The research question pertains to the validity of exploratory data analysis in maritime clusters and the possibility of the extraction of a *spatial* narrative, i.e. is exploratory spatial analysis able to reveal anything with reference to the governing threads of the competitive maritime clusters of the globe? To venture to answer the research question, exploratory geospatial analysis of maritime clusters has been conducted. The latter is found to uncover governing parameters and underlying paradigms in maritime clusters.

The contribution of this research resides in spatial analysis of maritime clusters, a field of distinct importance, as it can uncover the latent structure and governing threads of competitive maritime clusters and thus facilitate effective policy drafting and benchmarking. This work employs exploratory data analysis techniques and validates their use through appropriate metrics. The results point to the presence of a distinct latent structure in competitive maritime clusters. These results are further refined through cluster analysis, where the diverse traits of the values, dispositions, and perceptions of the latent structure of clusters can be portrayed. The methodological instruments employed to tackle the research question are analysed in the section that follows.

3. Methodology

The instruments utilized in this study are presented within this section. These include

the tests of validity and reliability of the dataset and the exploratory spatial analysis methods themselves. The methodology executed to arrive at the dataset was as follows. Through a sample of experts compiled both of academics with contributions to maritime (and/or industry) cluster research, and practitioners in official maritime clusters, a questionnaire was administered. This questionnaire was composed of the competitiveness factors for maritime clusters (as extracted from the literature). The respondents were asked to assign a value of importance for each factor, based on a Likert-type response scale. The responses were then categorized per country and (political and/or geographical) region of origin, thus arriving at the dataset of the present work (Figure 6).

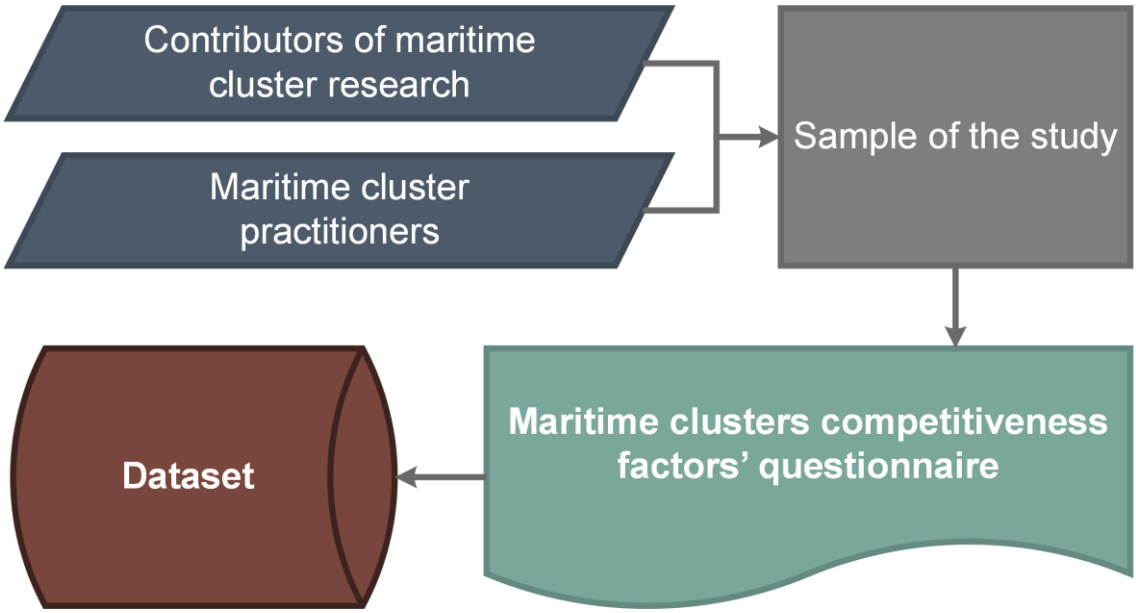

Figure 6 *The methodology for dataset acquisition (source: Authors, MS Visio™ output).*

Exploratory factor analysis was conducted on the dataset and the results hint to essentially two factors latently governing the manifestation of maritime clusters. To extract the specifics of these, cluster analysis on the responses (based on the regions comprising each of the factors) is conducted. In addition, measures of validity and reliability return very strong metrics, thus validating both the quality of the dataset

(through Cronbach's alpha) and the applicability of the exploratory factor analysis method used (through Bartlett's test and the Kaiser-Mayer-Olkin measure of sample adequacy, Figure 7).

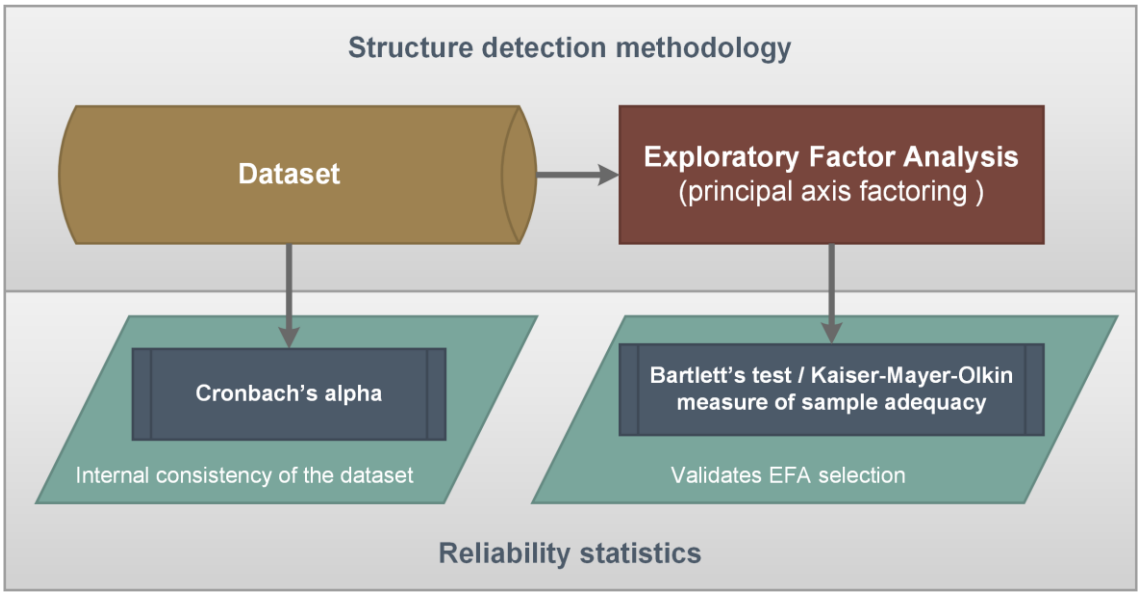

Figure 7 *Reliability statistics and the methodology for structure detection (source: Authors, MS Visio™ output).*

These results can assist in the understanding of the governing parameters of maritime clusters and can facilitate in effective policy decisions, in addition to benchmarking. The analytical instruments utilized are validated and from this baseline, further research can spawn from the work herein that can substantiate further and/or challenge these results.

3.1 The instrument and sample

To address the research question, an inventory of twenty-eight items was produced. These items pertain to the strategic factors deemed important for industry clusters, as addressed in the literature (cf. Stavroulakis and Papadimitriou 2016); they assemble Table 1. The inventory includes the Marshallian agglomeration economies (Items 2, 3, and 12), some of M. Porter's contributions (Items 20 and 21), and three items belonging exclusively to the maritime domain (Items 19, 22, and 24).

Table 1 *The items of the instrument (source: authors).*

No.	Factor
1.	Presence of research centre and/or higher education institution in the region
2.	Existence of a labour market
3.	Shared inputs and/or local supplier synergies
4.	Entrepreneurial culture
5.	Corporate culture
6.	Presence of an official governance structure
7.	Presence of financial institutions
8.	Market entry and exit barriers
9.	Breadth and diversity of markets
10.	Existence of innovation system
11.	Natural resources
12.	Knowledge spillovers between firms
13.	Firms' specialization
14.	Firms' diversification
15.	Synergies between firms' specialization and diversification
16.	Trust between cluster members
17.	Knowledge creation and management
18.	Effective strategic management of firms
19.	Factors inherent within the maritime industry
20.	Competition between the cluster's members
21.	Cooperation between the cluster's members
22.	Interconnectivity of transportation/maritime networks
23.	Technological interconnectivity
24.	Sustainability of maritime resources
25.	Proximity to other clusters
26.	Synergies with other clusters
27.	Expansion of the economic cycle
28.	Effective cluster policies

Based on these factors and following questionnaire-development guidelines, as documented in the literature (Dolnicar 2013; Khari and Siavashan 2012; Tarighi et al. 2017), the instrument (questionnaire) was drafted within the Google Forms™ platform (as included in Appendix A). The questionnaire was to assess relative importance through a five-point Likert-type scale (Albaum 1997; Allen and Seaman 2007; Likert 1932; Wilde et al. 1995). Before administering the questionnaire, it was pilot tested in a small sample of respondents and refined, for quality assurance purposes (as per proper questionnaire administration, to attain an adequate level of validity and reliability). The survey adhered to the mandates of the *European Textbook on Ethics in Research* (European Commission 2010), the *Ethics for Researchers* handbook (European Commission 2013), and the *European Charter for Researchers* (European Commission 2005).

As the sample acquisition must bear representativeness, data mining in the body of knowledge of maritime clusters along with that of maritime cluster practitioners was conducted. Thereby, the sample of the study consists of representatives from academia and practice, alike. These expert representatives either belong to an official maritime cluster, and/or have provided contributions in the body of research of maritime clusters. From a quantitative perspective, the absolute minimum of statistical treatment would pertain to a sample of fifty respondents. For this survey, the sample consists of two hundred and forty-seven respondents ($N = 247$). Therefore, the sample quantity may be deemed as more than adequate and this indication is substantiated further by a very high metric of internal consistency, mirrored in the calculation of Cronbach's alpha. As mentioned, the respondents are either representatives from industry, belonging to a firm from an established maritime cluster, (and/) or are academics that have provided a contribution in the body of knowledge with reference to industry clusters. From a

qualitative perspective, on the one hand, the maritime cluster practitioners had to belong to an 'official' maritime cluster, whereas the academic experts were drawn from a database that attains a quality assessment process (Scopus™). With the questionnaire refined after pilot testing and the sample complied, the former was forwarded to the latter electronically with a brief explanation of the scope and objectives of the research. If a response was not received within ten working days, a reminder was sent; if again there was no response, the process repeated itself once more. Each respondent was asked to rate the items of Table 1 based on a five-point Likert-type scale (as included in Table 2), as per their importance for a competitive maritime cluster.

