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Department of Maritime Studies

Strategic Management of Maritime Clusters

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PhD Thesis

Submitted in partial fulfilment of the requirements for the degree of

Doctor of Philosophy

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Strategic management of maritime clusters

Industry clusters have sparked interest from academia and practice, for decades. The concentration of innovative activity, value creation, and collaborative dynamics within a region that is coined as a cluster, manifests the opportunity for research from a plethora of perspectives (cf. with Zhang and Lam 2017 and Zhang and Lam 2013 that utilize and develop methodologies for specific case studies). At the same time, maritime clusters have drawn special attention from policy, since the maritime domain can provide sustainable regional, and even national, competitive advantages (this can be drawn from many instances within the literature, with one of the most indicative being Doloreux and Melançon 2006, where the importance of policy with reference to the competitiveness of the region becomes apparent). Maritime clusters are dynamic entities of industry that businesses and nations are adamant to foster. These clusters have provided many benchmarks for research as well, although, one research domain that has not been tapped into extensively, is that of strategic management (Pardali et al. 2017; Salvador 2014). Research has provided intermittent evidence of the importance of strategy within clusters, although the body of research is far from developed (as is evident in Doloreux 2017). The objective of this work is to provide the foundation of the body of strategic management for maritime clusters. The latter has materialized through three latent directions that formulate the sections of this thesis. The first is the contribution within the theory of maritime clusters (inclusive of the implications of strategic management); the second pertains to strategic analysis of maritime clusters, and the third includes the formulation of instruments for strategic management of maritime clusters. The contribution of this research involves the baseline of the domain of strategic management within maritime clusters that includes the proof of its importance for the body of research, as well as the formulation of instruments that can benefit both academia and practice.

Keywords: industry cluster; shipping; competitiveness; regional economics; economic geography; location theory.

Notes

The subsections included herein pertain to contributions that include conference papers, journal publications, a book chapter, and an essay. All these formulate the collective contribution towards answering the three major research questions of this work. At the same time, as distinct publications, each is standalone. Thereby, even though all publications refer to distinct contributions towards the research question of each section, one may observe some similarities in different sections, as there is no way to attain the standalone nature of the publications without the trade-off of some repetitions, especially in sections such as the literature reviews.

"Theses and dissertations which contain embedded Published Journal Articles (PJAs) as part of the formal submission can be posted publicly by the awarding institution with Digital Object Identifier (DOI) links back to the formal publications" (Source: Elsevier). The DOIs of all the PJAs embedded within have been included in the list of publications. Based on the internal regulation of the Department of Maritime Studies, before a Thesis can be approved, the PhD Candidate must have published at least two papers in scientific journals indexed in Scopus. This requirement has been met with the papers published in scientific journals indexed in Scopus with the author list of only my Advisor and myself.

In all papers the corresponding author is myself and my Advisor's role is that of supervisor. In some papers the author list is alphabetical. For all articles my contribution pertains to conception and design, methodology, acquisition of data, data analysis, data interpretation, data validation, and data visualization, drafting the articles and revising them critically, and final approval of the version(s) to be submitted and any revised version(s). Coauthors contributed in conception and design, article revision(s') planning and supervision, and final approval of the version(s) to be submitted and any revised version(s). Published articles stemming from my PhD work have been enriched, albeit in the review of literature, methodology, data analysis, and/or data visualization (where applicable).

Peter J. Stavroulakis
Athens, September 2019.

Thesis framework

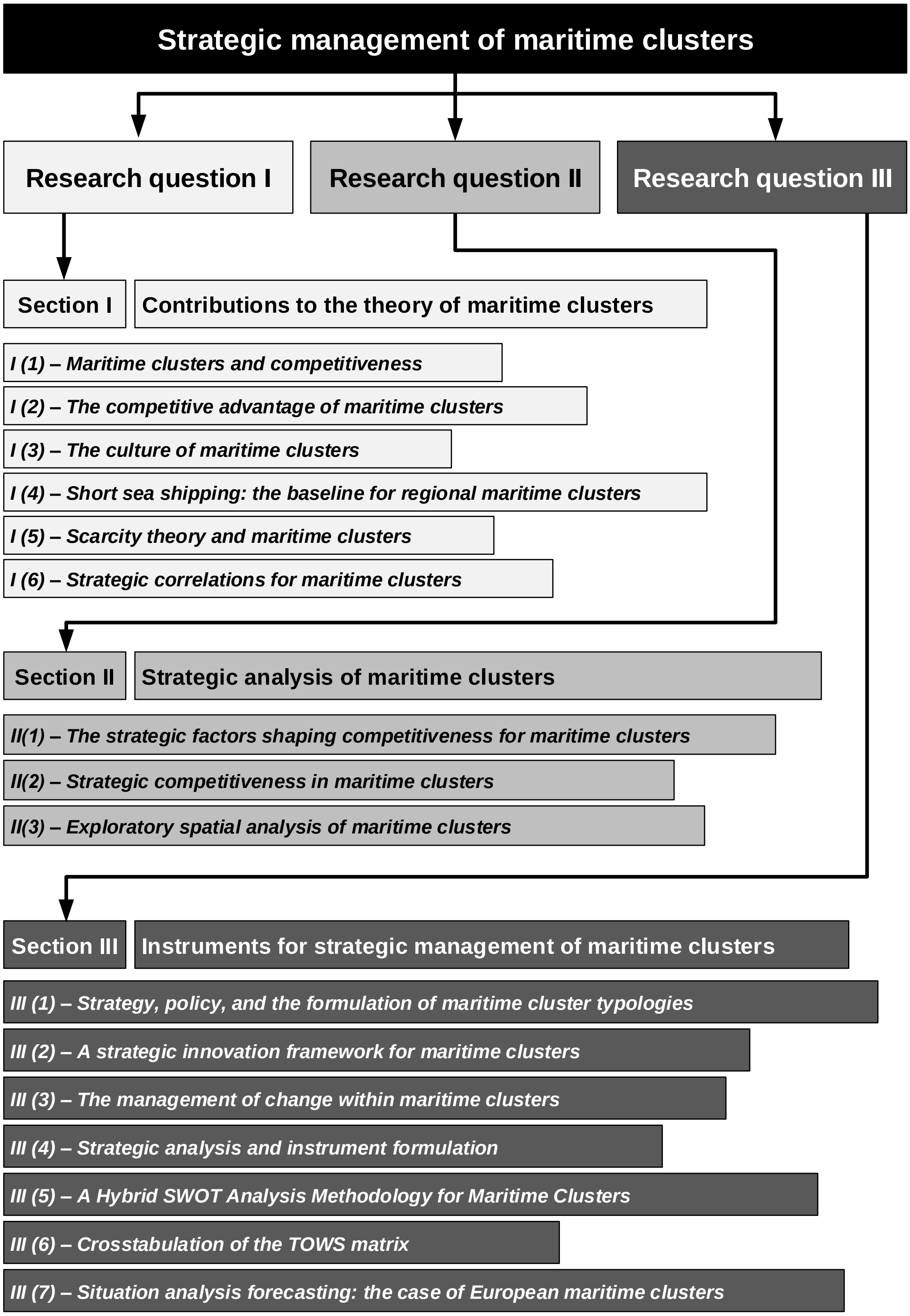


Table of Contents

List of publications

Journals

i. Stavroulakis, P. J., S. Papadimitriou, V. Tsioumas, I. G. Koliousis, and E. Riza. (2019). "Exploratory spatial analysis of maritime clusters." *Under review*.

