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Original citation & hyperlink:
Stavroulakis, PJ, Papadimitriou, S, Tsioumas, V, Koliousis, I, Riza, E & Kontolatou, EO 2020, 'Strategic competitiveness in maritime clusters', Case Studies on Transport Policy, vol. 8, no. 2, pp. 341-348.
https://dx.doi.org/10.1016/j.cstp.2019.10.008

DOI 10.1016/j.cstp.2019.10.008
ISSN 2213-624X

Publisher: Elsevier

Strategic competitiveness in maritime clusters

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Strategic competitiveness in maritime clusters

For decades, research into the domain of maritime clusters has provided interesting results, for practice and academia alike. The body of knowledge has crystalized into the conclusive importance of these types of clusters for regional and even national competitiveness, rendering lateral implications for strategy and policy. Even though the general premise of the literature is founded, research into distinctive facets of these industrial entities is sparse. The latter includes quantitative analysis of variables that hold a definitive impact for strategic management. The objective of this research is to conduct exploratory data mining among the factors that affect competitiveness within maritime clusters. Through a structured review of the body of knowledge concerning maritime clusters, an inventory of variables is extracted. These variables are sorted, per Likert-type importance and exploratory cluster analysis is conducted. Through this methodology, items with strong correlative factors are grouped and an importance narrative for the competitiveness of maritime clusters is developed. The results of this research can be further utilized for benchmarking purposes within managerial practice, inclusive of the domains of policy and strategy, in addition to providing a building block for future research.

Keywords: strategic management; industrial cluster; cluster analysis; competitiveness; exploratory analysis; Cronbach's alpha.

1 Introduction

Maritime business is fascinating. Some of the most outstanding and obscure excellence stories in business come from shipping. Stories and case studies that are rendered legends. The shipping industry has provided the term ‘wealth creation’ with a radically different understanding and manifestation. For a venture capital portfolio, a solid return can be considered a fifth of its value per annum. In good times, a solid return for shipping is considered as chartering a vessel for a couple of voyages and being able to purchase another vessel after the charter is fulfilled. The matter then is who exactly will predict the ‘good times’ (and from which stance) first; a venture that requires excessive risk, resilience, failure, perseverance, and eccentricity. As profits comprise of a completely different context in

shipping, then so does growth. A stroll in uptown Manhattan, gazing at the architectural marvels of our era, with a bit of research, may reveal that many of these are not in the hands of real estate conglomerates, holding companies, and investment firms; instead, many are owned by shipowners from faraway lands. That is maritime business, at its core; reach. But a reach that is provided within an (almost) level playing field that changes constantly, where its members face extreme difficulty to impose change and shift any odds to their advantage, as the demand governing the flow of wealth, is not of the shipping market, but of other markets.

The fact that shipping is governed by derived demand points to one of the reasons behind its volatility. In an extremely high-risk market, an entrepreneur can forge global competitiveness and business excellence out of (nearly) thin air, simply because she made the right call, simply because she acknowledged a specific opportunity first; and the pay-out can be renowned. For this reason exactly, shipping firms can be considered as 'dinosaurs of classical economics' (Stopford 2009), where on the one hand one can find astonishing wealth creation, but on the other, no monopolies. Maritime business is exceptional, diverse, and peculiar. It should not come as a shock that anything maritime is distinct, admirable, and comprising of a completely different analytical level. Industry clusters, then, in this sense and as they pertain to maritime business, are no exception.

The agglomeration of economic activity has long been an object of study, through many perspectives and facets. It has provided kindling for distinct scientific bodies of knowledge, such as economic geography, spatial economics, and regional science, all the way to regional innovation, competitiveness, and business policy (Porter 1998). Clusters have received acclaim from research, policy, and practice, as they generate local and regional competitive advantages. Pair them with shipping and one has a critical mass of disruptive innovation and volatile competitiveness.

Clusters of industry affect and involve many scientific domains. One of the latter that has been proven to bear importance in the body of knowledge concerning maritime clusters, is strategic management (Koliousis et al. 2019). On the antipode, in the context of industrial cluster theory and especially concerning strategic management, maritime clusters are indicative benchmarks. This can be acknowledged since maritime clusters are very important for the regions wherein they are disposed and because within them, markets of near-perfect competition (due to the distinct characteristics of shipping markets) are witnessed to thrive. It seems that strategy is an important catalyst in the mix of maritime cluster threads. But what about other aspects? The issue does not lie exclusively with the extraction of the factors that carve competitiveness in maritime clusters, but of their relative importance, as well. And what about the effect and relationship of strategy with these? Thereby, one of the domains that has not been researched conclusively yet, is that of the factors that govern maritime clusters' global success and sustainable competitiveness, especially with reference to their intrinsic relationships and their correlation with other important factors for maritime clusters, such as strategy. This is an important subsection of the body of knowledge that concerns maritime clusters, as within, the threads of maritime cluster competitiveness will be extracted. Furthermore, the qualitative and quantitative relationships among these factors must be researched. The work herein provides a quantitative contribution within this domain.