Table 2 *The five-point rating scale (source: authors).*

Value	Importance for a competitive maritime cluster
1	Not important / Not applicable
2	Slightly important
3	Moderately important
4	Important
5	Very important

A pitfall with the use of Likert-type scales refers to data treatment as interval data when it pertains to ordinal data. To circumvent this issue, the literature suggests that significant bias is not introduced in the analysis, so long as the respondents themselves consider the intervals between the possible choices of the scale as equal (Bishop and Herron 2015; Jamieson 2004). Therefore, in the instructions of the questionnaire, the respondents were asked to consider the intervals of the scale equidistant. From thereon out, one has arrived at a dataset with individual responses with reference to the importance of the competitiveness factors involved. To translate this data to spatial analysis, the responses were categorized not as per their respondent, but the region from where the response originated. Through this prism, the sample is transposed; rather than data mining with respect to the categorization of the strategic

factors, exploratory data analysis is conducted with respect to the spatial dynamics of responses.

To extract any patterns and underlying factors pertaining to spatial distribution of the data, exploratory factor analysis and subsequent cluster analysis is conducted. In addition, various metrics that express the validity and reliability of the dataset are calculated. All the instruments utilized are presented in the following subsections and consist of the remainder of the methodology section.

3.2 Reliability statistics

The internal consistency of the data was assessed through the reliability coefficient alpha (Cronbach 1951). Cronbach's alpha (as included in Equation 1) is the expected correlation of two tests that are designated to measure the same effect, where there are *N* subjects taking a test that consists of *k* items. S_i^2 refers to the variance associated with item *i* and S_p^2 refers to the variance associated with the observed total scores. One can consider that with a high degree of covariance, the items measure the same concept.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} S_i^2}{S_p^2}\right) \quad (1)$$

3.3 Bartlett's test and the Kaiser-Mayer-Olkin measure of sample adequacy

The chi-square value for Bartlett's test of sphericity is calculated through Equation 2.

$$\chi^2 = -\left(W - 1 - \frac{2p+5}{6}\right)\log|R| \quad (2)$$

The calculation refers to p(p-1)/2 degrees of freedom. The Kaiser-Mayer-Olkin measure of sample adequacy is included in Equation 3.

$$KMO_j = \frac{\sum_{i \neq j} r_{ij}^2}{\sum_{i \neq j} r_{ij}^2 + \sum_{i \neq j} a_{ij}^{2*}} \quad KMO = \frac{\sum\sum_{i \neq j} r_{ij}^2}{\sum\sum_{i \neq j} r_{ij}^2 + \sum\sum_{i \neq j} a_{ij}^{2*}} \tag{3}$$

Therein α_{ij}^{*} is the anti-image correlation coefficient. These two tests are rather generic concerning exploratory factor analysis with reference to extracting any underlying elements (and/or detecting any underlying structure) within the data and can validate the selection of exploratory factor analysis (Costello and Osborne 2005; Fabrigar et al. 1999). The Kaiser-Meyer-Olkin measure assesses the partial correlations among the variables. One would expect a high value for this marker of sampling adequacy if the analysis is to be considered valid. Bartlett's test of sphericity demonstrates whether the correlation matrix is an identity matrix. This circumstance would hint towards the fact that the factor model use is not appropriate. Therefore, one expects statistical significance to manifest the appropriateness of use of the factor model.

3.4 Principal axis factoring

Of a variety of methodologies for exploratory factor analysis, principal axis factoring is conducted for the present dataset as the most appropriate method for pattern recognition of a dataset not following a normal distribution (Gorsuch 1997); as is the dataset compiled herein. In this method, the matrix of factor loadings based on factor *m* is calculated as in Equation 4.

$$\Lambda_m = \Omega_m \Gamma_m^{1/2} \tag{4}$$

Where

$$\Omega_m = (\omega_1, \omega_2, \ldots, \omega_m) \tag{5}$$

and

$$\Gamma_m = diag(|\gamma_1|, |\gamma_2|, \dots, |\gamma_m|) \quad (6)$$

The communality of variable i is given by Equation 7.

$$h_i = \sum_{j=1}^{m} |\gamma_j| \, \omega_{ij}^2 \quad (7)$$

Thereby, an iterative solution for communalities and factor loadings is sought. At the i^{th} iteration, the communalities from the preceding iteration are placed on the diagonal of R, resulting in R_i. An analysis of eigenvectors is performed on the latter, along with the novel communality of variable j, as estimated by Equation 8.

$$h_{j(i)} = \sum_{j=1}^{m} |\gamma_{k(i)}| \, \omega_{jk(i)}^2 \quad (8)$$

Then, the factor loadings are obtained by Equation 9.

$$\Lambda_{m(i)} = \Omega_{m(i)} \, \Gamma_{m(i)}^{1/2} \quad (9)$$

The iterations continue until the maximum number is reached or until the maximum change in the communality estimates is less than the convergence criterion.

3.5 Promax oblique rotation

To assist with the interpretation of the principal axis factoring results, rotation is conducted. There are two basic categories of rotation, depending on whether the variables are correlated. If no correlation is expected, one should select orthogonal rotation (e.g. Varimax), whereas if the variables are correlated, then one should select oblique rotation (e.g. Promax). Since the variables herein are indeed correlated (a region

can be dependent on another region and a competitiveness factor can be dependent on another factor), Promax rotation is conducted (Hendrickson and White 1964). Promax proposes a computationally fast rotation, achieved by first rotating to an orthogonal (Varimax) solution and then relaxing the orthogonality of the factors to better fit simple structure. Varimax is used to get an orthogonal rotated matrix as in Equation 10.

$$\Lambda_R = \{\lambda_{ij}\} \tag{10}$$

The matrix $P = (p_{ij})_{p\times m}$ is calculated, as in Equation 11.

$$p_{ij} = \left|\frac{\lambda_{ij}}{\left(\sum_{j=1}^{m}\lambda_{ij}^2\right)^{1/2}}\right|^{k+1}\left(\sum_{j=1}^{m}\lambda_{ij}^2\right)^{1/2}\Big/\lambda_{ij} \tag{11}$$

Here, k (k > 1) is the power of Promax rotation. The matrix L is calculated in Equation 12.

$$\boldsymbol{L} = (\Lambda_R'\Lambda_R)^{-1}\Lambda_R'\boldsymbol{P} \tag{12}$$

The matrix **L** is normalized by column to a transformation matrix **Q = LD** where $\mathbf{D} = (diag(\mathbf{L}'\mathbf{L}))^{-1/2}$ is the diagonal matrix that normalizes the columns of **L**. At this stage, the rotated factors are $f_{promax\_temp} = \mathbf{Q}^{-1} f_{\text{var } imax}$. Because $\text{var}(f_{promax\_temp}) = (\mathbf{Q}'\mathbf{Q})^{-1}$, and the diagonal elements do not equal unity, one must modify the rotated factor to $f_{promax} = \mathbf{C}f_{promax\_temp}$ where $\mathbf{C} = \{diag((\mathbf{Q}'\mathbf{Q})^{-1})\}^{-1/2}$. The rotated factor pattern is $\Lambda_{promax} = \Lambda_{\text{var } imax}\mathbf{QC}^{-1}$. The correlation matrix of the factors is $\mathbf{R}_{ff} = \mathbf{C}(\mathbf{Q}'\mathbf{Q})^{-1}\mathbf{C}'$. The factor structure matrix is then $\Lambda_S = \Lambda_{promax}\mathbf{R}_{ff}$. With the rotation conducted, one can interpret the results of the principal axis factoring, as per the latent structure of the data.

3.6 Cluster analysis

To provide a greater depth in the interpretation of the exploratory factor analysis, cluster analysis for the items included in the each of the factors (extracted from the factor analysis) is conducted. This is executed through hierarchical clustering measuring squared Euclidian distance (between-groups linkage, as in Equation 13).

$$\text{Euclidian distance } (\mathrm{x}, \mathrm{y}) = \sqrt{\sum_i (x_i - y_i)^2} \tag{13}$$

The process begins with all cases thought of as distinct clusters, whilst finding the most similar pair of factors (by calculating their distance) and joining them. The process continues, until, at the end, the two final clusters are joined. Depending on the measure of dissimilarity selected, a different number of clusters may be produced. With the agglomeration schedule extracted, one can pair items and distances and thus investigate which items were the first to be merged to a cluster, along with the rest of the sequence. Through cluster analysis of the grouping of items produced by the factor analysis, one can attain insight as to the specifics that govern the distinct factors extracted. The results' section includes all the computations conducted through the utilization of the instruments analysed above and is as follows.

4. Results

4.1 Reliability

The answers of the respondents are categorized per origin (geographical and/or political groupings, as included in Table 3). The country groupings assist the factor extraction process and point towards clusters of commonalities. Within the dataset, Cronbach's alpha is computed, as in Table 3. This indicator is calculated at 96.3% – a very high

value. Therefore, one can ascertain that the data has very high internal consistency and can accurately portray regional specifics, as intended. With a reliable dataset, one can proceed with the exploratory factor analysis component of the methodology.