ii. Stavroulakis, P. J., S. Papadimitriou, V. Tsioumas, I. G. Koliousis, E. Riza, and E. Kontolatou. (2019). "Strategic competitiveness in maritime clusters." *Case Studies on Transport Policy*, Article in Press. DOI: https://doi.org/10.1016/j.cstp.2019.10.008

iii. Koliousis, I. G., S. Papadimitriou, E. Riza, P. J. Stavroulakis, and V. Tsioumas. (2019). "Strategic correlations for maritime clusters." *Transportation Research Part A* 120C: 43-57. DOI: https://doi.org/10.1016/j.tra.2018.12.012

iv. Koliousis, I. G., S. Papadimitriou, P. J. Stavroulakis, and V. Tsioumas. (2018). "The Management of Change within Maritime Clusters." *FME Transactions*, 46(3): 360-366. DOI: https://scindeks.ceon.rs/article.aspx?artid=1451-20921803360K

v. Koliousis, I. G., S. Papadimitriou, E. Riza, P. J. Stavroulakis, and V. Tsioumas. (2018). "Scarcity theory and maritime clusters: From paradox to modelling." *Marine Policy*, 93: 40-46. DOI: https://doi.org/10.1016/j.marpol.2018.03.029

vi. 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. DOI: https://doi.org/10.1016/j.marpol.2017.09.010

vii. Stavroulakis, P. J. and S. Papadimitriou. (2017). "Situation analysis forecasting: the case of European maritime clusters." *Maritime Policy and Management*, 44 (06): 779-789. DOI: https://doi.org/10.1080/03088839.2017.1330560

viii. Stavroulakis, P. J. and S. Papadimitriou. (2016). "The strategic factors shaping competitiveness for maritime clusters." *Research in Transportation Business and Management* 19: 34-41. DOI: https://doi.org/10.1016/j.rtbm.2016.03.004

Conferences

i. Papadimitriou, S., V. Tsioumas, P. J. Stavroulakis, and I. G. Koliousis. (2019). "A strategic innovation framework for maritime clusters." *MHCL 2019 Conference*, Bar, Montenegro.

ii. Koliousis, I. G., S. Papadimitriou, E. Riza, P. J. Stavroulakis, and V. Tsioumas, V. (2018). "Strategic competitiveness in maritime clusters: exploratory analysis." *SIGA2 Conference*, Antwerp, Belgium.

iii. Koliousis, I. G., S. Papadimitriou, P. J. Stavroulakis, and V. Tsioumas. (2017). "Strategic change management and maritime clusters: a sequential approach." *MHCL 2017 Conference*, Belgrade, Serbia.

iv. Koliousis, I. G., S. Papadimitriou, P. J. Stavroulakis, and V. Tsioumas. (2017). "The Culture of Maritime Clusters as a Paradigm for Competitiveness and Sustainability within Global Supply Chains." *ICTR 2017 Conference*, Thessaloniki, Greece.

v. Stavroulakis, P. J., S. Papadimitriou, and Y. Koliousis. (2017). "The Law of Conservation of Energy Towards Defining Maritime Cluster Dynamics." *International Conference on Maritime Energy Management*, Malmö, Sweden.

vi. Stavroulakis, P. J., S. Papadimitriou, and E. Riza. (2016). "Cross-Tabulation of the Tows Matrix: A Novel Dimension for Assessing the Competitiveness of Maritime Clusters." *ICTTE 2016 Conference*, Belgrade, Serbia.

vii. Stavroulakis, P. J. and S. Papadimitriou. (2015). "A Hybrid SWOT Analysis Methodology for Maritime Clusters." *IAME 2015 Conference*, KL, Malaysia.

viii. Stavroulakis, P. J. and S. Papadimitriou. (2015). "The Strategic Factors Shaping Competitiveness for Maritime Clusters: An Overview." *SIGA2 Conference*, Antwerp, Belgium.

ix. Stavroulakis, P. J., S. Papadimitriou, and Y. Koliousis. (2015). "The Competitive Advantage of Maritime Clusters." *SNAME 2015 Conference*, Athens, Greece.

Book Chapter

Papadimitriou S., D. V. Lyridis, I. G. Koliousis, V. Tsioumas, E. Sdoukopoulos, and P. J. Stavroulakis. (2018). "The Dynamics of Short Sea Shipping / New

Practices and Trends." *Palgrave Studies in Maritime Economics.* DOI: https://doi.org/10.1007/978-3-319-98044-7_3

Essay

Papadimitriou, S., I. G. Koliousis, and P. J. Stavroulakis. (2016). "Analytical Competitiveness in Maritime Clusters." *University of Piraeus*.

List of equations

List of figures

List of tables

Acknowledgments

Five years ago, I had stopped thinking about going after a terminal degree and was content in the professional domain wherein I was active. But things changed. In an office in the University of Piraeus, the term ‘maritime cluster’ was communicated to me as an interesting domain with research potential. From that moment on, my life started shifting little by little, as I was more and more entrenched and mesmerised by this field. Combining shipping and maritime affairs with industrial clusters is indeed interesting and researching these within a strategic management perspective is what makes the work irresistible. As with any new researcher, it was and is a challenge to contribute in a domain where there is no baseline, but at the same time this instance provided the opportunity of a greater leeway of scope. Ideas came and went, optimism and enthusiasm were (more often than not) crushed with each rejection letter from an editor, only to chisel one’s determination in becoming better and realizing that science means not no stones left unturned, but a constant thirst of turning stones, many times just to realize that many more have to be turned.

All this to arrive to today, a milestone in any aspiring researcher’s path, the Thesis. And this milestone surrounded by a life that I would not change one bit, all aspects of which came to be realized because one person in my life first uttered the term ‘maritime cluster.’ So how do you thank a person for your life? Obviously, you can’t; but what you can do is at least attempt to foster and communicate their values, academic culture, professionalism, and ethics. My Advisor; there are no words to express my gratitude. I was as lucky as a person can be to have met him, to have been inspired to have courage and determination in all things by him, and to have been so many times steered to the right path, through his direction. The term was first uttered to my ears by Professor Papadimitriou, in his office, and this work cannot but be regarded as his child.

I am very grateful to my Advisory Committee members, Professor Lyridis and Professor Pantouvakis, for the direction, support, and advice they provided throughout the course of my research. I must also express my gratitude to my brothers in arms, Ioannis Koliousis and Vangelis Tsioumas, for their help, vigilance, trust, and demeanour that will always serve as a beacon for all my academic affairs. Elena Riza laid much of the groundwork for the development of the instruments formulated and furthermore for my drive to pursue clarity and scientific rigor through the vision of health. Without her, there would be riddance of focus, as she sparked all interest to have no barriers in thought, insofar that the only restriction and simultaneous objective is that of health.

The important contribution of the experts that took part in the surveys conducted must be acknowledged as well, in addition to the productive and insightful comments of all the anonymous reviewers of the previous versions of this work, that were so successful in broadening my horizons, making me more decisive, and assisting in the attainment of a higher level of scientific robustness for my work. I also wish to express my gratitude to the editors of ‘Research in Transportation Business and Management,’ ‘Maritime Policy and Management,’ ‘Marine Policy,’ ‘Transportation Research Part A: Policy and Practice,’ ‘FME Transactions,’ and ‘Case Studies in Transport Policy.’ Without these journals this work would not be possible, at least in the level of quality attained. The University of Piraeus should be acknowledged as well, for providing a support framework for research that includes database access and participation in international conferences.

My family is owed a debt of gratefulness for the enduring tangible and intangible support, without which I could not have handled the capacity to focus on this research.

Section I
Contributions to the theory of maritime clusters

Maritime clusters have for decades been considered very important for academia and practice, yet their research body is still developing. Thus, a relevant research opportunity arises, with an extended scope of research topics that pertain to the theory itself. This section contains contributions to the theory of maritime clusters, as attempting to encircle the correlation of this with strategic management, to tackle the first research question: is strategic management important for the domain of maritime clusters? Thereby, included in this section are contributions that establish the importance for strategic management in maritime clusters, through theoretical and analytical methods. These contributions, that make up the subsections of Section I, are as follows.