The research question is formulated as per the feasibility of quantitative assessment of the strategic factors that formulate competitiveness in maritime clusters. And exactly here lies the impact of the present work, as through a robust calculatory methodology, it provides a quantitative assessment of the strategic factors within the literature; this, both for their importance, but furthermore, for extracting relationships among them. To tackle the research question a review of the literature has provided the most prevalent competitiveness factors for maritime clusters. To assess the factors, a pool of experts within academia (that have already

delivered a contribution in the body of knowledge) was compiled. The experts provided an assessment of the competitiveness factors for maritime clusters through a questionnaire. The latter required a categorization of the factors per Likert-type importance. The results were then analysed to provide descriptive statistics of the assessment; this has resulted in the classification (per relative importance) of the factors. Furthermore, a cluster analysis of the results has provided 'importance clusters' that can be extremely useful in analysing maritime clusters, as well as an 'importance narrative' for their manifestation.

The paper is organised as follows. This section is followed by a literature review, with the objective to analyse the most relevant literature for the extraction of the factors that formulate competitiveness in maritime clusters. The literature review section is followed by the methodology section, wherein the methodological instruments utilized are described. The results section follows, that presents and discusses the results of the analysis. The paper closes with the conclusion section that provides an overview of the work and discusses its relevance and impact.

2. Literature review

The history of cluster research finds itself tangled within the very foundations of classical economic theory. Adam Smith's (1776) reference of the 'invisible hand' that will guide a 'domestic industry' towards prosperity has been extremely influential. Despite Smith's important influence on the birth of location theory (Pinto, 1975), he is not formally considered to have rendered a contribution towards modern industrial cluster theory. Nevertheless, the resonance is apparent. The amalgamation of regional stakes will give rise to mutualism, in addition to the fact that collective prosperity may be guided through the invisible, the implicit, and the mysterious. Along with the father of modern economics, comes the father of location theory; within von Thünen's (1826) work lies the birth of a

fascinating standard for agglomeration. This model is directly associated with commodities' shelf life, rendering a structure that includes a distribution of perfect competition and ceteris paribus modelling, within a centralized agglomeration of activity and satellite ventures (Pinto 1975). The dominating threads of this distribution are the combination of transportation cost and firm (farm) size; what is considered as the Thünian system. A note should be inserted here, that within his ground-breaking work, von Thünen himself recognizes Adam Smith's influence (Clark 1967).

Bridging location theory with the dimensions that pertain to industrial agglomeration, comes the father of industrial cluster theory and the first of the neoclassical economists, Alfred Marshall. It would be worthy to note that many aspects of his contributions can be traced back to von Thünen, in the same way that von Thünen's can be traced back to Adam Smith. Marshall's (1920) 'economies of agglomeration' (a local pool of skilled labour, local supplier linkages, and local knowledge spillovers; cf. with Potter and Watts 2012) provide a viable (and enduring) framework for the analysis of industrial clusters. Marshall refers to the mysteries of trade within an industrial locality that "…become no mysteries; but are as it were in the air and children learn many of them unconsciously." Though, how an analytical mind such as Marshall's, that gave form to the rationalism of 'supply and demand' dynamics, may give way to such an obscure interpretation, is no mystery at all. It's just how clusters operate; across, theoretically, conceptually, and factually, from the explicit.

Paradox has found its way into contemporary industrial cluster theory and comes in many forms. One would be the 'location paradox' (Porter 2000), entailing the paradoxical importance of a diversity of regions, within a continually globalized economy. Porter's (2000) mention, that "paradoxically, the most enduring competitive advantages in a global economy seem to be local," is of distinct importance, as it encompasses the whole philosophy of contrast within the theory. Industrial clusters offer the propitious niche so that a locality

can remain competitive, within an accentuating global context. This within itself is a paradox, since globalization is the dominating trend for many industries, to the point that, it would seem, regional and fragmented economies with no apparent natural (or other) resources, cannot (or at first sight should not) be able to remain competitive. But they are able do much more, since clusters not only compete, but creatively dominate global industries.

Whether the nomenclature designates a ‘core,’ or a centralised component, one of the major extracts of modern research is the centralisation aspect of clusters (De Langen 2002). This find may have its roots in the work of Christaller (von Böventer 1969), where the foundations of correlating spatial proximity of an industry and centralization, are established. All the modern threads of the theory can be traced back to the conception and rudiments of economics; minus one. Maybe economic theory had to be patient for the constitution of strategic management as a discrete body of scientific thought, so that cluster theory may bloom towards its full might. Indeed, whenever analysing industrial agglomeration, the unifying and common stake is one, that of strategy. This indication has been substantiated in the research body (Koliousis et al. 2019).

Maritime clusters have been documented to be very important for regional and national economies; yet, at the same time, even elementary aspects escape the theory (Doloreux 2017; Koliousis et al. 2018a). Along with the fact that it is considered natural for maritime activities to cluster within a locality (De Langen 2002), maritime clusters provide dynamic cases of industrial clusters, for academia and practice, altogether. This may extend to not only established maritime clusters, but to the regional potential of manifesting a competitive maritime cluster (Brett and Roe 2010). Maritime cluster formulation provides strategic management with a solid base for analysis of regional competitiveness (Chang 2011). The latter is linked to its internal system of innovation and the maritime industry is a major proponent of this instance (Jenssen 2003). Thus, a maritime cluster can be important

for a region, not because it creates competitiveness ex nihilo, but since it may assist towards the germination of mutualism dynamics, that will enforce a greater volatility of the system of innovation. The importance of policy that may act as a catalyst for innovation is prevalent within maritime clusters (Doloreux and Shearmur 2009), as well. Maritime cluster formulation can be influential not only to policy (Yin et al 2018), but also to regional strategy, in its entirety (Doloreux and Shearmur 2018, Pinto et al. 2015).