Table 3 *Reliability statistics and country groupings (source: authors, SPSS™ output).*

Reliability Statistics for country groups		
Cronbach's Alpha	**Cronbach's Alpha Based on Standardized Items**	**N of Items**
.963	.965	17

Country groupings		
No.	**Grouping**	**Notes**
1.	Balkans	As per geographical grouping
2.	Big Four EU	France, Germany, Italy, United Kingdom
3.	DOS	Germany, Austria, Switzerland
4.	East Asia	China, Hong Kong, Japan, South Korea, Taiwan
5.	EU	Austria, Belgium, Bulgaria, Czech Republic, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, Malta, Netherlands, Poland, Portugal, Spain, Sweden, United Kingdom
6.	Mediterranean	As per geographical grouping
7.	Middle East	As per geographical grouping
8.	Oceania	As per geographical grouping
9.	Scandinavia	As per geographical grouping
10.	South America	As per geographical grouping
11.	Western Europe	As per geographical grouping
12.	N11	Indonesia, Iran, Mexico, Nigeria, the Philippines, Turkey, South Korea
13.	ASEAN	Indonesia, Malaysia, the Philippines, Singapore, Thailand
14.	North America	As per geographical grouping
15.	Four Asian Tigers	Hong Kong, Singapore, South Korea, Taiwan
16.	G7	Canada, France, Germany, Italy, Japan, United Kingdom, United States
17.	FRITES	France, Italy, and Spain (España)

4.2 Factor analysis

The results of the Kaiser-Meyer-Olkin measure that assesses the partial correlations among the variables and Bartlett's test of sphericity are included in Table 4. Both tests point towards the fact that the exploratory factor analysis suits the data very well. Sampling adequacy is at 79.8% (a high value) and Bartlett's Test of Sphericity is statistically significant, rejecting the hypothesis that the correlation matrix is an identity matrix. Thus, the factor model use is appropriate for the dataset.

Table 4 *Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett's Test (source: authors, SPSS™ output).*

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.798
Bartlett's Test of Sphericity	Approx. Chi-Square	374.698
	df	136
	Sig.	0.000

Another marker that validates the use of the principal axis factoring model is the communalities' values. One can observe that the communalities of most country groupings are included in very high ranges, with few outliers (Appendix B). While utilizing the Kaiser criterion (selected eigenvalues larger than unity, as in Appendix B), two factors are secured through the exploratory factor analysis. These factors are responsible for over 71% of cumulative variance – a high value. Maybe this is the first solid evidence of the actual validity of the reliability statistics. Out of seventeen markers, only two factors explain over 71% of the variance. Essentially, this is the goal of the exploratory analysis, as it provides a given number of factors with an amounted (and high) percentage that explains the variance among the dataset of items. Through this methodology, one can ascertain that essentially two latent variables govern the covariance of the manifest variables. This is an important result, as it points towards complementarities in the philosophy and culture of maritime clusters between (extremely) diverse countries. This could be evidence of the maritime community

bridging cultural disparities, as well.

The Scree test (Figure 8) graphs the eigenvalues of the factors and involves a visual inspection for the breaking point (elbow) where the data flattens out. As one can observe, after the second factor the data flattens out excessively. Therefore, the Scree test validates the selection of two factors. Through the pattern matrix (Table 5) one can observe the groups of countries that are compiled through each of the factors. The first factor includes North America, Western Europe, the EU, the Mediterranean, Europe's Big Four, Scandinavia, G7, FRITES, the Balkans, DOS, and N11. The second factor includes East Asia, the Middle East, the ASEAN countries, Oceania, South America, and the Four Asian Tigers. Through this factor analysis, one can extract that there are essentially two governing philosophies that provide the latent baseline for the maritime clusters of the world. This result pertains to an analytical replication of a prevalent notion in shipping affairs, insofar that two distinct cultures govern shipping business, the Eastern and Western culture (Talley 2008).

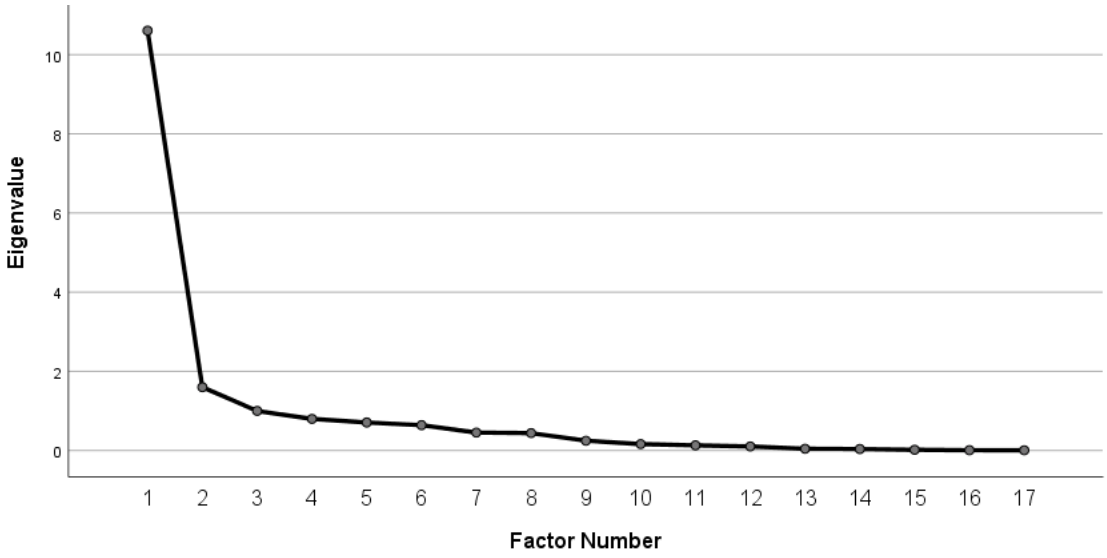

Figure 8 *The Scree test (source: authors, SPSS™ output).*

Table 5 *The pattern matrix (source: authors, SPSS™ output).*

Pattern Matrix[a]	
	Factor

	1	2
North America	1.065	
Western Europe	.999	
EU	.956	
MED	.903	
Big Four EU	.891	
Scandinavia	.881	
G7	.845	
FRITES	.826	
Balkans	.790	
DOS	.786	
N11	.498	
East Asia		.789
Middle East		.767
ASEAN		.700
Oceania		.530
South America		.481
Four Asian Tigers		.365
Extraction Method: Principal Axis Factoring. Rotation Method: Promax with Kaiser Normalization.		
a. Rotation converged in 3 iterations.		

The composition of the two factors is evident through the factor plot in rotated factor space (Figure 9), where the clusters of countries composing the two factors can be portrayed in two-dimensional space. It is interesting to note that there is clearly a factor of Northern American and European origin and another of Asian, Southern American, and Middle Eastern background, but what is more interesting is that the N11 countries although belonging to the first factor (Table 5), when portrayed in the plane seem to adjourn to complementarities among both factors. This could mean that the rapidly growing economies of the world are still crystallizing their cluster culture.

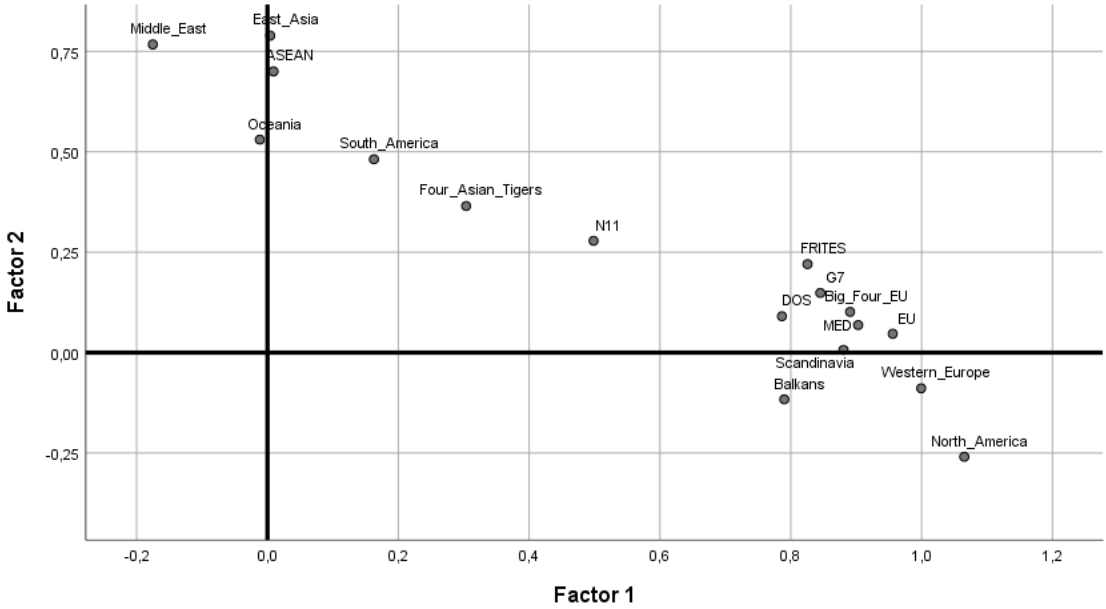

Figure 9 *The factor plot in rotated factor space (source: authors, SPSS™ output).*

4.3 Cluster analysis

To analyse factors extracted, cluster analysis is conducted for both the country groupings governed by the first factor (of mostly western influence, including: Balkans, Big Four EU, DOS, EU, FRITES, G7, MED, N11, North America, Scandinavia, and Western Europe) and those by the second factor (of mostly eastern influence, including: ASEAN, East Asia, Four Asian Tigers, Middle East, Oceania, and South America). This process will assist the interpretation of the results of the exploratory factor analysis, by pointing to the clusters of competitiveness variables that each constellation of country groups deems more important (Figure 10).