(1) **Maritime clusters and competitiveness**

Analyses the basic elements of the theory in the outset of generic industry clusters and maritime clusters. It also examines the common ground of clusters and strategic management.

(2) **The competitive advantage of maritime clusters**

Delves into maritime cluster research to uncover the competitive advantage of clusters and returns the notions of a holistic and collective culture in clusters, along with paradox.

(3) **The culture of maritime clusters**

Attempts a reconciliation of cluster attributes in a framework of shared values within a regional perspective.

(4) **Short sea shipping: the baseline for regional maritime clusters**

Uncovers the complementarities of clusters and an important regional shipping aspect, short sea shipping, within a strategic planning perspective.

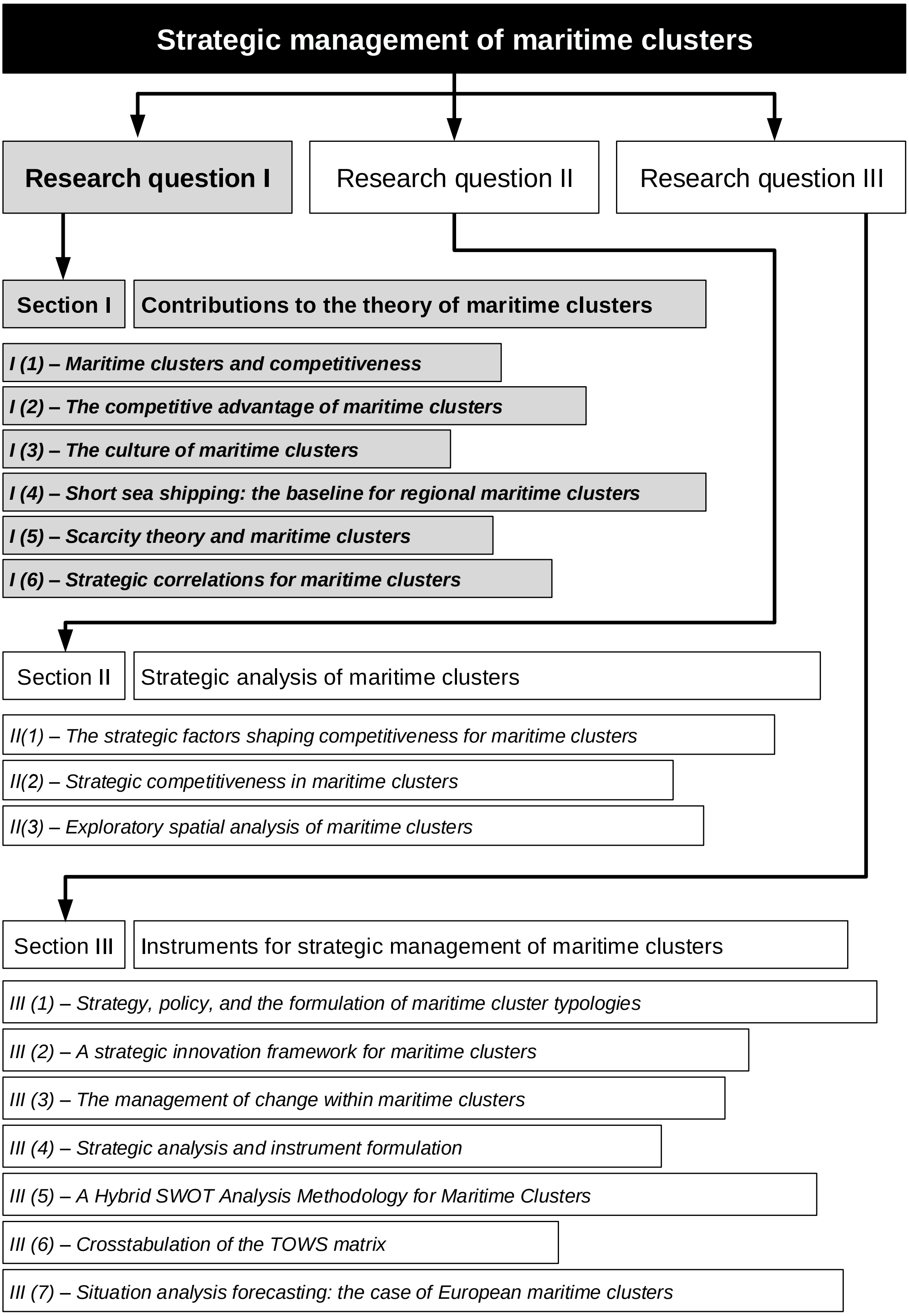
(5) **Scarcity theory and maritime clusters**

Provides a rudimentary model to explain the scarcity paradox within maritime clusters.

(6) **Strategic correlations for maritime clusters**

Delivers strong evidence of the correlation of strategic management and academic impact for the research of maritime clusters.

Thesis framework (Section I)



I (1) – Maritime clusters and competitiveness

> Industrial clusters have been found to be very interesting cases for economic geography and many other disciplines, majorly because clusters are very radical and peculiar entities. They have earned their status since they are the practical manifestation of spatial agglomeration with simultaneous collective prosperity, an aspect that may be seen to violate the scarcity principle. For this reason, clusters have been the object of admiration for many decades of scientific analysis and thought. The fact that within clusters, competitiveness manifests itself as an aspect of mutualism, pertains to the interest clusters provide for strategic management, for if we can discern the strategic threads of proximate symbiosis, there is no vision that may remain untrodden. Therefore, the study of industrial clusters within a strategic management perspective aspires to unveil the determinants of sustainable competitiveness that are pursued with such fervour in our world. Industrial clusters provide the system wherein differentiated values are sanctioned and collective survival is a given. Maritime clusters have been considered as a pillar of regional and national competitiveness; the reason why governing and regulatory bodies are so keen to recreate and stimulate their generation. Since there exists a haven wherein competition does not imply zero-sum eventualities, but reciprocal and harmonious dynamics, strategic management has extracted an ally that holds the potential to provide a very volatile realm for research. This work pertains to analyzing and crystalizing the importance of strategic management within maritime clusters that will facilitate the portrayal and assessment of analytical competitiveness within these entities of industry.

Introduction

Spatial concentration of industries has captured the interest of many scientific disciplines for decades. The derivation of this interest and subsequent analysis is the formulation of a discrete body of knowledge that pertains to the threads, dynamics, and synergies within economies of agglomeration, though not to the point that these may be considered a case absent of mystery, wherein all governing components are known and understood. One reason behind this fact is that industrial clusters are riddled with paradox, from their development to their decline, and from their theoretical principles, to their habitual practicalities. This fundamental paradox that resides within any and every cluster is explained due to the reason that clusters are nothing if not ‘natural’ entities. This is to say, that a cluster cannot be artificial or completely manufactured, for thence it will belay paradox, leading to an eventual non-cluster. This ‘natural’ constituent of clusters leads to the essential genealogy of all clusters, for whence studying any kind of cluster its governing parameters are always the same. We will consistently observe competition befriending cooperation, sustainable wealth creation for all, and the illusion of scarcity through constant innovation. We may arrive at the conclusion that it cannot come as with astonishment that paradoxical elements reside harmoniously within clusters; thence the reason they are notorious surfaces, for clusters reconcile and promise equilibrium through challenging inefficiency. When there is scarcity, a cluster will promise resilience through continuous innovation. The question remains as is created; how is a cluster of any kind, albeit of insects, firms, or industries capable of contesting scarcity and mandating cooperative prosperity for its members?