A basic extract of cluster research favours the approach of collective stakes' reconciliation, as within clusters there is culture, in the sense of shared values and convictions. The culture within a maritime cluster will form a distinct dimension that will affect not only regional competitiveness, but the cluster's sustainability as well (Shinohara 2010). 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 continuous innovation, through traditions whose threads are lost in time, but 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 industry. This culture of mutualism seems to reside at the core of the cluster's competitiveness.

Maritime clusters provide relevant case studies (Pardali et al. 2016) for a wide range of analysis, ranging from the instatement of theories for cluster conceptualization (Fløysand et al. 2012), to models' (Stavroulakis and Papadimitriou 2017; Zhang and Lam 2017; Zhang and Lam 2013) and frameworks' (Koliousis et al. 2018b; Koliousis et al. 2017; Monteiro et al. 2013; Rupo et al 2018; Stavroulakis and Papadimitriou 2016; Zagkas and Lyridis 2011) formulation. Strategic analysis of maritime clusters has also inspired the extraction of synergies among frameworks and models, to produce novel methodologies of assessing

cluster strength (Othman et al. 2011). Maritime clusters may provide the analytical base for investigating industrial clusters' dimensions, such as innovation (Pinto et al. 2018), thereby rendering prevalent innovation typologies (Makkonen et al. 2013). The latter needn't be restricted to a cluster's abstract constitution but can be formulated for distinct maritime clusters (Salvador 2015).

Maritime clusters not only provide the basis for the formulation of novel frameworks and models but can deliver interesting results within accepted modelling techniques (Pagano et al. 2016). Therefore, one may extract that not only are maritime clusters an important construct for regional and national economies, due to the dynamism of the maritime industry, but that they also provide a rather abundant domain for the formulation and assessment of methodologies and instruments, both empirical and theoretical. Though within and among maritime clusters there are many differentiating features, some seem to persist as prevailing. The review of industrial cluster theory, in tandem with the selection of a type of cluster, and an elementary demonstration as to the specifics of geographical concentration, all point to one very fundamental, but absent (in terms of research discourse) matter regarding agglomeration.

This query has not been adequately exhibited, researched, nor modelled (yet) and pertains to the relative importance of the strategic factors that affect competitiveness within a cluster. Though this, by extension, would lead to the identical query with respect to maritime clusters, all the way back to the foundations of industrial cluster theory. The latter relates to the wealth-creation capacity of a collectively prosperous (yet competitive) system, situated within the confines of a geographical region; therein, the analysis of importance with reference to specific factors would provide relevant results and assist the formulation of novel maritime (and other) clusters. The domain of this work is exactly that; the determinants of competitiveness in maritime clusters are extracted from the literature, and are assessed,

analysed, and classified. The methodology section that follows presents the methodological instruments utilized for said assessment.

3. Methodology

To qualitatively analyse and investigate the factors that instigate and sustain competitiveness of maritime clusters, a twenty-one-item questionnaire was developed (its link can be found in Appendix A), based on the European Textbook on Ethics in Research, the 'Ethics for Researchers' handbook, and the European Charter for Researchers. The questionnaire items were created upon the factors that guide competitiveness within maritime clusters, as extracted from the literature (cf. with Stavroulakis and Papadimitriou 2016) and are as follows (Table 1).

Table 1 The competitiveness factors for maritime clusters.

No.	Strategic 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 / policy
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

As is evident from Table 1, the factors range from the Marshallian agglomeration economies (Items 2, 3, and 12) all the way to some of M. Porter's contributions (Items 20 and 21). The objective was to provide an inclusive list of factors from the literature that belong to an extensive array of domains. An item regarding solely the maritime domain was included as well (Item 19). The questionnaire was then drafted within the Google Forms™ platform, based on a five-point Likert-type scale (Albaum 1997; Allen and Seaman 2007; Likert 1932), measuring relative importance (Wilde et al. 1995). The questionnaire is still active (accepting responses) and can be accessed through the link found in Appendix A. In order to evaluate the factors presented, a pool of experts was drawn from the body of knowledge of industry clusters. This pertained to scientists, researchers, and academics that have provided a contribution to the body of knowledge with respect to industry cluster theory. To attain a level of quality within the pool, the experts were drawn from a scientific database that follows a quality assessment procedure (Scopus™).

The questionnaire was sent by email 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 was repeated with another iteration. The

respondents were asked to rate each of the items, as per their importance for a competitive maritime cluster, based on the Likert-type scale included in Table 2. The questionnaire was also inclusive of a distinct (blank) field, should a respondent wish to add a strategic factor in the list. Of course, these factors have not been quantitatively assessed in this study and will involve a future paper, since if the factors' list changed temporally, the results' validity would suffer. For completeness, the factors complementing those in Table 1 that were proposed by the respondents themselves have been included in Appendix B.