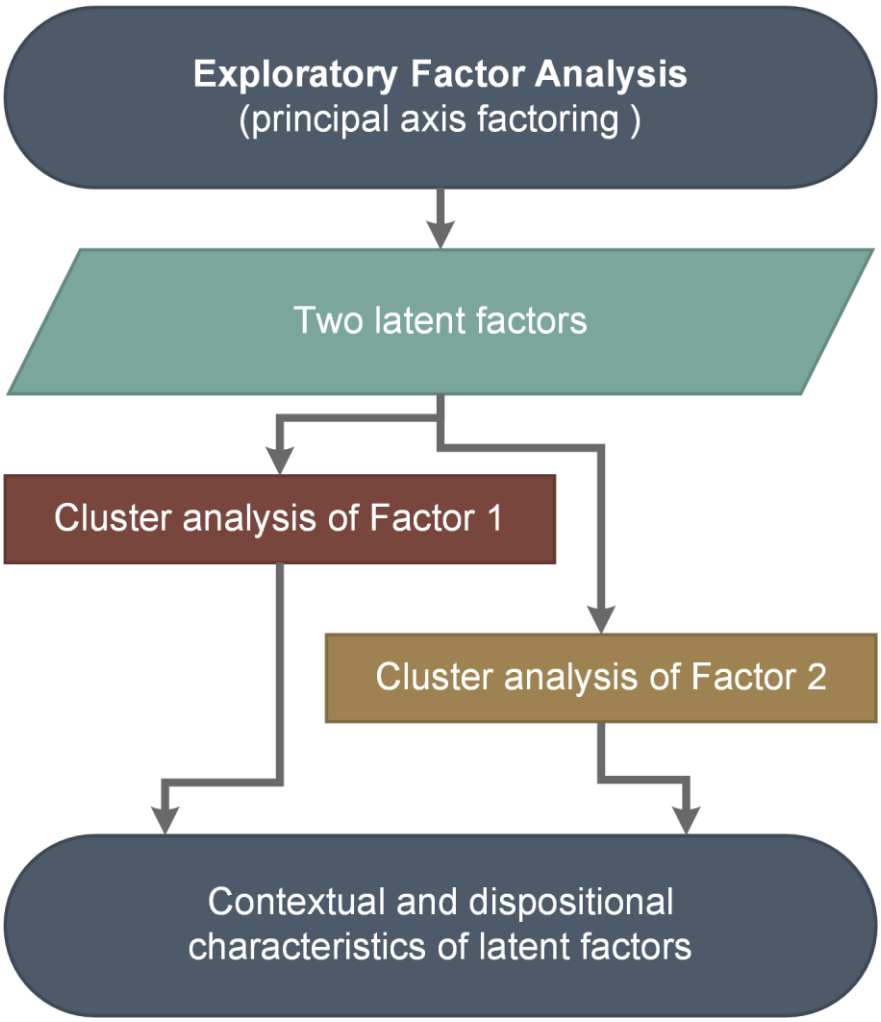

Figure 10 *Cluster analysis upon the two latent factors (source: Authors, MS Visio™ output).*

The results of the cluster analysis portray very different clusters of importance for the two factors. For actor one, the agglomeration schedule and dendrogram (Table 7 and Figure 13 respectively, as in Appendix C) point to the fact that the first cluster of importance includes the markers of corporate culture, the sustainability of maritime resources, governance, the presence of financial institutions, factors inherent in the maritime industry, as pairing with strategic management and technological interconnectivity. At the same time, natural resources and the proximity to other clusters seem to act as outliers (Figure 11).

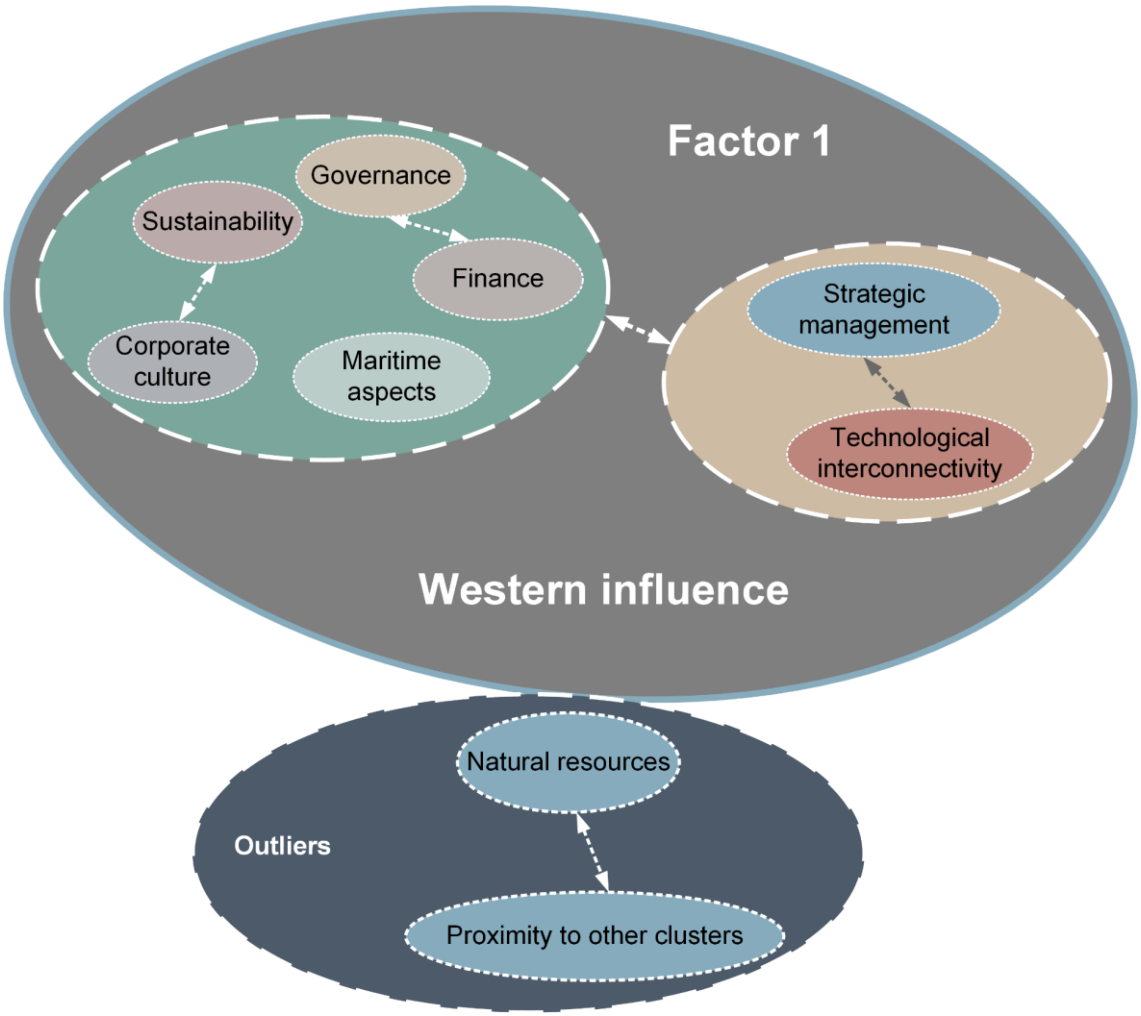

Figure 11 *Cluster analysis of Factor 1, that of western influence (a selection of clusters is shown, for the complete analysis please refer to Appendix C – arrows designate the first items to be joined, source: Authors, MS Visio™ output).*

For the second factor (Table 8 and Figure 14 respectively, as in Appendix C), the results are quite different, as here (with the eastern influence) knowledge spillovers between firms (a Marshallian factor) pair up with trust, where strategic management is joined with knowledge management and innovation to take part in the first clusters formed. Next comes cluster proximity, entrepreneurial culture, and factors inherent in the maritime industry, where the first factor to join cooperation is the presence of financial institutions (an interesting finding nonetheless, as the presence of financial institutions is clustered with cooperation). The first factor to join the sustainability of maritime resources is governance; this fact may point to the requirement that maritime resources should be governed in a sustainable manner.

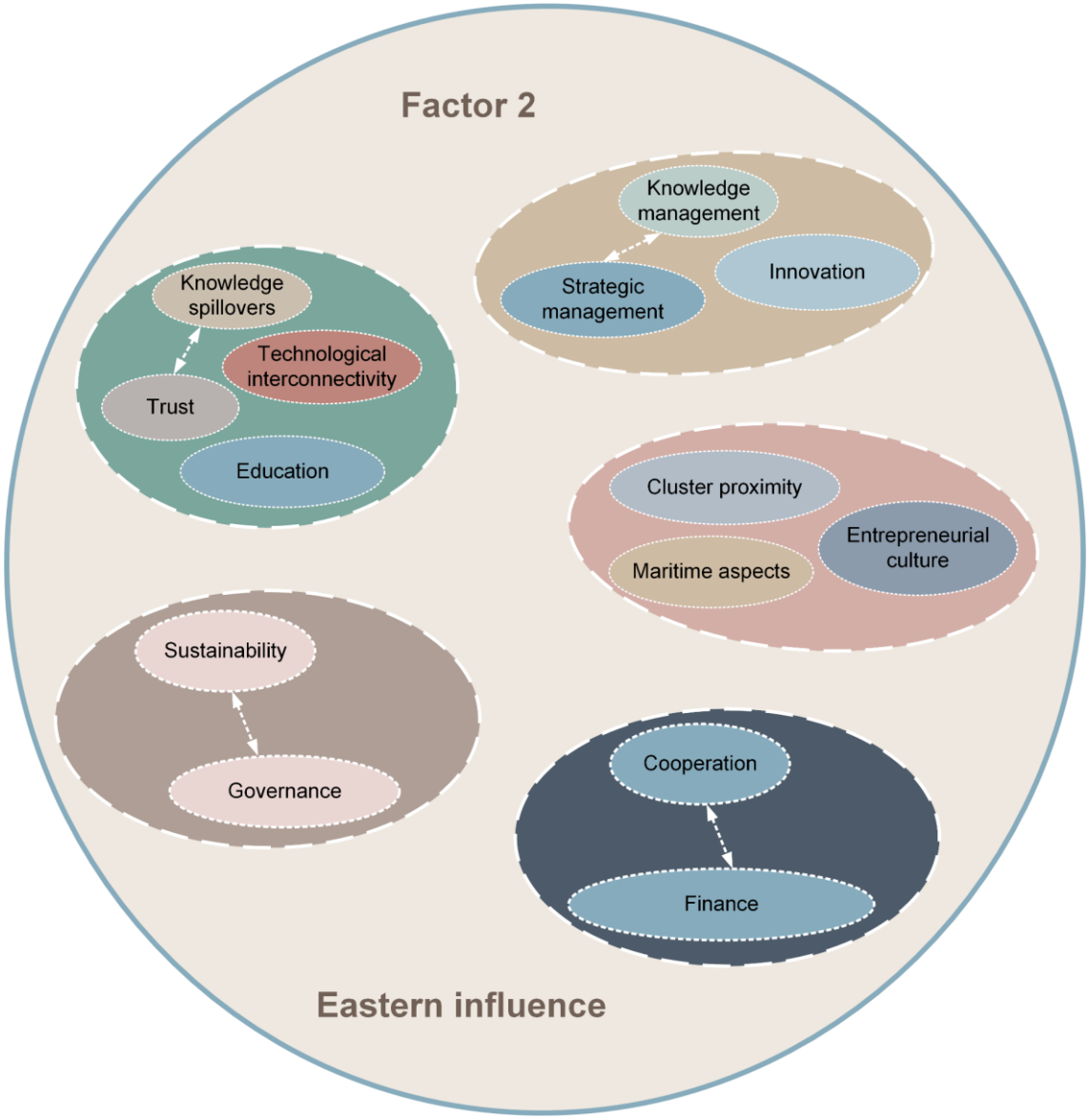

Figure 12 *Cluster analysis of Factor 2, that of eastern influence (a selection of clusters is shown, for the complete analysis please refer to Appendix C – arrows designate the first items to be joined, source: Authors, MS Visio™ output).*