Within this question, lies the harmonious promise of mutualistic abundance, even within ever-dictating environmental scarcity. But this eventuality is what we know, for it is apparent to all. The how and why eludes a constant struggle for the complete understanding of a cluster’s dynamics. Though it is endearing that within an analytical perspective clusters seem to relinquish their mysteries and surrender to order, rather than chaos. Consequently, the enigma any researcher seeks to settle, is not that of a cluster per se, but its paradoxical predilections that never cease to exist, or amaze. Herein we acquiesce over the theory of industrial clusters, through the prism of competitiveness, to investigate any resonance with clusters and strategic management.

The theory of industrial clusters

The conceptual infrastructure of what is coined today as industrial cluster theory, starts in the 19th century, and though Andersson et al. (2004) trace von Thünen's 1826 contribution of 'Der Isolierte Staat' at the outset of the theory, modern literature considers Alfred Marshall as the forefather of the theory. Within his 'Principles of Economics' (1890/1920), the chapter on 'The Concentration of Specialized Industries Localities' provides a very holistic review of the spatial concentration of industrial activity, presenting the reasons that trigger agglomeration and account for its sustainability. Since even the title of the specific chapter contains the 'specialization' epithet, Marshall is noted as tagging the competitiveness of a locality with the specialization of the industry, and many researchers have placed his theory across from Jacobs' (1969) theory, wherein competitive advantage lies within an industry's diversification. Reference should be made to the effects of the Jacobian theory and its implications with respect to 'social capital,' that resonate with Marshall's references to the 'character of people' and the cultural milieu. Apart from several research finds that favour one theory or the other, there is substantial evidence that the two theories may not share an exclusive foundation, but may partake within a mutual, synergistic, and correlative nature (Helsley and Strange 2014).

If we were to theoretically deconstruct spatial concentration, before entering the debate of specialization versus diversification, we would first have to attempt to solve the non-relocation enigma. Since industrial activity will hold a nomadic nature until its unchallenged stake is identified within a location, to repose within a locality of competitors hints to the fact that the trade-off worked towards agglomeration. In addition to non-relocation, agglomeration will facilitate the germination of new activities, lateral to the industry, within this exact location. At this distinct instant lies the deflection of scarcity theory, for instead of constant depletion of resources and the subsequent practical depreciation of the locality, we find that the cluster will sustainably grow. As will be analysed, one of the reasons liable for the miscarriage of the scarcity paradigm is innovation, i.e. the cluster's dynamics will lead firms to innovate and flourish, instead of relocating. Thence back to specialization and diversification. Innovation is defined as diversification, truly just because it offers the unique, unfamiliar, and original. But just as though innovation spawns as a venture diversified, innovation holds a certain qualitative hue; not anything diversified may be coined as innovative, for innovation must preclude triviality. To meet this end, the innovative activity should be specialized, since without specialization it will not offer an objective and meaningful service.

Thus, a theoretical notion may be founded, that innovation requires a coupling of elements. There must be a structural component of a 'positive' nature that should pertain to something different from what is readily available, like so, diversified; in addition to a qualitative component of a 'normative' nature that will provide the conditional prerequisite of specialization. This theoretical construct conceives that not only specialization and diversification are not mutually exclusive, but interdependent, as well. Of course, there is no assurance that there can be no instance that only one may solemnly provide the anchor for competitiveness, nor can we defend the thesis that there is no case when one aspect may have more influence than the other. But it seems that when innovation is at the heel of economic activity, a plethora of dimensions are at play and no unilateral cause by itself may suffice to explain this elaborate process.

Marshall introduced the distinct agglomeration economies that may formulate a regional competitive advantage, as better access to skilled labour, in that a specific location will hold a conclusive supply of a pertinent work force, specialized suppliers that will be able to provide a competitive product, and regional knowledge spillovers from competing firms. From his work, we could add local/natural resources to the list as well, for within they are addressed as a 'chief cause,' along with the economies of agglomeration. Natural and/or regional resources would stand as an uncontested selection of a proximate distribution of firms. Another interesting point within Marshall's work, adjacent to the process referenced above, is that of 'creating new wants.' It seems that even from the instigation of the theory, innovation and indeed the system it implicitly carries, is a crucial component of an industrial cluster. Then again, from the aspect of spatial dynamics, we address innovation as a sort of indispensable component that provides the rhythm and temporal breadth for the economic activity within a cluster. But it seems that though innovation may be essential for a sustainable industrial cluster, it is not an aspect self-sustained. An affluent environment that will lead to the formulation of shared values and convictions is also necessary and referenced by Marshall as the 'character of people' along with the inherent societal and environmental dynamics. These values and convictions will serve as the pillars of culture that the seeds of innovation will find recess to blossom into a systemic determinant. Culture is a pinnacle and basic element simultaneously, as though a cognitive force that avails itself into reproduction through innovation.

A catalytic farewell within Marshallian analysis is the "are as it were in the air" reference when describing the skillset obtained within the region of an industrial cluster. This cryptic statement goes to show that explanations within the functions of a cluster may prove elusive and obscure; paradoxical even. Of course, these would be the characteristics of any one instance that in nature is conceptual and not physical; as is culture. This is a crucial detail within the analytical perspective of competitiveness within industrial clusters, for they seem to entangle physical as well as conceptual constructs and this fact must follow any venture to explain and determine the threads of a cluster's competitiveness. Yes, the reference is made to a material existence, but this most closely resembles an organism, rather than just a brick and mortar concoction. This exactly is the reason that we find astonishing semblance between clusters of any kind, for mainly they compose entities within themselves and include conceptual characteristics; what we would coin as a psyche, nonetheless.

From the explicitly analytical sphere within economics, whence referencing industrial clusters, we are led to the somewhat stochastic and this process cannot but recall Adam Smith and his infamous 'invisible hand,' whose one reference in the Wealth of Nations has spurred schools of thought and follows textbooks of economic theory from cover to cover today. It could be of interest to note that the invisible hand is referenced to explain the implicit nature of a system that will facilitate common prosperity within a national perspective. Adam Smith was describing national industries but the mental leap from national industries to industrial clusters is not that wide, for one may include the other, or even yet, one may pertain to the other. The fact of the matter remains that the values behind wealth generation within a locality are not explicit, and thus do not have physical ingredients as part of a recipe that one may wilfully recreate. Industrial clusters (and clusters in general) are interconnected systems that share hard and soft facts, infrastructure, resources, concrete physical components, but also ideas, values, characters, notions, dreams, and culture.

The fact that clusters may be elusive to recreate may not rest solely on the fact that there is no way of knowing the exact ingredients that will lead to a cluster's manifestation, but their combination as well. Therefore, an in vitro cluster may just be labelled as a cluster but may not show any semblance to a cluster in vivo, found 'in the wild,' in its natural habitat where it germinated freely and of its own causes and not because of trend or whim. These cluster characteristics are inadvertently the cause of cluster theory ambiguity that we observe as well, to the point that an all-around definition of industrial clusters may be thought as absent. To date, industrial cluster literature would define the construct as *a volatile and holistic eco-systemic society of proximate and sustainable economic activity*; this activity would not be sustainable if it were not for the social dynamics within. Social dynamics lead to the practical manifestation of innovation, since firms are driven to innovate, exactly because of their systemic interaction with the rest of the cluster. Through this definition, there is distinct differentiation from what would be described as a 'network' or an 'industry.'