Table 2 The Likert-type scale.

Value	Importance
1	Not important/Not applicable
2	Slightly important
3	Moderately important
4	Important
5	Very important

A major issue within the discourse with respect to the Likert scale is whether the variables can be treated as interval data, since they pertain to ordinal data. As the results are based on assessing an extrinsic response (from the respondent), it can be accepted that a viable solution is to request that the respondents themselves consider that the items in the scale refer to interval data (Bishop and Herron 2015; Jamieson 2004). Thus, for the purposes of the survey, the respondents were asked to consider the intervals between the items equidistant, so that the variables can approximate interval data. With this in mind, the respondent could proceed to rate each of the items as per its importance for a competitive maritime cluster. The process of filling in the questionnaire was expected to last about ten to fifteen minutes. Once the responses were received and a pertinent amount of time had passed for any subsequent reminders to be sent, the dataset and the sample of the survey were formulated.

One of the most important factors in statistical treatment is the acquisition of a representative sample. Some techniques may even go as far as intrinsically discrediting their use if a sample is less than fifty. Therefore, for this particular survey, an important parameter referred not only to the quality of the pool of experts, but of the sample size, as well. Out of the database of experts, the respondents and the subsequent sample of the present survey, amounted to one hundred and eighty-four individuals (*N=184*). Thus, the sample of the survey can be considered representative. With a representative sample, one can proceed to statistical treatment. The work herein made use of simple descriptive statistics to rank the competitiveness factors and of cluster analysis to extract importance clusters among the items.

For the classification of the competitiveness factors, two types of weighed means (Bavaresco and Lucena 2012) were calculated. The first weighted mean calculation (W1) considered the generic weights of the items, ranging from 'one' to 'five.' The other regarded weighted averages through five weights ranging from zero to one (Fehring 1987), as per their allocation in the importance scale (Likert-scale point 1 corresponds to a weight of 0, Likert-scale point 2 corresponds to a weight of 0.25, Likert-scale point 3 corresponds to a weight of 0.50, Likert-scale point 5 corresponds to a weight of 0.75, and Likert-scale point 5 corresponds to a weight of 1); these weights are presented in a percentage and denoted as 'W2.' The restrictions of Likert-type scales (Carifio and Perla 2008) when involving a numeric 'importance scale' were scrutinised and as the respondents were asked to consider the distances between the points of the scale equidistant, bias can be considered to have been retained at a minimum. In a subsequent step, the results of the weighted means were ranked. The weighted arithmetic mean was calculated as in Equation (1), where x_i is the value of the variable for each case and w_i the weight for each case.

$$\bar{x} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i} \quad (1)$$

Subsequently, a cluster analysis for the Likert-type scale items was conducted, to extract the relevant clusters within. The methodology used was hierarchical clustering measuring squared Euclidian distance (between-groups linkage). The Euclidian distance between the items is presented in Equation (2). The process begins with all cases thought of as distinct clusters, whilst finding the most similar pair of clusters (by calculating their distance) and joining them. The process continues, until, at the end of the process, the two final clusters are joined. Depending on the measure of dissimilarity selected, a different number of clusters is extracted. With the agglomeration schedule produced, one can investigate which items have the smallest distances and were the first to be merged to a cluster, along with the rest of the sequence. The above analysis can offer a first step for exploratory analytical procedures with respect to the dynamics of factors that affect competitiveness within maritime clusters.

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

The reliability of the data was assessed through the reliability coefficient alpha (Cronbach 1951). The measure (Equation 3) can be considered as the expected correlation of two tests set to measure the same effect, where there are *N* persons taking a test that consists of *k* items (here *N=184* and *k=21*). 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. It is expected, with a high degree of covariance, that the items measure the same concept. In this study, the concept is 'importance of a factor,' therefore, a high Cronbach α hints to the fact that the survey actually

assesses this notion effectively. The presentation and analysis of the results extracted from the methodology described above are included in the following section.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} S_i^2}{S_p^2}\right) \quad (3)$$

4. Results

The raw data consisted of 3,826 observations and 38 missing values, producing a result of 0.98% missing values of the dataset (of 184*21=3,864 observations). For this dataset, Cronbach's α (Equation 3) is calculated at α = 83.9%. Values of Cronbach's α over 80% are considered as more than acceptable (Kline 2000). Therefore, one can gather that the raw data has high internal consistency. The case processing summary and the internal consistency results are included in Table 3.

Table 3 The case processing summary and Cronbach's alpha (source: authors, SPSS™ output).

Case Processing Summary				**Reliability Statistics**	
		N	%	Cronbach's Alpha	N of Items
Cases	Valid	166	90,2	0,839	21
	Excluded[a]	18	9,8	a. Listwise deletion based on all variables in the procedure.	
	Total	184	100,0		

Table 4 Response frequency and weighted means (source: authors, MS Excel™ output).