What is evident from the cluster analysis of the factors is that the first factor portrays a more elaborate representation of the factors of importance, where the second factor attains a more comprehensive cluster narrative. Again, this fact replicates the presence of an underlying philosophy in twain, as concerning maritime affairs.

5. Discussion and conclusions

Maritime clusters are important industrial constructs for the regions wherein they reside. Clusters provide the framework whereupon sustainable regional competitive advantages

will bloom. Through the catalyst of knowledge creation and innovation, a network of trust among competitors is created, that enhances the effectiveness of the whole cluster. Although maritime clusters are considered important from a plethora of perspectives, research into their spatial disposition and governing paradigms is sparse. The work herein aims to contribute towards bridging this gap. Factors that are considered important as included in the body of knowledge for maritime clusters are compiled into a Likert-type questionnaire. Experts from academia and practice are asked to rate these items as per their relative importance. The results are then categorized according to their geographical origin and country groupings are produced, that provide the dataset of the present study.

Within the dataset, an array of quantitative methodologies is employed, with two basic objectives. One pertains to the validation of the dataset and the methodological instruments utilized; the other ventures to detect any latent structure within the data. Cronbach's alpha is used as a marker of the internal consistency of the dataset and returns a very high value. Bartlett's test and the Kaiser-Mayer-Olkin measure of sample adequacy are used as indicators of the appropriateness of the exploratory factor analysis and adequacy of the sample, respectively. Again, these produce high values. To extract any latent structure within the data, principal axis factoring (with Promax rotation) is used. The results point to two latent factors governing the data. This result is important, as with a validated and reliable dataset and methodology, there is strong evidence of discrete constructs assembling the paradigms of culture within maritime clusters. Not only this, but it seems that globally, these cultures are shared among very different geographical locations.

The major contribution of this work pertains to the results of the exploratory factor analysis. For the country groupings included, the latent constructs governing

these maritime clusters are made up of two distinct factors. Confirmatory factor analysis, as a future step, can help confirm the rudiments of these results and any succeeding hypothesis as per the distinct disposition of the latent factors. Nevertheless, through cluster analysis of the results, some preliminary directions may be inferred as to the latent structures of the exploratory factor analysis' results. Through this methodology, one can identify the governing forces of the clusters within the different geographical and/or political regions. Industry clusters bear on similarities, yet, each cluster has its own character that manifests through different traits and factors. As location plays such a significant role on cluster formation and sustainability, when analysing clusters even within the same industry, one would expect that (as a leading factor) location will impact distinctions with fallout extending to the cluster's core and attributes, alike. The results of the cluster analysis corroborate this thesis; the disposition of clusters depends on location, and overall, cluster traits can simultaneously share many characteristics.

These insights can help identify the character of a maritime cluster and furthermore, steer firms in clusters towards sustainable competitiveness, derived from effective policy directions. Further analysis upon the governing factors of the culture within a maritime cluster can help firms attend to the growth of these clusters through extended perceptions as per the cluster's characteristics, as well as the ability of identifying inefficiencies internally. Through this approach, this work can pertain to a policy-formulation and benchmarking instrument for maritime cluster practitioners, as a readily available inventory of both competitiveness factors (that firms can include in their strategy formulation) and geospatial directions (based on the factors of the exploratory factor analysis), that can be utilized at the same time. Notwithstanding, the same is true not only for practitioners but for academics as well, as a plethora of

instruments and research directions can be utilized to challenge or verify the results herein. Thereby, another contribution of this work refers to the validity of the instruments utilized. The validation tests confirm that the methodologies selected are appropriate for the data, and by extension, the analysis. This fact may pave the way for more research using these instruments.

This work may have many managerial implications, as benchmarking with unambiguous directions may be pursued. The implications within policy and strategy are apparent as well, as depending on spatial disposition, maritime clusters can draft policies and formulate strategies towards value-creation and sustainable competitive advantages, based on the clustering of the strategic factors produced herein. At the same time, as mentioned, additional exploratory analysis techniques may be utilized to solidify or challenge the conclusions of this work. Studies can compare results from different maritime clusters and even many different types of industry clusters as well, to try to uncover synergies and/or any divergence from this work. One evident future step would be to delve into a level of analysis further and extract the clusters of countries that share symbiotic characteristics as pertaining to the culture of their maritime clusters.

A known fact in maritime affairs pertains to the presence of essentially two distinct cultures in shipping, the Eastern and Western (Talley 2008). Through this study, this fact is replicated, insofar that the culture of shipping transcends into maritime clusters as well. The perceptions of importance as per the competitiveness factors of maritime clusters present themselves with two latent factors, mirroring the distinct cultures of the East and West. These results are important as they not only replicate a notion rooted in shipping affairs for centuries, but furthermore indicate that maritime clusters portray the distinctions of the culture wherein they reside. Future research can

extrapolate this extract with the investigation of the correlation between cluster culture and other distinct aspects of sustainable competitiveness embedded in clusters.

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References

Albaum, G. 1997. “The Likert scale revisited: An alternate version.” International Journal of Market Research 39 (2): 331-348.

Albotoush, R., Tan Shau-Hwai, A. 2019. “Evaluating Integrated Coastal Zone Management efforts in Penang Malaysia.” Ocean and Coastal Management, 181, art. no. 104899.

Allen, I.E., and C.A. Seaman. 2007. “Likert scales and data analyses.” Quality Progress 40 (7): 64-65.

Amdam, R., & Bjarnar, O. 2015. “Globalization and the Development of Industrial Clusters: Comparing Two Norwegian Clusters, 1900–2010.” Business History Review, 89(4), 693-716. doi:10.1017/S0007680515001051.

Ashrafi, M., Walker, T.R., Magnan, G.M., Adams, M., Acciaro, M. 2020. “A review of corporate sustainability drivers in maritime ports: a multi-stakeholder perspective.” Maritime Policy and Management, Article in Press.

Athiyaman, A., Parkan, C. 2008. “A Functionalist Framework for Identifying Business Clusters: Applications in Far North Queensland.” Australian Journal of Management 33 (1): 201-229.

Bishop, P. A., and R. L. Herron. 2015. “Use and Misuse of the Likert Item Responses and Other Ordinal Measures.” International Journal of Exercise Science 8.3: 297–302.

Bjarnar, O. 2009. “Transformation of knowledge flow in globalizing regional clusters. Molde University College.” Working Paper 2010: 2.

Bjarnar, O. 2009. “Transformation of knowledge flow in globalizing regional clusters. Molde University College.” Working Paper 2010: 2.

Bowen, R.E., Riley, C. 2003. “Socio-economic indicators and integrated coastal management.” Ocean and Coastal Management, 46 (3-4), pp. 299-312.

Brett, V., and M. Roe. 2010. “The potential for the clustering of the maritime transport sector in the greater Dublin region.” Maritime Policy and Management 37 (1): 1-16.

Cai, D., Teng, L., Lin, Z., Zhixian, C., Haofeng, D. 2010. “Industrial landscape analysis with high spatial resolution grid in GIS.” 2nd International Conference on Information Science and Engineering, ICISE2010 - Proceedings, art. no. 5689780: 6670-6673.

Chain, C.P., Santos, A.C.D., Castro, L.G.D., Jr., Prado, J.W.D. 2019. "Bibliometric Analysis of the Quantitative Methods Applied to the Measurement of Industrial Clusters." Journal of Economic Surveys 33 (1): 60-84.

Chen, Q., Wang, R., Ma, J. 2015. "Micro-spatial structure of innovation cluster." Tongji Daxue Xuebao/Journal of Tongji University 43 (8): 1273-1278 & 1288.

Clark, C. 1967. "Von Thunen's Isolated State." Oxford Economic Papers 19(3): 370-377.

Costello, A.B., Osborne, J.W. 2005. "Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis." Practical Assessment, Research and Evaluation 10 (7).

Cronbach, L. J. 1951. "Coefficient alpha and the internal structure of tests." Psychometrika 16: 297-334.

Cruz, S.S., Teixeira, A.A.C. 2015. "The neglected heterogeneity of spatial agglomeration and co-location patterns of creative employment: evidence from Portugal." Annals of Regional Science 54 (1): 143-177.

Djoumessi, A., Chen, S.-L., Cahoon, S. 2019. "Factors influencing innovation in maritime clusters: An empirical study from Australia." Marine Policy, Article in press.

Dolnicar, S. 2013. "Asking Good Survey Questions." Journal of Travel Research 52 (5): 551-574.

Doloreux, D. 2017. "What is a maritime cluster?" Marine Policy 83: 215-220.

Doloreux, D., and R. Shearmur. 2009. "Maritime clusters in diverse regional contexts: The case of Canada." Marine Policy 33 (3): 520-527.