Departing from the foundations and roots of industrial cluster theory, we may be led to the modern pillars of the theory, as set by Michael Porter. Porter has affixed important contributions to the body of knowledge concerning industrial clusters and has relinquished the 'diamond model' as an instrument to analyse the source of the locational competitive advantage within a cluster; this framework is widely accepted and extensively utilized. The diamond model provides a discrete categorical framework of the dimensions that pertain to regional competitiveness and can provide a comprehensive framework to assess and analyse an industrial cluster, at least with respect to a theoretical perspective. In his work, Porter analyses the 'location paradox' of modern economic activity that manifests itself as a direct corollary of cluster dynamics. He moves to point out that we would logically expect that with the advanced technological achievements we have witnessed, location would cease to exist as a weighing factor; but inadvertently it seems that location is more important than ever. An indicative phrase he uses is that "paradoxically, the most enduring competitive advantages in a global economy seem to be local” (Porter 2000), just to demonstrate yet once again the implicit nature of industrial clusters. Yet the points made by Porter are as valid as they are prevalent, for it is everything but ordinary to address the dynamics of agglomeration, and surely the analysis is not without paradox. Porter’s analyses also include the ‘complementarities’ of cooperation and competition that lead to safeguarding each strategic and competitive element rather than eradicating one another. At first glance the notion pertains to a paradox yet again, but within a cluster setting it is absolute normality that cooperation will drive competition and vice versa. Where at the same time, within the manifestation of economic activity, competition will usually lead to elimination and cooperation will be the cause behind any synergistic occurrence.

Clusters deal with the complementary nature of paradoxical and (at least at first glance) conflicting elements. It may be reasoned that it is this semantic paradox of conflict that gives birth to new wants and ideas, for within the safety of a social environment, the envelope is pushed to new limits, thus procuring new markets (if not creating them) and through this process, cluster vitality is ensured. Through these obscure processes the substantiation of a vision may be found elsewhere, but within proximity, new arms are delivered, but utilized for collective health. To add to the above, Porter discusses the importance of networks that will affirm efficient communication, wherein trust will find abundance. Indeed, trust within an industrial cluster network is a promising aspect and one that once again demonstrates the grandeur of cluster dynamics. From the strategic management aspect and especially with reference to business strategies, Porter notes how firms within a cluster tend to yield to differentiation strategies rather than low-cost strategies.

To bridge the gap of modern cluster theory with its foundations, we find that the former is naught but temporal, for the pillars that formulate cluster characteristics remain alike. *Systemic networks that cooperate and compete are driven to constant innovation through a culture of trust*. This inventory of dynamic relationships facilitates research interest as well as practitioners' and policy makers' involvement, as clusters hold the key to mutual prosperity for a specific region that will drive a competitive advantage that may be naturally and internally sustained. The systemic and organic nature of a cluster brings us to values not so much of isolation, but as referenced above, of a natural entity, or that of an ecosystem. The same way that within an ecosystem there are flows of chemical substances and energy, and not only nothing goes to waste, but abundance and prosperity find solace, we can address the flows of values within an industrial cluster. These characteristics and their intricacies foster the enduring interest of researchers and practitioners sustained within this domain.

Research has extracted that knowledge creation is a distinct characteristic within industrial clusters (Bathelt et al. 2004), within a framework that generates and facilitates the efficient manifestation of economic activity (Maskell and Lorenzen 2004). These finds may strengthen the thesis that within clusters one can witness a self-sufficient system that not only holds the key to effective operations, but to their tactical replenishment, as well. Cooke (2001) performs a query as to agglomeration economies with respect to innovation, and Maskell (2001) supports the claim that an industrial cluster will sustain knowledge creation, and this, within a network of industry dynamics. Apart from knowledge creation, innovation as well holds strong as a major trait of the activities within an industrial cluster setting (Baptista and Swann 1998). Asheim and Coenen (2005) coin industrial clusters as 'regional innovation systems' and utilize a pair of knowledge management systems to extract the link between innovation and knowledge creation. Though their intricacies and dynamics are topics of analytical investigation, there would seem that there is consistent agreement that knowledge creation and innovation are plethoric and prime functions within an industrial cluster setting.

As expected, consistent agreement may settle across from unanimous agreement, as offsets in the theory of industrial clusters can be witnessed within its decomposition (Martin and Sunley 2003) as well as in its pitfalls, for the theory may diverge from clarity (Gordon and McCann 2000). It is evident that if operations are contained within a materiality principle perspective with the awareness that an industrial cluster is not a panacea, then strengths and weaknesses of clusters can indeed both be addressed. This comes in direct agreement with the find that though there is plentiful literature with respect to industrial clusters, their analytical potential regarding reliability and validity is scarce, as addressed by Malmberg and Maskell (2002). The researchers move to underline the importance and central role of knowledge creation for an industrial cluster setting. Simmie (2004) directly correlates competitiveness with innovation and notes that the latter may not be proximately or geographically restricted, for innovation may act within a greater system that knows no boundaries.

The matter of competitiveness and especially whether cooperation or competition tilts the dynamics within an industrial cluster is a prevalent matter with respect to research capacity. Apart from the dichotomy of the two, there is evidence that they may not be mutually exclusive but may share synergistic effects, along with the importance of a predominant culture and potent leadership potential (Molina and Yoong 2003). The indicators assessing performance may have their respective place within an industrial cluster setting, as investigated within a business lifecycle basis (Skokan and Zotyková 2014). In addition to the internal dynamics of an industrial cluster, an aspect of importance is that of policy, that can be assessed within a national perspective (Piperopoulos and Piperopoulos 2010).

In part with clusters' analysis come analytical methodologies for mapping (Bennett et al. 1999), as well as a plethora of quantitative methods including input-output analyses (Feser and Bergman 2000; Binti Shuja et al. 2012). The generation of business models can be utilized for the basis of an emerging cluster (Groznik 2009), as the topic is of much importance, mainly for extracting the threads of industrial clusters that are at the stage of initiation, to investigate the systemic principles within. For this to happen, instruments such as the extraction or pertinent typologies may prove effective (Bazzoli et al. 1999). Typologies and models for the analysis of industrial clusters find resonance within the literature that has provided complete conceptual structures wherein the components of industrial clusters are included and explained (Hendry et al. 2000; Perry 2007). These models may pertain to the actual functional deconstruction of the componential nature of an industrial cluster and provide an inquisitive approach within.

The systems active within a cluster should be mapped, for there is convergence that many of these are alike. For example, maritime clusters may be centred on a shipbuilding core, whence the latter may differ itself within another cluster type, such as a research institution. Oakey et al. (2001) provide another kind of typology extraction, based on the physical or functional manifestation of clustering. The dynamics of clusters can be analysed as well, for as the specifics of industrial clusters may find much breadth, as can the forms upon which the analysis is based, whether in a distinct industrial cluster manifestation, or within creative industries

(Evans 2009). The topic of culture surfaces yet again, in the form of distinct clusters of this type (Mommaas 2004).

As can be extracted, the theory of industrial clusters from its initiation, its evolution (Hoover 1948), up to its modern characteristics, has much to contribute to literature and practice, alike. Though there is no universally accepted theory as to the complete analytical capacity of an industrial cluster, within a cluster setting we can expect a grouping of parameters to be present, albeit innovation and knowledge creation, along with dynamics of cooperation and competition, that will lead to distinct thriving of a cluster's members to achieve the result that pertains to competitiveness. Each characteristic of this process holds the potential to provide an array of interesting analytical results that can be extracted through a plethora of novel or readily formulated methodologies.

Competitiveness within industrial clusters

There is an unambiguous convergence of literature with respect to the dimensions of industrial clusters that formulate the basis of competitiveness. These pertain to networks that through constant innovation, facilitate knowledge creation that suffices to render the cluster competitive. Within the specifics and dynamics of these manifestations, research potential is plethoric. The effect of specific locations with respect to pertinent competition has been investigated by Amin and Cohendet (1999) that return the result of competitive advantage indeed affected (if not dictated) by locality. Competitive advantage can be extracted within a cluster as well as between different industrial clusters (Lin et al. 2006), to the point that even extrinsic systems may be affected by a cluster. Knowledge creation can sustain a competitive advantage therein, if there is a knowledge management system in place that may direct the process accordingly (Pinch et al. 2003).