Factor	**1**	**2**	**3**	**4**	**5**	**W1**	**W2**	**N**
1. Education sector	2	6	30	62	83	4,19	79,78%	183
2. Labour market pooling	1	2	11	63	107	4,48	87,09%	184

3. Local supplier synergies	0	4	22	65	93	4,34	83,56%	184
4. Entrepreneurial culture	0	6	34	78	65	4,10	77,60%	183
5. Corporate culture	0	8	53	85	37	3,83	70,63%	183
6. Governance structure and policy	3	13	46	68	53	3,85	71,17%	183
7. Financial institutions	2	10	41	77	52	3,92	72,94%	182
8. Market entry and exit barriers	9	22	49	67	33	3,52	62,92%	180
9. Breadth and diversity of markets	0	15	60	71	36	3,70	67,58%	182
10. Innovation system	2	3	32	78	67	4,13	78,16%	182
11. Natural resources	16	35	49	48	35	3,28	56,97%	183
12. Knowledge spillovers	2	8	24	79	69	4,13	78,16%	182
13. Specialization	1	5	39	89	47	3,97	74,31%	181
14. Diversification	5	15	66	60	36	3,59	64,70%	182
15. Specialization and diversification	2	6	44	68	63	4,01	75,14%	183
16. Trust	1	5	26	52	99	4,33	83,20%	183
17. Knowledge management	2	6	19	79	77	4,22	80,46%	183
18. Strategic management	2	6	38	67	68	4,07	76,66%	181
19. Factors/maritime industry	2	6	42	79	51	3,95	73,75%	180
20. Competition	4	15	55	79	28	3,62	65,47%	181
21. Cooperation	1	5	16	77	82	4,29	82,32%	181

The results of the weighed arithmetic mean calculated with the two methods (W1 and W2) are provided in Table 4. The frequency of each response is presented in the same Table, along with the number of responses when missing values were excluded (in column ‘N’). The factors are sorted (as per their importance) and their classification is included in Table 5. For comparison purposes, the initial numbering of the factors has been retained.

Table 5 The factors sorted per significance (source: authors, MS Excel™ output).

Order	Factor	W1	W2
1	**2. Labour market pooling**	4,48	87,09%
2	**3. Local supplier synergies**	4,34	83,56%
3	**16. Trust**	4,33	83,20%

4	**21. Cooperation**	4,29	82,32%
5	**17. Knowledge management**	4,22	80,46%
6	**1. Education sector**	4,19	79,78%
7	**10. Innovation system**	4,13	78,16%
8	**12. Knowledge spillovers**	4,13	78,16%
9	**4. Entrepreneurial culture**	4,10	77,60%
10	**18. Strategic management**	4,07	76,66%
11	**15. Specialization and diversification**	4,01	75,14%
12	**13. Specialization**	3,97	74,31%
13	**19. Factors/maritime industry**	3,95	73,75%
14	**7. Financial institutions**	3,92	72,94%
15	**6. Governance structure and policy**	3,85	71,17%
16	**5. Corporate culture**	3,83	70,63%
17	**9. Breadth and diversity of markets**	3,70	67,58%
18	**20. Competition**	3,62	65,47%
19	**14. Diversification**	3,59	64,70%
20	**8. Market entry and exit barriers**	3,52	62,92%
21	**11. Natural resources**	3,28	56,97%

One can gather that Marshall's agglomeration economies still bear an important aspect in the competitiveness of maritime clusters (as assessed by the pool of experts), as all three rank very high (labour market pooling ranks at no. 1, local supplier synergies at no. 2, and knowledge spillovers at no. 8). It could be considered interesting that cooperation and trust rank very high as well (no. 4 and no. 3 respectively), whereas competition ranks at no. 18 (a significant find, as competition and cooperation are considered complementary forces in the theory); natural resources rank last. Therefore, if one was to focus on the most important factors, these would include the Marshallian economies of agglomeration, along with many factors that regard contemporary research, such as trust and cooperation, the innovation system, and strategic management.

For the succeeding cluster analysis, the agglomeration schedule is presented in Table 6. One can point out that the factor of natural resources requires nineteen stages to be joined with another cluster and when it does, this happens since it is the last factor of the inventory. Therefore, its rank in importance through the weighted average calculation and its priority in the exploratory cluster analysis are correlated. It seems that for a competitive maritime cluster, this item is far from important, both from a comparative sense, but also when its importance is associated with other items of the inventory.

Table 6 The agglomeration schedule of the cluster analysis (source: authors, SPSS™ output).

Agglomeration Schedule						
Stage	Cluster Combined		Coefficients	Stage Cluster First Appears		Next Stage
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	10	17	101,000	0	0	3
2	16	21	121,000	0	0	8
3	10	18	122,500	1	0	8
4	2	3	127,000	0	0	11
5	4	5	132,000	0	0	10
6	14	15	137,000	0	0	15
7	12	13	159,000	0	0	11
8	10	16	161,833	3	2	9
9	1	10	178,000	0	8	10
10	1	4	184,500	9	5	13
11	2	12	191,500	4	7	13
12	7	9	193,000	0	0	15
13	1	2	200,813	10	11	14
14	1	19	208,000	13	0	16
15	7	14	219,500	12	6	16
16	1	7	235,269	14	15	17
17	1	6	249,647	16	0	18
18	1	20	263,444	17	0	19
19	1	8	325,368	18	0	20
20	1	11	435,100	19	0	0