Doloreux, D., and Shearmur, R. 2018. "Moving maritime clusters to the next level: Canada's Ocean Supercluster initiative." Marine Policy 98: 33-36.

European Commission, Directorate-General for Research and Innovation Directorate B – European Research Area Unit B.6 – Ethics and gender. 2013. "Ethics for Researchers." Last accessed on June 3rd 2020, available at: http://ec.europa.eu/research/participants/data/ref/fp7/89888/ethics-for-researchers_en.pdf

European Commission, Directorate-General for Research Directorate L — Science, Economy and Society Unit L3 — Governance and Ethics. 2010. "European Textbook on Ethics in Research." Last accessed on June 3rd 2020, available at:

https://ec.europa.eu/research/science-society/document_library/pdf_06/textbook-on-ethics-report_en.pdf

European Commission, Directorate-General for Research Directorate The human factor, mobility and Marie Curie activities Unit D1 – Sector Researchers' careers. 2005. "The European Charter for Researchers." Last accessed on June 3rd 2020, available at: https://www.euraxess.at/sites/default/files/am509774cee_en_e4.pdf

Fabrigar, L.R., MacCallum, R.C., Wegener, D.T., Strahan, E.J. 1999. "Evaluating the use of exploratory factor analysis in psychological research." Psychological Methods 4 (3): 272-299.

Feser, E.J., Sweeney, S.H. 2000. "A test for the coincident economic and spatial clustering of business enterprises." Journal of Geographical Systems 2 (4): 349-373.

Fjørtoft, B.E., Grimstad, S.M.F., Glavee-Geo, R. 2020. "Motivations for CSR in the Norwegian maritime cluster: stakeholder perspectives and policy implications." Maritime Policy and Management, Article in Press.

Fløysand, A., Jakobsen, S.-E., Bjarnar, O. 2012. "The dynamism of clustering: Interweaving material and discursive processes." Geoforum, 43 (5), pp. 948-958.

Fløysand, A., S.-E. Jakobsen, and O. Bjarnar. 2012. "The dynamism of clustering: Interweaving material and discursive processes." Geoforum 43 (5): 948-958.

Fowler, C.S., Kleit, R.G. 2014. "The effects of industrial clusters on the poverty rate." Economic Geography 90 (2): 129-154.

Gage, N. 1979. "A Tiny, Remote Island Spawns Dynasties of Greek Shipowners." Special to The New York Times. Last accessed on June 3rd 2020, available at: https://www.nytimes.com/1979/05/06/archives/a-tiny-remote-island-spawns-dynasties-of-greek-shipowners-tiny.html

Global Centres of Excellence. 2014. "Operations Report 2014." Last accessed on June 3rd 2020, available at: http://www.bluemaritimecluster.no/download?objectPath=upload_images%2FDAFBDC1863C94070A675725DA50D7608.pdf

Goetz, S.J., Rupasingha, A. 2002. "High-tech firm clustering: Implications for rural areas." American Journal of Agricultural Economics 84 (5):1229-1236.

Gorsuch, R.L. 1997. "Exploratory factor analysis: Its role in item analysis." Journal of Personality Assessment 68 (3): 532-560.

Guo, J., Lao, X., Shen, T. 2019. “Location-based method to identify industrial clusters in Beijing-Tianjin-Hebei area in China.” Journal of Urban Planning and Development 145 (2).

Halpern, B.S., McLeod, K.L., Rosenberg, A.A., Crowder, L.B. 2008. “Managing for cumulative impacts in ecosystem-based management through ocean zoning.” Ocean and Coastal Management, 51 (3), pp. 203-211.

Hassink, R. 1997. “What distinguishes ‘good’ from ‘bad’ industrial agglomerations?” Erdkunde 51 (1): 2-11.

Hendrickson, A. E., and White, P. O. 1964. Promax: A quick method for rotation to oblique simple structure. British Journal of Statistical Psychology 17: 65–70.

Hershman, M.J. 1988. “Urban Ports and Harbor Management - Responding to Change along U.S. Waterfronts.” Routledge, NY.

Hilborn, R., Stokes, K., Maguire, J.-J., Smith, T., Botsford, L.W., Mangel, M., Orensanz, J., Parma, A., Rice, J., Bell, J., Cochrane, K.L., Garcia, S., Hall, S.J., Kirkwood, G.P., Sainsbury, K., Stefansson, G., Walters, C. 2004. “When can marine reserves improve fisheries management?” Ocean and Coastal Management, 47 (3-4), pp. 197-205.

Hoque, M.A.-A., Ahmed, N., Pradhan, B., Roy, S. 2019. “Assessment of coastal vulnerability to multi-hazardous events using geospatial techniques along the eastern coast of Bangladesh.” Ocean and Coastal Management, 181, art. no. 104898.

Hutton, T.A. 2006. “Spatiality, built form, and creative industry development in the inner city.” Environment and Planning A 38 (10): 1819-1841.

Jamieson, S. 2004. “Likert scales: how to (ab)use them.” Medical Education 38: 1212–1218.

Kadokawa, K. 2011. “Applicability of Marshall’s agglomeration theory to industrial clustering in the Japanese manufacturing sector: An exploratory factor analysis approach.” Journal of Regional Analysis and Policy, 41 (2): 83-100.

Katsanevakis, S., Stelzenmüller, V., South, A., Sørensen, T.K., Jones, P.J.S., Kerr, S., Badalamenti, F., Anagnostou, C., Breen, P., Chust, G., D'Anna, G., Duijn, M., Filatova, T., Fiorentino, F., Hulsman, H., Johnson, K., Karageorgis, A.P., Kröncke, I., Mirto, S., Pipitone, C., Portelli, S., Qiu, W., Reiss, H., Sakellariou, D., Salomidi, M., van Hoof, L., Vassilopoulou, V., Vega Fernández, T., Vöge, S., Weber, A., Zenetos, A., Hofstede, R.T. 2011. “Ecosystem-based marine

spatial management: Review of concepts, policies, tools, and critical issues." Ocean and Coastal Management, 54 (11), pp. 807-820.

Kavtaradze, M., Revutska, N., Bejanidze, N. 2020. "Perspectives of forming maritime logistic clusters in Georgia." Proceedings - 16th Annual General Assembly and Conference of the International Association of Maritime Universities, IAMU AGA 2015, pp. 143-147.

Kaygalak, I., Reid, N. 2016. "The geographical evolution of manufacturing and industrial policies in Turkey." Applied Geography 70: 37-48.

Khari, A., Siavashan, F. 2012. "Analysis of management factors determining the efficiency of dairy product companies in Golestan province." Agris On-line Papers in Economics and Informatics 2 (3): 1625-1631.

Kies, U., Mrosek, T., Schulte, A. 2009. "Spatial analysis of regional industrial clusters in the German forest sector." International Forestry Review 11 (1): 38-51.

Klepper, S. 2010. "The origin and growth of industry clusters: The making of Silicon Valley and Detroit." Journal of Urban Economics 67 (1): 15-32.

Koliousis, I. G., S. Papadimitriou, E. Riza, P. J. Stavroulakis, and V. Tsioumas. 2019. "Strategic correlations for maritime clusters." Transportation Research Part A: Policy and Practice 120: 43-57.

Koliousis, I. G., S. Papadimitriou, E. Riza, P. J. Stavroulakis, and V. Tsioumas. 2018a. "Scarcity theory and maritime clusters: from paradox to modelling." Marine Policy 93C: 40-46.

Koliousis, I. G., S. Papadimitriou, E. Riza, P. J. Stavroulakis, and V. Tsioumas. 2017. "Strategy, policy, and the formulation of maritime cluster typologies." Marine Policy 86: 31-38.

Koliousis, I.G., S. Papadimitriou, P.J. Stavroulakis, and V. Tsioumas. 2018b. "The management of change within maritime clusters." FME Transactions 46 (3): 360-366.

Kozhikkodan Veettil, B., Quang, N.X. 2019. "Mangrove forests of Cambodia: Recent changes and future threats." Ocean and Coastal Management, 181, art. no. 104895.

Kranjac, M., Sikimić, U., Salom, J., Tomić, S. 2017. "Spatial analysis of the clustering process." 2017 40th International Convention on Information and Communication Technology, Electronics and Microelectronics, MIPRO 2017 - Proceedings, art. no. 7973426: 238-243.

Lagoudis, I., Madentzoglou, E.M., Theotokas, I.N., Yip, T.L. 2019. “Maritime Cluster Attractiveness Index.” Maritime Business Review 4 (2): 169-189.

Lall, S.V., Rodrigo, G. Chris. 2001. “Perspectives on the sources of heterogeneity in Indian industry.” World Development 29 (12): 2127-2143.

Likert, R. 1932. “A Technique for the Measurement of Attitudes.” Archives of Psychology 140 (55).

López, F.A., Páez, A. 2017. “Spatial clustering of high-tech manufacturing and knowledge-intensive service firms in the Greater Toronto Area.” Canadian Geographer 61 (2): 240-252.

Lv, X., Wang, Y., Peng, J., Wu, J. 2008. “Spatial concentration characteristics of urban land use along highways in rapidly urbanized region of Shenzhen.” Dili Xuebao/Acta Geographica Sinica 63 (8): 845-855.

Makkonen, T., T. Inkinen, and J. Saarni. 2013. “Innovation types in the Finnish maritime cluster.” WMU Journal of Maritime Affairs 12 (1): 1-15.

Marinho, B., Coelho, C., Hanson, H., Tussupova, K. 2019. “Coastal management in Portugal: Practices for reflection and learning.” Ocean and Coastal Management, 181, art. no. 104874.

Marshall, A. 1920. Principles of Economics. London: Macmillan and Co.

Martin, R., Sunley, P. 2003. “Deconstructing clusters: Chaotic concept or policy panacea?” Journal of Economic Geography, 3 (1), pp. 5-35.

Miller, M.B. 2003. “The business trip: Maritime networks in the twentieth century.” Business History Review, 77 (1), pp. 1-32.