Knowledge management within an industrial cluster is a truly potent subject and whether this is facilitated more via formal or informal and tacit channels, is a question that could be effectively tackled in the future. These pillars of industrial clusters may be documented from a foresight point of view (Roveda and Vecchiato 2008), wherein the issue of formality of communication may arise again. A major find as to these inquiries may be the proponent within the theory as to the potent emergence of an orchestrated industrial cluster and whether a fabricated industrial cluster may present sustainability of the competitive advantages within.

With respect to individual firms within the industrial cluster setting, an evidence-based corollary pertains to the reinforcement of the competitive advantage due to the presence of a cluster's dynamics (Zhang 2014); elevated performance may be the case as well (Lima and Carpinetti 2012). The linked processes of knowledge creation and innovation-driven competitiveness is a find most interesting (Lai et al. 2014), as the volatility of a cluster's characteristics contain a path of determinant traits that seem to provide a solid foundation. These can be investigated based on a network environment of the cluster itself (Zhang and Zhang 2008), or within the network pertaining to a dedicated industrial cluster (Cai et al. 2010). The cases involving the competitive advantage within the industrial cluster setting are numerous (Zhang 2011); if one was to reference maritime clusters specifically, the competitive advantage within them may serve as the trigger for typology instigation, focusing upon the extraction of the dimensions of maritime cluster generated competitive advantage (Jing 2011). Maritime clusters seem to bear many similarities with generic industrial clusters and as such, pertain to aspects of policy and coordination, and innovation and knowledge creation, among others.

The importance of any of these components may be the object of investigation, as we can witness with respect to innovation (Zhou 2011). Synergies extracted because of the strategic cooperation of firms is another important aspect and a topic of further research potential (Hsieh and Pai 2010). It can be found in near agreement that an industrial cluster setting may provide the stepping-stone for the formulation of a sustainable competitive advantage as well as the circumstances for the mutual benefaction of the firms within. An industrial cluster includes the necessary components of esoteric viability, both for cooperative and competing ventures. This dualism may be acknowledged as a determinant competitive advantage for a cluster itself. The forces that may serve to initiate the systemic interactions that will facilitate competitive advantage formulation may very well pose as investigative topics per se (Hill and Brennan 2000). A recurring trait of efficiency is that of trust within an industrial cluster's networks (Li and Ran 2009). Other examples of cluster manifestation may focus on enterprise belief levels (Chen and Xie 2009), and factors with respect to the instigation of competitive advantage within an industrial cluster (Li and Li 2007); this can be sought out as a question of conceptual interrelation with knowledge sharing (Wilson and Spoehr 2010).

The impact of the externalities of an industrial cluster may provide the reason guiding a national competitive advantage (Akoorie and Ding 2009); this could pertain to one explanation of the lofty concentration of research interest in recent years. In addition, the reasons behind this competitive advantage can be investigated with a plethora of instruments (Clancy et al. 2001). On the one hand, it is memorable to witness that modern research mobilizes its more cutting-edge instruments and methodologies, and on the other that the results of the latter seem to converge to a basic array of paradoxical characteristics that are extracted as inherent within any cluster manifestation. It would maybe provide a wide capacity of research outcomes, to investigate the particularities of what is coined as the innovation culture that thrives within an industrial cluster (Lin and Sun 2010), that may very well be the reason behind the generation of a proximate competitive advantage. A latent culture may provide a further, but basic, explanation as to the factors determining cluster diversification, as well.

The cluster's externalities may not necessarily be contained within a region or nation; they may travel across borders (Galazova and Panfilova 2014) and these conclusions may find resonance within the threads of modern cluster theory, akin to the knowledge spillovers as referenced in Marshall's work. Again, an interesting research arena is relinquished, for a spillover may take place with reference to a specific collection of factors, albeit internal or external of cluster members and the cluster itself. The internal systemic dynamics of these processes can provide an ample breadth of investigative potential, but apart from the existential dynamics, one must not be remiss of the human factor (Kuo 2013). It would seem as self-evident that such a hefty concoction of industry must indeed require respect as to the human component, to attain any semblance of sustainability.

The matters of innovation and knowledge creation may find their respective origin within a cluster as per research and development intricacies (Molina-Morales and Expósito-Langa 2012); at first glance it would be expected that research and development initiatives would be responsible for the generation of new knowledge, but it would be interesting to investigate the capacity of this generation within a firm, whence a culture of innovation is inherent. Synergies with other functions, such as marketing, have been documented (Brown et al. 2010) and this focal direction may be useful, for within a marketing perspective it has been found that distinct knowledge-sharing upon the cooperative basis of an industrial cluster, may solidify an international competitive position of a firm (Felzensztein et al. 2014). A connection between cluster generation, economic activity, and cultural commons has been established already (Rudi and Antrosio 2009), insofar as a cluster's intrinsic characteristic framework seems to include cultural specifics. These synergies can lead to innovation capability of any type of firm within the cluster (Piperopoulos and Scase 2009), as the former may stand as the vanguard for even small and medium firms.

It would seem as though industrial clusters are the spawning grounds for a culture of symbiosis of competing firms; the latter, though antagonistic in nature, through said culture will be provided the armament for a plethora of dynamics that lead to mutualism. These traits mainly drive knowledge-creation and knowledge-sharing through networks lined with trust; these networks of synergies can lead to explicit innovation capacity within the industrial cluster that could not have been brought about otherwise (or elsewhere). The distinct attainment of this latent culture that will germinate within this endemic eventuality may foster the competitive advantage of an array of constructs, from a firm or an industry, to a nation itself. The natural expression of this plethoric gathering of beneficial elements may lie within the circumstantial predisposition of the differentiation of organically formulated industrial clusters; it could also explain why their artificial generation may be considered futile (Andersson et al. 2004).

Maritime clusters

Maritime clusters are considered as pertaining to the foundations of national prosperity and their manifestation is a much-attended occurrence. A pertinent literature extract is that of ecological modelling based on natural systems, that may find direct application within maritime clusters, albeit within predator/pray modelling

(Zhang and Lam 2013), or other models that derive from an ecological perspective (Jin and Zhen 2013). The fact that natural models may find such resonance within maritime clusters may be the instance of semblance with respect to the eco-systemic nature of all clusters. Apart from their natural characteristics and convergence with natural ecosystems, maritime clusters do provide an array of competitive advantages; the correlation of the former with respect to policy and its importance must be kept in account as well (Othman et al. 2011); though policy alone may not be able to pertain to a healthy industrial cluster, it serves as a discrete dimension of the cluster's sustainability. Analytical models can find applicability within a maritime cluster perspective, whether through the generic diamond model (Benito et al. 2003), or within its modifications and extensions that may include novel perspectives and concepts (Monteiro et al. 2013). The diamond model is found of practical utility and the fact that the instrument is not rigid but may be modified, can only work towards its merit.

National clustering and/or the maritime industry itself may provide the object of analysis (Brett and Roe 2010) and occurrences of innovation that will sustainably lead to competitiveness may be investigated within a national maritime cluster (Jenssen 2003). The distinct manifestations of innovation characteristics within maritime clusters have found convergence of capabilities within the maritime industry (Pinto and De Andrade 2013) and it would be interesting enough to investigate whether innovation capability is a shared aspect with convergent mechanisms within industrial clusters of different industries. Of course, any investigative capacity must take under consideration the primal effect of the systemic environment throughout the maritime cluster, and its holistic nature as well (Laaksonen and Mäkinen 2013). It is very interesting to extract that an operation within a cluster will achieve fruition only if the cluster is sanctioned. It is as though the prerequisite of operation within a maritime cluster is the respect of the environmental circumstances that pertain to the cluster itself.