For the first cluster to emerge, the innovation system (Item 10) pairs up with knowledge creation & management (Item 17). So, it seems that the two most related items as

per their importance are innovation and knowledge creation (associated concepts nonetheless, so this can be an instance of the quantitative substantiating and solidifying the qualitative). The next factor to join the cluster is strategic management (Item 18), followed by cooperation (Item 21), and trust (Item 16). A rather interesting result, as the exploratory cluster analysis is carving a relational narrative explaining that the most tightly knit factors (always relating to their importance) are innovation, knowledge creation, trust, cooperation, and strategy. This extract almost bears semblance to some contemporary business frameworks on how to attain a sustainable competitive advantage. If a level of dissimilarity is selected so that this first cluster remains as is, the cluster analysis renders a total of thirteen clusters (Figure 1). These thirteen clusters pertain to five clusters that contain at least two factors (numbered in Figure 1), whereas the remaining eight clusters are distinct items.

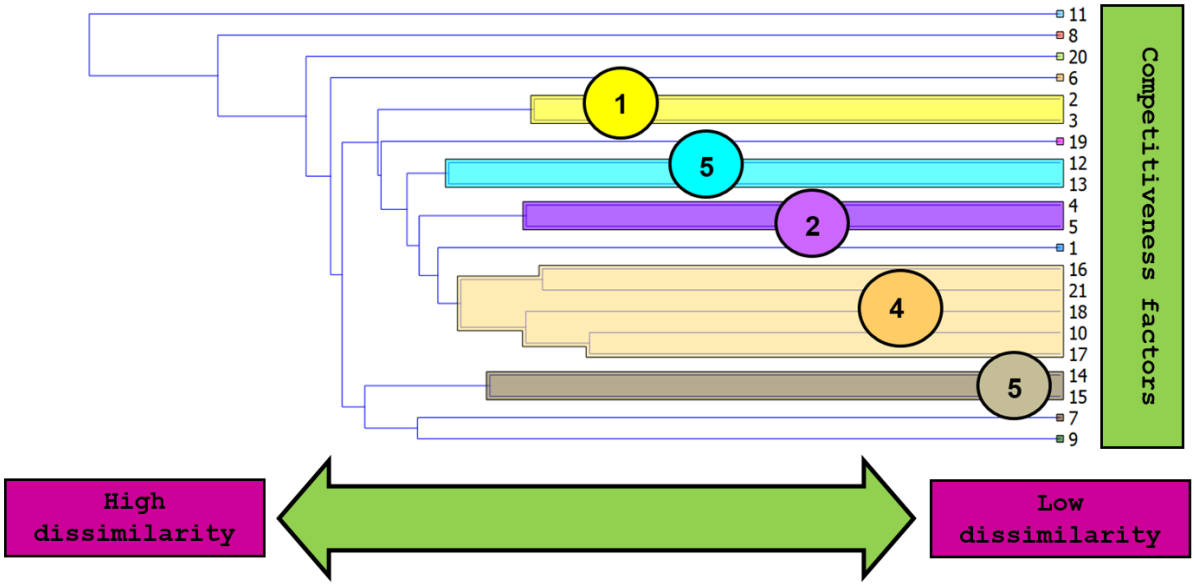

Figure 1 The dendrogram with thirteen clusters (source: authors, Orange™ output).

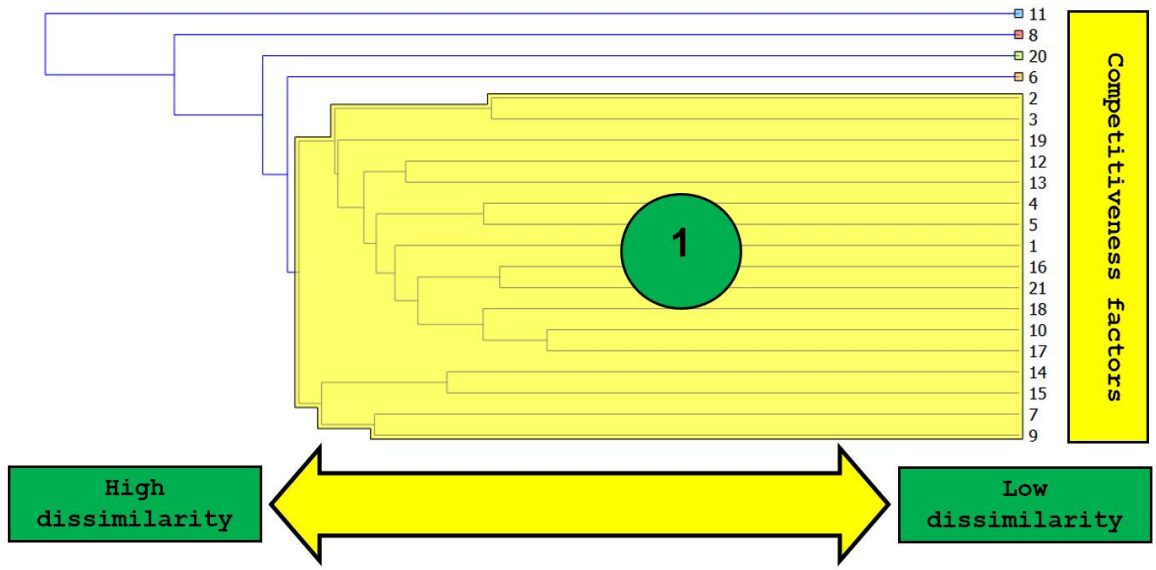

Figure 2 The dendrogram with five clusters (source: authors, Orange™ output).