Monasterio, L.M. 2006. “Wages and industrial clusters in rio grande do sul (Brazil).” Review of Regional Studies 36 (3): 304-323.

Nursyamsi, A., Moeis, A.O., Komarudin. 2018. “Effect of Policy Analysis on Indonesia’s Maritime Cluster Development Using System Dynamics Modeling.” IOP Conference Series: Earth and Environmental Science 127 (1).

Othman, M. R., G. J. Bruce, and S. A. Hamid. 2011. “The strength of Malaysian maritime cluster: The development of maritime policy.” Ocean and Coastal Management 54 (8): 557-568.

Pagano, A., G. Wang, O. Sánchez, R. Ungo, and E. Tapiero. 2016. “The impact of the Panama Canal expansion on Panama’s maritime cluster.” Maritime Policy and Management 43 (2): 164-178.

Pardali, A., Kounoupas, E., Lainos, I. 2016. “Can clusters be bi-polar? Exploring the case of the Piraeus port–maritime cluster.” Maritime Policy & Management, 43:6, 706-719.

Pardali, A., Kounoupas, E., Lainos, I. 2016. “Can clusters be bi-polar? Exploring the case of the Piraeus port–maritime cluster.” Maritime Policy and Management 43 (6): 706-719.

Pinto, H., A. R. Cruz, and C. Combe. 2015. “Cooperation and the emergence of maritime clusters in the Atlantic: Analysis and implications of innovation and human capital for blue growth.” Marine Policy 57: 167-177.

Pinto, H., Uyarra, E., Bleda, M., Nogueira, C., Almeida, H. 2018. “Economic crisis, turbulence and the resilience of innovation: Insights from the Atlantic maritime cluster.” Advances in Spatial Science: 61-80.

Pinto, J. V. 1975. “Background and Development of Location Theory.” PhD diss., The University of Oklahoma.

Pollnac, R.B., Crawford, B.R., Gorospe, M.L.G. 2001. “Discovering factors that influence the success of community-based marine protected areas in the Visayas, Philippines.” Ocean and Coastal Management, 44 (11-12), pp. 683-710.

Pomeroy, R.S. 1995. “Community-based and co-management institutions for sustainable coastal fisheries management in Southeast Asia.” Ocean and Coastal Management, 27 (3), pp. 143-162.

Porter, M. E. 2000. “Location, competition, and economic development: Local clusters in a global economy.” Economic Development Quarterly 14 (1): 15-34.

Porter, M.E. 1990. “The Competitive Advantage of Nations.” The Free Press New York.

Porter, M.E. 1998. “Clusters and the new economics of competition.” Harvard business review 76 (6): 77-90.

Potter, A. and H. D. Watts. 2012. “Revisiting Marshall’s Agglomeration Economies: Technological Relatedness and the Evolution of the Sheffield Metals Cluster.” Regional Studies: 1-21.

Qingmei, L., Hong, Z. 2020. “The effect of maritime cluster on port production efficiency.” Maritime Policy and Management, Article in Press.

Rupo, D., Perano, M., Centorrino, G., Sanchez, A.V. 2018. “A framework based on sustainability, open innovation, and value cocreation paradigms-A case in an Italian maritime cluster.” Sustainability (Switzerland) 10 (3).

Salvador, R. 2015. “Maritime clusters evolution. The (not so) strange case of the Portuguese maritime cluster.” Journal of Maritime Research 11: 53-59.

Samoilys, M.A., Osuka, K., Mussa, J., Rosendo, S., Riddell, M., Diade, M., Mbugua, J., Kawaka, J., Hill, N., Koldewey, H. 2019. “An integrated assessment of coastal fisheries in Mozambique for conservation planning.” Ocean and Coastal Management, 182, art. no. 104924.

Sharma, V.N. Spatio-temporal analysis of industrial clusters - a case of Madhya Pradesh (1993) Transactions - Institute of Indian Geographers, 15 (1), pp. 39-50.

Shi, X., Jiang, H., Li, H., Wang, Y. 2020b. “Upgrading port-originated maritime clusters: Insights from Shanghai's experience.” Transport Policy, 87, pp. 19-32.

Shi, X., Jiang, H., Li, H., Xu, D. 2020a. “Maritime cluster research: Evolutionary classification and future development.” Transportation Research Part A: Policy and Practice, 133, pp. 237-254.

Shin, D.-H., Hassink, R. 2011. “Cluster Life Cycles: The Case of the Shipbuilding Industry Cluster in South Korea.” Regional Studies 45 (10): 1387-1402.

Shinohara, M. 2010. “Maritime cluster of Japan: Implications for the cluster formation policies.” Maritime Policy and Management 37 (4): 377-399.

Sifneos, E. 2013. “Greek family firms in the azov sea region, 1850-1917.” Business History Review, 87 (2), pp. 279-308.

Sjøtun, S.G., Njøs, R. 2019. “Green reorientation of clusters and the role of policy: ‘the normative’ and ‘the neutral’ route.” European Planning Studies, Article in press.

Smith, A. 1776/2007 edition. An Inquiry into the Nature and Causes of the Wealth of Nations. Amsterdam, Lausanne, Melbourne, Milan, New York, Sao Paolo: MetaLibri Digital Library.

Soja, E. 2000. “Postmetropolis: Critical Studies of Cities and Regions.” Blackwell, Oxford.

Stavroulakis, P. J., and S. Papadimitriou. 2016. “The strategic factors shaping competitiveness for maritime clusters.” Research in Transportation Business and Management 19: 34-41.

Stavroulakis, P. J., and S. Papadimitriou. 2017. “Situation analysis forecasting: the case of European maritime clusters.” Maritime Policy and Management 44(6): 779-789.

Stavroulakis, P.J., Papadimitriou, S., Tsioumas, V., Koliousis, I.G., Riza, E., Kontolatou, E.O. 2019. “Strategic competitiveness in maritime clusters.” Case Studies on Transport Policy, Article in press.

Talley, W. 2008. “Maritime Safety, Security and Piracy.” Informa Law, Routledge, ISBN 9781843117674.

Tarighi, R., Sajjadi, S.N., Hamidi, M., Khabiri, M. 2017. “Factors affecting the development of the electronic marketing capacity of professional sports federations.” Annals of Applied Sport Science 5 (2):87-96.

Tuan, L.T. 2013. “What can corporate governance build in shipping companies?” International Journal of Shipping and Transport Logistics, 5 (2), pp. 113-136.

von Thünen, J. H. 1826. Isolated State. New York: Pergamon Press.

Wang, C., Lu, L., Fang, T., Xia, Q. 2012. “Spatial pattern evolution of Shanghai tourist lodging industry during the World Expo construction period.” Dili Xuebao/Acta Geographica Sinica 67 (10): 1423-1437.

Wilde, B., G. Larsson, M. Larsson, and B. Starrin. 1995. “Quality of care from the elderly person’s perspective: Subjective importance and perceived reality.” Aging Clinical and Experimental Research 7 (2): 140-149.

Yoon, H., Srinivasan, S. 2014. “Is open space a magnet for business? A spatial analysis of New York.” International Journal of Sustainable Development and World Ecology 21 (1): pp. 60-76.

Zagkas, V.K., Lyridis, D.V. 2011. “A framework for modelling and benchmarking maritime clusters: An application to the maritime cluster of Piraeus.” Advances in Maritime Logistics and Supply Chain Systems: 131-156.

Zhang, W., and J. S. L. Lam. 2013. “Maritime cluster evolution based on symbiosis theory and Lotka-Volterra model.” Maritime Policy and Management 40 (2): 161-176.

Zhang, W., and J. S. L. Lam. 2017. “An empirical analysis of maritime cluster evolution from the port development perspective - Cases of London and Hong Kong.” Transportation Research Part A: Policy and Practice 105: 219-232.

Zhao, H.-X., Wang, M., Duan, X.-J. 2012. “Spatial optimization of industrial clustering under the constraint of water environmental capacity in Taihu Lake Basin.” Zhongguo Huanjing Kexue/China Environmental Science 32 (8): 1530-1536.

Zhu, C., Xie, H., Zhou, W., Zhang, S. 2013. “Impact of administrative division adjustment on location and accessibility of Heifei, China.” Applied Mechanics and Materials 253-255 (PART 1): 271-277.

Appendix A

The maritime cluster questionnaire can be accessed through the following link:

https://forms.gle/MVzaRknCQkEqX7C48

Appendix B

Table 6 *Communalities and the Kaiser criterion (source: authors, SPSS™ output).*

Communalities		
	Initial	**Extraction**
Balkans	.919	.512
Big Four (EU)	.989	.927
DOS	.920	.724
East Asia	.875	.627
EU	.984	.977
MED	.976	.905
Middle East	.621	.436
Oceania	.603	.273
Scandinavia	.952	.784
South America	.707	.365
Western Europe	.944	.885
N11	.766	.515
ASEAN	.826	.499
North America	.942	.825
Four Asian Tigers	.725	.377
G7	.972	.908
FRITES	.990	.978
Extraction Method: Principal Axis Factoring.		

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	10.607	62.393	62.393	10.383	61.075	61.075	10.120
2	1.600	9.412	71.805	1.133	6.662	67.737	6.988
3	1.000	5.880	77.684				
4	.798	4.696	82.380				
5	.708	4.164	86.544				
6	.640	3.764	90.308				
7	.453	2.663	92.971				
8	.439	2.581	95.552				
9	.247	1.455	97.007				
10	.163	.957	97.964				
11	.130	.765	98.729				
12	.104	.610	99.339				
13	.045	.262	99.600				

14	.037	.215	99.816				
15	.018	.104	99.920				
16	.007	.043	99.963				
17	.006	.037	100.000				
Extraction Method: Principal Axis Factoring.							
a. When factors are correlated sums of squared loadings cannot be added to obtain a total variance.							