The plethora of innovation types has found investigatory capacity (Makkonen et al. 2013), since, as research concludes, radical processes are not favoured whence pitted against more systemic and aggregate forms of innovation. This find may point towards the more profound nature of a maritime cluster, wherein processes are not sporadic, but move to strengthen the foundations of the cluster, rather than resorting to cursory approaches. In addition, this detail comes about an infrastructure of intrinsic cluster values that may very well provide the foundation of the cultural aspect of the cluster. Maritime clusters demonstrate acute compliance and tolerance whence this culture is honoured and analogous asperity if the culture of values they sanction may be threatened. It would not be such a giant leap to consider that maybe the basic focal construct that should be investigated, may very well not be the maritime cluster per se, but the framework of values that formulated the distinct culture therein.

Maritime industries may hold the potential to formulate industrial clusters (Kraaijeveld 2012); this topic holds further investigatory interest, so that it can provide insightful knowledge with respect to the cluster formulation process. The circumstance of not reinforcing a maritime cluster with systemic coordination, policy, and oversight, but instead with maritime tradition, is a topic still investigated (Ortega et al. 2013). Apart from knowledge management, factors affecting the capacity of innovation within a maritime cluster may be the intrinsic assets of firms and the dynamics within the latter; at the same time the outmost of care must be exhibited within the procedure of policy drafting, for maritime clusters may not be free of ambiguity (Doloreux and Melançon 2008). It cannot be stated that this form of caution is unique within maritime cluster theory, for every conceptual formulation, once put to practical use, may be contested by a latent parameter. The bridge of industrial cluster theory with the specific instance of maritime clusters comes to demonstrate that the pillars of generic clusters, that are the system of innovation, the importance of networks of trust, and the reinforcing culture and policy, are equally important for maritime clusters as well (Isaksen 2009).

The system of innovation may resonate with many functions, and not only with research and development as referenced above, for complementarities with engineering capacity have also been documented (Jansson 2011). As within industrial clusters, maritime clusters may provide the domain for pertinent analytical typologies' formulation with respect to competitiveness (Lee et al. 2014). Models within these frameworks may be extracted as well, with the objective to provide the structural components of maritime cluster competitiveness (De Langen 2002). One could conjecture that the factors of policy and innovation may not be mutually exclusive, but may hold associative bonds within a maritime cluster, especially since policy may facilitate the circumstances wherein innovation may bloom. In addition, latent culture may act as the catalyst whereby the effect of policy will be determined (Doloreux and Shearmur 2009). All these components will drive towards the sustainability of a maritime cluster, or better yet, towards the sustainability of competitiveness within the cluster. For this to happen, it comes in near agreement that coordinative support is a prerequisite that will facilitate knowledge creation and innovation, within a network that shares a culture of interdependent values (Shinohara 2010).

An initial comparative remark with respect to generic industrial cluster theory and maritime clusters is that the constituents of both seem to bear similarities, in function and in form, for they seem to shield their intrinsic networks of values and trust via processes such as knowledge creation that will lead to the product of competitiveness, via innovation. Within this framework, the importance of governance (Lam et al. 2013), along with policy (Flitsch et al. 2014), cannot be overstressed.

Critical review of maritime cluster literature

An initial engaging extract from the literature is the fact that maritime clusters seem to share the same basic traits that sustain competitiveness in all clusters. It would be interesting to investigate the differentiating characteristics of clusters, among divergent industries. Though by hazarding the conjecture, these probably reside in functional rather than in structural components of the cluster and this because the threads of all industrial clusters seem to converge. There is an underlying culture of understanding, mutuality, and respect that leads to manifestations of trustful cooperation, even within competitive surroundings. This culture seems to trump the zero-sum game of solely going after a market share; it does so through knowledge creation that leads to competitive innovation and thus does not only sustains but creates new markets. Here we could compare Marshall's 'creation of new wants' to find out that the theory of industrial clusters is linked, if not unaltered, at least within its core.

The concept that is absent from the theory that could hold the role of a binding agent, is that of the form and function of evolution, to attain the product of innovation. We could present the parameters of innovation and evolution as sororal, as both lie within the aetiology of diversity. The latter seems to be the outcome of an intricate assortment of processes within networks. The same strategies utilized from a biological entity that evolves towards survival are witnessed within an industrial cluster, that evolves towards its competitive end. The characteristic that in the former is coined as evolution, in the latter is accounted as innovation. The mechanisms that trigger these effects are of paramount interest and importance, for if their mysteries are relinquished, thence so is the passport to permanence. This comes as a definite lesson of industrial cluster theory; the thesis that investment within a culture of mutuality will lead to multilateral benefits, is what sets a cluster's competitiveness apart. These remarks could even justify the daring assessment that maybe competitiveness is not what's at the core of the system and what should instead concern the pertinent research direction, is the veiled culture that fosters this plethoric agglomeration of beneficial characteristics.

The fact is that within a cluster there resides the freedom of constant endemic innovation, along with complete and harmonious symbiosis and uncontested respect for what the cluster stands. For the privilege of innovation to spawn, respect may be the prerequisite, and this potential holds the determinant explanation for the basic paradox of industrial clusters and one that may even explain the location paradox. So thence the answer to the question as to why a firm selects a location instead of another, especially when another holds lower relative costs, is that, it simply doesn't. Location will matter since it will provide the right to innovate, along with the simultaneous procurement of proximate optimism and refuge, as a cluster constituent. Thence the locational paradox may be no paradox at all, since the selection of a location may be explained outright or may be not even a selection at all, but a perfectly natural systemic eventuality. This dual repository of impregnable traits may stand as the distinct and sustainable competitive advantage of the cluster construct, at least as compared with other types of industrial assemblies. It is as thought the culture of the cluster itself comes with a failsafe that within the array of freedom of activity of the firms within, the cluster will see towards the fortification of its own prosperity and subsequent continuity.

A lateral important aspect of an industrial cluster's manifestation is the extent to which an array of parameters that apply within extrinsic operations, such as coordination, oversight, governance, and policy may affect the cluster's competitiveness, or its overall health. Research is in the position to relinquish the thesis that policy is a very important aspect of an industrial cluster's well-being; but once again, a dual array of predisposition must be in effect. On the one hand policy is not enough to carve the systemic parameters that will lead to a cluster's dynamic prosperity, and on the other, without policy an industrial cluster may run aground. Policy could be coined as a separate dimension that affects a cluster's uninterrupted function, but nevertheless a trait that is not enough to lead to cluster efficiency by itself. The policy's function may be that of an effective body for mitigation as well as prevention, for policy may be instituted whence a generic cluster issue is documented, or indeed forecasted. Thence policy will pertain to the enforcer of the peace of mind for the cluster. It is as though policy and governance will play the role of the feedback loop that will be able to respond to any potential threat to the cluster, with assertive protective measures.

The issue of balancing policy with systemic function resides in the same order of affairs such as those that concern a cluster's creation. The matter of the difficulty and even the ability of setting out to create a cluster comes within its competitive advantage, as reference above. Instead of focusing on fabricating an industrial cluster, the assets should consider providing the threads that constitute the pertinent culture wherein a cluster may function. Thence only will an agglomeration of firms perform the dual role that is necessary to be a part of an industrial cluster; it is vital to keep in mind that this prerequisite cannot be manufactured (without the culture baseline) but must be left to evolve systemically. This consideration must not be accepted as the dismissing factor for engineering the circumstances wherein an industrial cluster may flourish, or as a prohibiting eventuality with respect to industrial cluster generation, but rather as a systemic parameter that must be taken under consideration. Then we will shift from the establishment of cluster policy organizations to cluster culture organizations that will focus on the specifics of reinforcing the culture of mutualism that an industrial cluster is so dependent upon, rather the brick and mortar institutions that will provide the physical, but may short-circuit the conceptual determinants of industrial cluster infrastructure. This indeed is a fact that can serve as a near mutual reconciliation of industrial cluster theory, for all research points to the elemental force of the shared culture within an industrial cluster.