From the varied selection of dissimilarity, a different number of clusters can be formulated. It is interesting to note that if the clusters selected amount to five, then a cluster with seventeen factors is extracted, where the rest of the factors can be considered as outliers (Figure 2). Outlier analysis within this context could extract valuable information and assist effective strategic management and policy drafting for maritime clusters, as the prioritization of different factors as per their relational importance, is evident. Within the present analysis, the outliers can be considered as the factors of natural resources (Item 11), the market entry and exit barriers (Item 8), competition (Item 20), and the presence of an official governance structure (Item 6); interesting and important finds, nonetheless.

The sequence of strategic factors that are grouped based on proximity, could be used as a prioritization schedule for the maritime cluster formulation process, as in the dendrogram of Figure 3. Therefore, through outlier analysis and the relevant sequencing of the emerging clusters, strategies and policies for cluster formulation can surface.

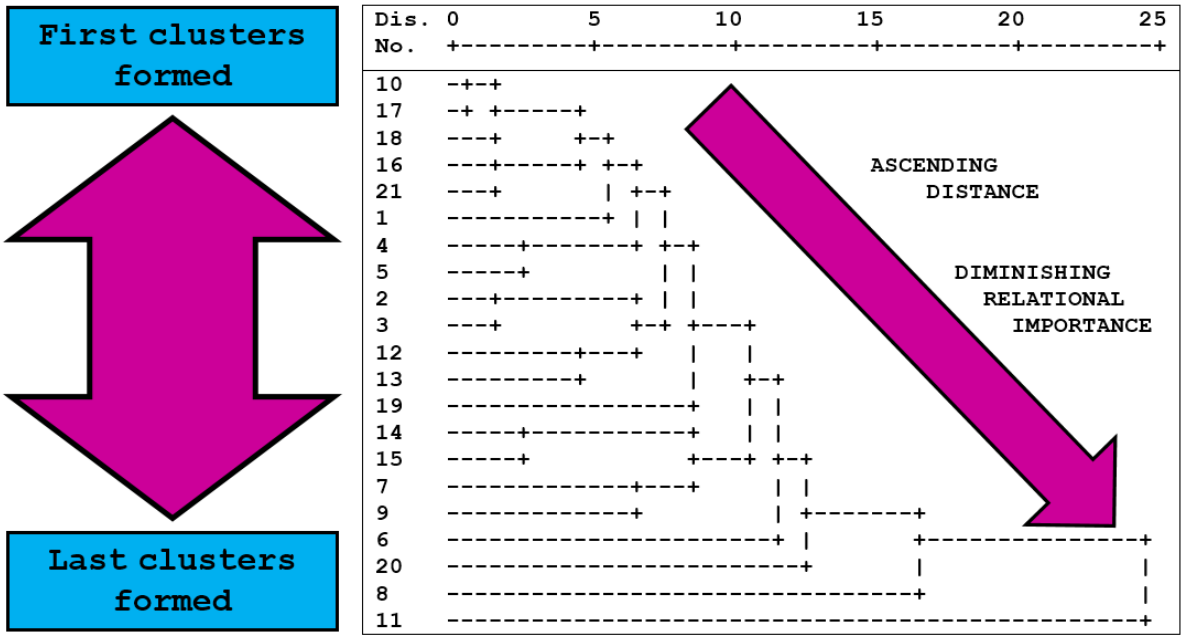

Figure 3 The dendrogram using average linkage between groups (source: authors, SPSS™ output).

Conclusions

Clusters are considered as very important constructs for regional and national economies, as the dynamics within them transcend the constraints of many economic entities. Within clusters, there seems to bloom a constellation of members that compete and cooperate within a culture of collectiveness and mutualism that produces excellence, innovation, and prosperity, for the whole region. From many cluster types identified, there are some that stand out. Among the latter, maritime clusters provide exemplary cases of the cluster concept. The competitive nature of the maritime industry necessitates strategic actions that could help companies cope with extreme competitiveness and strengthen their market position. These firms can take advantage of the coexistence of cooperation and competition within clusters and propel their business forward.

Maritime clusters have come to be considered as beacons of global excellence not only for the sector, but for all clusters of industry. The concentration of shipowners, port

agents, suppliers of marine equipment, port authorities, shipbrokers, logistics providers etc. in the same region can potentially enhance their competitiveness, so long as they operate in a coordinated manner; as one. In addition, maritime clusters are important constructs for research, policy, and practice. As such, it is extremely relevant to produce frameworks and inventories of the strategic factors that are important for the formulation and sustainability of these clusters.