Appendix C

Table 7 *The agglomeration schedule for Factor 1 (source: authors, SPSS™ output).*

Factor 1 agglomeration schedule						
Stage	Cluster combined		Coefficients	Stage cluster first appears		Next stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	5	24	.100	0	0	10
2	4	17	.143	0	0	6
3	6	7	.144	0	0	10
4	10	12	.189	0	0	8
5	9	13	.209	0	0	12
6	1	4	.287	0	2	15
7	3	21	.290	0	0	17
8	10	15	.300	4	0	15
9	14	27	.318	0	0	18
10	5	6	.327	1	3	14
11	18	23	.331	0	0	19
12	9	28	.369	5	0	23
13	2	16	.384	0	0	17
14	5	19	.400	10	0	19
15	1	10	.469	6	8	16
16	1	22	.565	15	0	22
17	2	3	.567	13	7	22
18	8	14	.569	0	9	21
19	5	18	.610	14	11	23
20	11	25	.728	0	0	27
21	8	26	.733	18	0	24
22	1	2	.928	16	17	26
23	5	9	.948	19	12	25
24	8	20	1.030	21	0	25
25	5	8	1.862	23	24	26
26	1	5	3.580	22	25	27
27	1	11	8.662	26	20	0

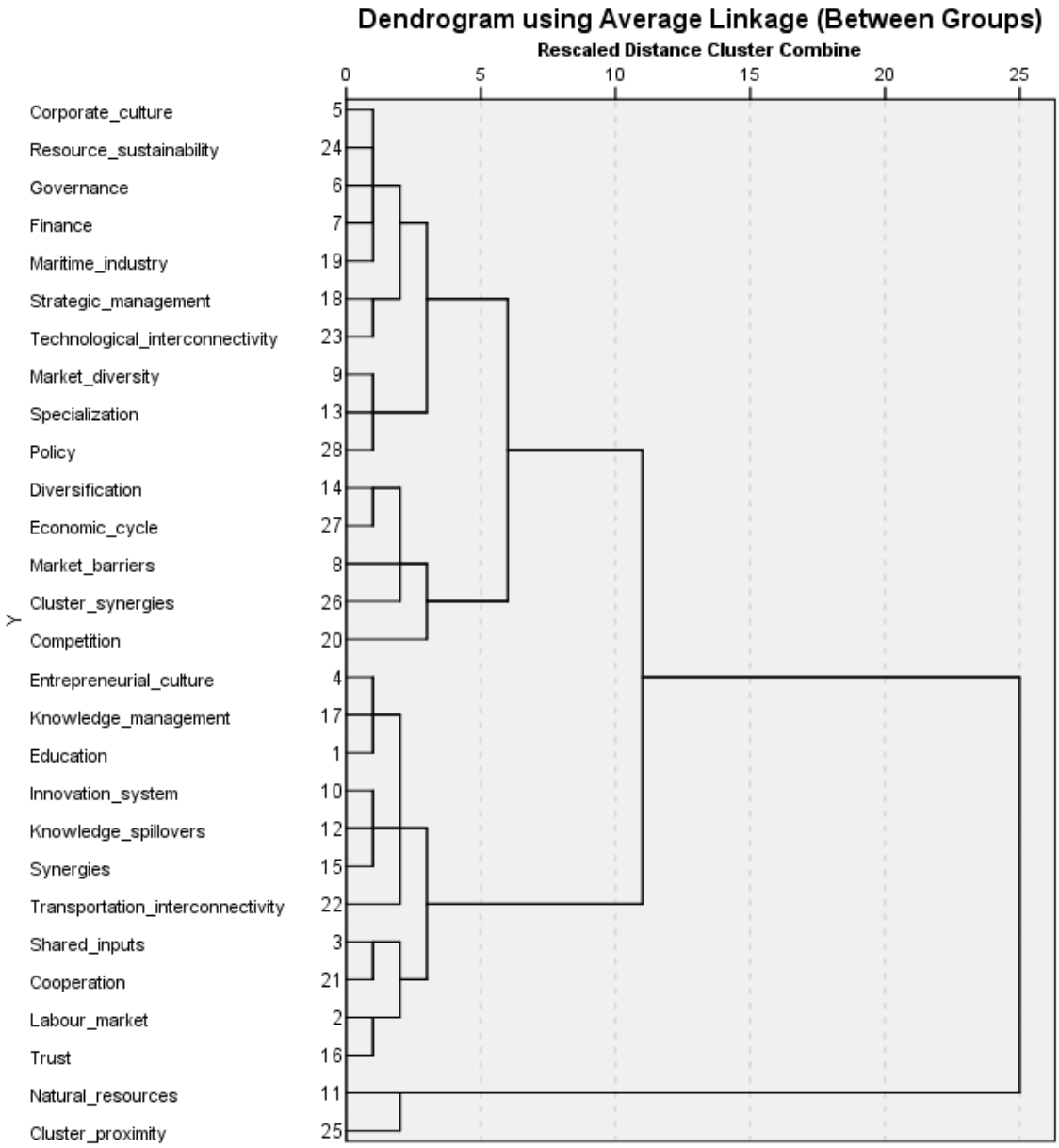

Figure 13 *The dendrogram for Factor 1 (source: authors, SPSS™ output).*

Table 8 *The agglomeration schedule for Factor 2 (source: authors, SPSS™ output).*

Factor 2 agglomeration schedule						
Stage	Cluster combined		Coefficients	Stage cluster first appears		Next stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	12	16	.006	0	0	6
2	17	18	.031	0	0	9
3	14	20	.099	0	0	12
4	6	24	.101	0	0	19
5	3	13	.105	0	0	13
6	12	23	.106	1	0	8
7	19	25	.119	0	0	10
8	1	12	.142	0	6	17

9	10	17	.159	0	2	13
10	4	19	.159	0	7	17
11	7	21	.183	0	0	15
12	9	14	.195	0	3	22
13	3	10	.239	5	9	15
14	11	15	.272	0	0	18
15	3	7	.326	13	11	20
16	2	22	.333	0	0	20
17	1	4	.341	8	10	19
18	11	27	.363	14	0	24
19	1	6	.414	17	4	21
20	2	3	.501	16	15	21
21	1	2	.622	19	20	23
22	8	9	.650	0	12	25
23	1	26	.896	21	0	26
24	5	11	.921	0	18	25
25	5	8	1.062	24	22	26
26	1	5	1.307	23	25	0

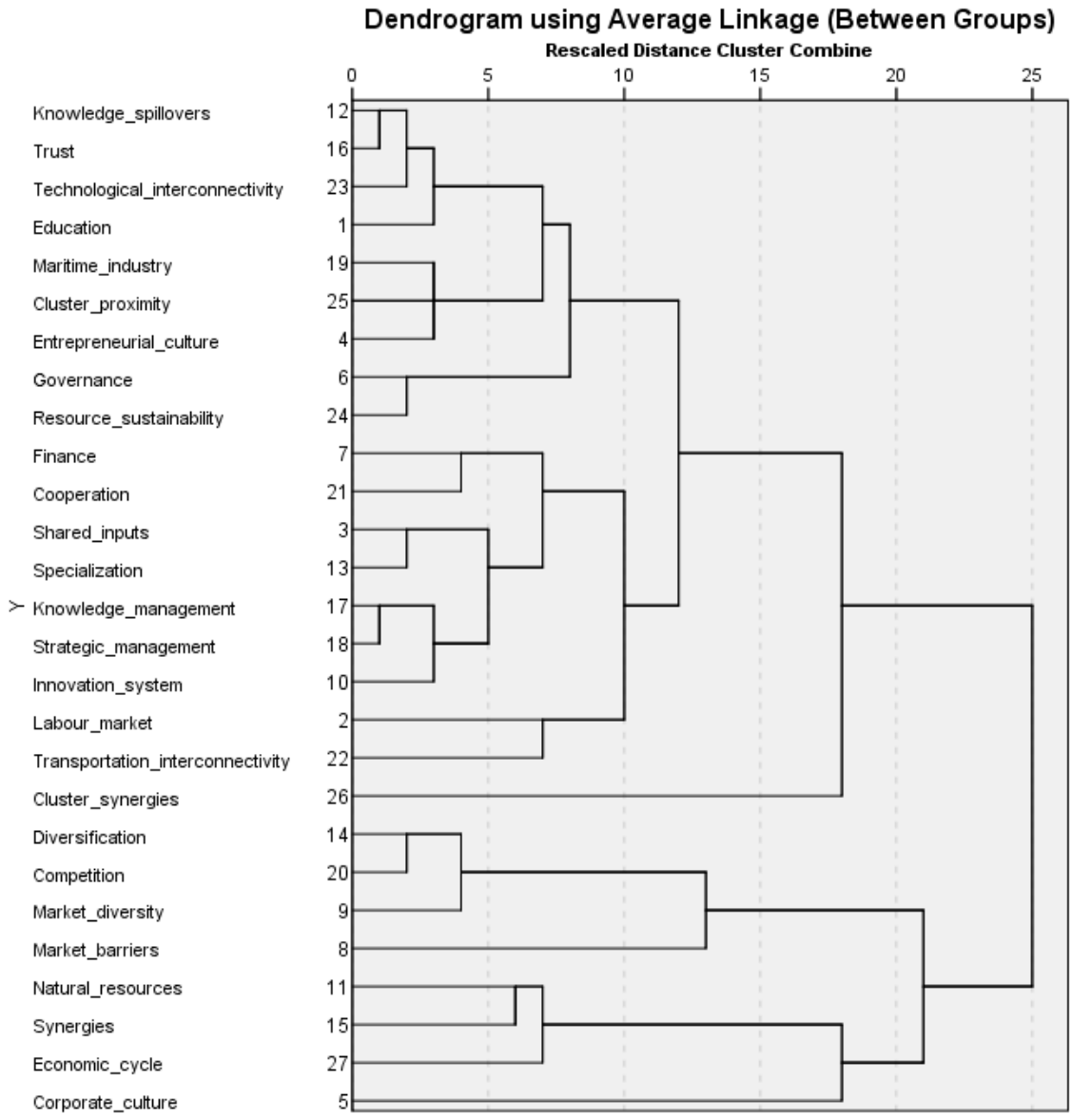

Figure 14 *The dendrogram for Factor 2 (source: authors, SPSS™ output).*