Within the literature concerned with generic industry clusters and maritime clusters, many types of strategic factors that impact competitiveness may be extracted. In addition, relevant inventories for maritime clusters have been formulated. Within this body of knowledge, quantitative analysis of these factors with reference to the maritime domain, is scarce. Through this work, pertinent factors that affect competitiveness for maritime clusters are extracted from the literature and their relative importance is assessed. Through this assessment, a ranking of factors is produced, through the calculation of two different weighted averages. The findings suggest that the most significant factors involve labour market pooling, local supplier synergies, trust, cooperation, knowledge management, and the education sector. As a subsequent step, a cluster analysis of the factors is conducted and grouping of clusters is secured. Cluster analysis can be a beneficial instrument for strategic analysis, as it not only indicates which factors are grouped first, but it also can produce outliers. In addition, the calculation of reliability returned a high value for Cronbach's alpha, hinting to strong internal consistency.

The results of this analysis can be used for subsequent research to enrich the body of knowledge even further, as more methods of cluster analysis may be used to investigate the convergence or the divergence with these results. Notwithstanding, this research can be beneficial for managerial practice as well, as a practical categorization and ranking of the factors is procured that can facilitate strategic management and policy formulation

simultaneously. Essentially, this study complements the existing literature by extrapolating the key drivers of strategic competitiveness in maritime clusters and ranking them based on their perceived importance. The sequence of factor grouping in the cluster analysis can be utilized as a cluster formulation outline based on importance that can contribute in the cluster formulation process, not only for maritime clusters, but for all cluster types. Specifically, the research findings reveal that in regions where there is labour market pooling, synergies among local suppliers, trust, cooperation, knowledge management, and active presence of educational institutions, it is feasible to create highly effective and functional clusters. Therefore, in order to reap the benefits that can potentially be offered by a cluster, communities should devote more resources and effort towards the development of these critical factors.

Within this work, the factors that guide competitiveness for maritime clusters are extracted from the literature and analysed within a quantitative context. This analysis can facilitate the categorization of the factors based on their priority for a competitive maritime cluster to enhance its competitive position. Through the cluster analysis and its agglomeration schedule, the sequence of factors that form competitive clusters, can be used as a standard for cluster initiation. In addition, the methodology can be utilized to assess other types of clusters, thereby providing the competitive differences (if any) among the different types of clusters. Thus, the impact of this research is multidimensional. The methodology can be further benchmarked for future research in the domain of strategic management of maritime clusters, by utilizing more quantitative instruments to analyse and compare the results herein.

Acknowledgments

The authors wish to gratefully acknowledge the contribution of the experts that took part in

the maritime cluster survey and of the anonymous reviewers that provided valuable feedback in the previous versions of this work.

Appendix A

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

https://forms.gle/VQuqa89Bhjwt8hw48

Appendix B

The factors added to the strategic factors list by the respondents are:

1. Interconnectivity of transportation/maritime networks
2. Technological interconnectivity
3. Sustainability of maritime resources
4. Proximity to other clusters
5. Synergies with other clusters
6. Expansion of the economic cycle
7. Global sourcing

References

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

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

Bavaresco, T., and A.F. Lucena. 2012. “Nursing Intervention Classifications (NIC) validated for patients at risk of pressure ulcers [Intervenções da Classificação de Enfermagem NIC validadas para pacientes em risco de úlcera por pressão]” Revista Latino-Americana de Enfermagem 20 (6): 1109-1116.

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.

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.

Carifio, J., and R. Perla. 2008. “Resolving the 50-year debate around using and misusing Likert scales.” Medical Education 42 (12): 1150-1152.

Chang, Y.-C. 2011. “Maritime clusters: What can be learnt from the South West of England.” Ocean and Coastal Management 54 (6): 488-494.

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

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

De Langen, P. W. 2002. “Clustering and performance: The case of maritime clustering in the Netherlands.” Maritime Policy and Management 29 (3): 209-221.

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

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

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

Fehring, R. 1987. “Methods to validate nursing diagnosis.” Heart & Lung: J Acute Critical Care 16 (6): 625-9.

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

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

Jenssen, J. I. 2003. “Innovation, capabilities and competitive advantage in Norwegian shipping.” Maritime Policy and Management 30 (2): 93-106.

Kline, P. 2000. The handbook of psychological testing (2nd ed.). London: Routledge.

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, P.J. Stavroulakis, and V. Tsioumas. 2018b. “The management of change within maritime clusters.” FME Transactions 46 (3): 360-366.

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.

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

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

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

Monteiro, P., T. de Noronha, and P. Neto. 2013. “A differentiation framework for maritime clusters: Comparisons across Europe.” Sustainability (Switzerland) 5(9): 4076-4105.

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 and Management 43 (6): 706-719.

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

Porter, M. E., & Porter, M. P. 1998. “Location, clusters, and the" new" microeconomics of competition”. Business Economics, 7-13.

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

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.

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): art. no. 729.

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

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

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.

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.

Stopford, M. 2009. Maritime Economics. Abingdon, Oxon: Routledge.

von Böventer, E. 1969. “Walter Christaller's Central Places and Peripheral Areas: The Central Place Theory in Retrospect.” Journal of Regional Science 9 (1): 117–124.

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

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.

Yin, J., Fan, L., Li, K.X. 2018. “Second ship registry in flag choice mechanism: The implications for China in promoting a maritime cluster policy.” Transportation Research Part A: Policy and Practice 107: 152-165.

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.