Through culture, the rudiments of collective prosperity may be founded. It is indeed within this distinct competitive advantage that settlement between cooperation and competition is based and acted upon. Within this elementary notion of equity, is true mutualism exhibited and though at a first glance it may seem as paradoxical, there is nothing curious about it; respecting mutualism implies respect at cluster dynamics, so once again we arrive at a clustering dualism. The veiled culture will sustain the pertinent building blocks of knowledge generation and management that will reinforce innovation, and these will manifest themselves as the ‘at first’ conflicting traits of cooperation and competition. Later, in the emergence of operations it will become apparent that within an industrial cluster setting, these two traits not only are not mutually exclusive circumstances, but nonetheless interdependent occurrences, for one can sustain the other, all within the cultural context of the industrial cluster.

It should be noted that the cluster construct does not come without strings attached, for it includes its own set of pitfalls. The dual nature of characteristics referenced above, that contains freedom to innovate and the prerequisite to respect the culture, may not be divergent and unrelated, for freedom within the culture may pertain to limits and constraints, given that certain aspects of operations are allowed, and certain others prohibited. But this is not freedom at all, rather a preconditioned kind of dynamic stability that bears no semblance to a discrete privilege within the flexibility of an entity's operations. Whether this thesis stands as a conceptual or practical axiom, should be strengthened or at least investigated with evidence-based means. The connection between the chaotic nature of innovation and the respect of culture should be investigated further, for it may lead to a predisposition of an industrial cluster's principles, since innovation is favoured only if it carries certain traits. If this notion finds compensated manifestation, then it may be interesting to reveal what happens (and through what kind of mechanism or process) if an innovative activity out of the accepted framework attempts to surface and if this is at all stifled through intrinsic or extrinsic processes. This eventuality may again be paralleled to natural occurrences, exactly as the immune system of a biological organism will attack any construct it does not recognize as its own.

Another note that may undermine a cluster's beneficial characteristics, is that of its regional profile. Industrial clusters may be just that, a cluster within an industry that has developed due to specific regional resources and characteristics. Maybe we can observe similar traits in different kinds of clusters, but the regional characteristics that are truly responsible for a cluster's emergence may still escape the theory. Maybe industrial clusters are simply a regional tale of excellence so specialized, that any attempt to duplicate the phenomenon based on past documented cluster dynamics, is doomed to fail. This would mean that the regional characteristic of a cluster is just that, so individual in nature that its intricacies simply cannot survive elsewhere. The much-needed research to support or dismiss this claim may serve as the sequential offspring of the ‘specialization versus diversification’ divide. As much as modern economies would benefit from clusters that would give birth to national competitive advantages, maybe the reasons behind cluster emergence is a daunting and complex system that has everything to do with a specific location; concerning only the assets and resources situated (or potentially situated) within. Even if this were true, further research would carve a more detailed narrative as to the mysteries and intricacies of industrial cluster theory.

Irrespective though of the notions mentioned above, it is certain that industrial clusters are there to portray a variety of attractive characteristics, many of which refer to mutualism and the necessity of the task environment’s perseverance. Within this acknowledgment of the need of other entities’ well-being apart from our own, lie the keys toward the foundation of a mutual culture and the subsequent construct of opulence it supports. Industrial clusters exhibit a marvellous case of non-zero-sum games that can put to shame anything but a cooperative strategy. This is far from an idealistic or fabricated conclusion, for industrial clusters have found a way to beat the clock and turn the tables on scarcity and finite resources at once. When scarcity is concerned, wealth is perceived elsewhere and novel domains that contain the latter in plethoric amounts, are discovered. All these marvellous processes can be the exit strategy for crises, as they hold the viable alternate route away from the stale dead-end of liability.

From a strategic management standpoint, the dynamics within a cluster will lead to an industry’s constant fragmentation through diversification, that even if any topology within the cluster is led to consolidation, this again may bloom into a plethora of cross-industry activity. It could be stated that anything that may lead to staleness is found across from a cluster's standpoint, for constant operational replenishment is a distinct cluster characteristic, insofar as the activities do not harm the cluster itself. The point to be extracted is that maybe this is the vision of the cluster, to provide a sustainable competitive advantage within the confines and proximity of competition. It would seem an audacious venture nonetheless, for, operations within a strategic management perspective, always must keep under consideration the configuration and state of the external environment and whence competition is present, action must be taken accordingly. Industrial clusters are the practical case wherein not only respect of the competition may prove fruitful, but wherein the mere presence of competition hints to mutual prosperity, for all. This exact element is what germinates in a compelling drive to study, understand, and recreate the marvel within an industrial cluster, because permanence is not based on resources and markets of individuality and inequality, but rather on a symbiotic and mutualistic momentum that produces collective competitiveness.

Most, if not all, aspects mentioned herein are the object of scholarly investigation and as though their results do hold a distinct (though still crystallizing) body of knowledge, their potential is promising; this goes to show that even though there is agreement as to the basic pillars and dimensions of industrial clusters (though even therein debate resides), their intricacies are far from fully understood. Pertinent contributions may contain novel instruments to document cluster dimensions, new formulations of models and typologies, or even basic research, within an industrial cluster. The input to be utilized from a strategic management perspective is significant, for industrial clusters and strategic management share the common interest of the vision of sustainable competitiveness. Within industrial clusters firms can find the haven of competitiveness and strategic management provides the analytical inventory and conceptual framework to manage said competitiveness, so it is not surprising that considerable complementarities reside between the two. Instruments formulated for strategic management for clusters can be utilized with respect to this domain, and hopefully, will facilitate the documentation and enrichment of competitiveness within.

Strategic management and industrial clusters

Within any given business context, there are few truths that are indisputable; one of these is the perpetual proverb that *things change*. By 'things,' the axiom implies any parameter or component within a system, albeit physical or conceptual; this comes to signify the fluid and dynamic nature of all systems. Thus, 'things change' moves more towards a universal truth than a witty proverb, for all about the world and its systems is under constant transition. If it is the environment that stands as our object of analysis, this means that within an ever-changing environment, any entity that wishes to survive must continuously evolve, so that it may adapt to change. Thusly we have arrived at the pinnacle of situation analysis. Within a chaotic and perpetually shifting environment, analytical instruments with respect to the documentation of pertinent factors that affect this change are of vital importance. The relative effectiveness and success of each will be dependent upon the scrutiny and breadth of the venture. The lateral importance of the constant state of change with respect to any act that attempts to first tackle, thence harness, and subsequently benefit from change, must follow (and benefit from) the environment in perfect synchronization. This drive will be aware of any pertinent environmental changes and thence propose viable directions to accomplish efficient adaptation to this, or any other change. One could state that because of this fact, situation analysis is one of the most important aspects (if not the most important aspect) of strategic management.

A major constituent and simultaneous pitfall of the requirements of situation analysis is as apparent, as it is veiled, because situation analysis must bear a strategic foresight character. This goes to demonstrate that change must be detected and even forecasted; that the latter must prove within a materialistic perspective, at least to infuse validity within the proceedings of situation analysis. Then we can conclude that situation analysis not only has to possess the objective characteristics to freely extract and analyse situational parameters, but this must happen within a dedicated and case-oriented perspective; a delicate process, to say the least.

The importance of situation analysis cannot be overemphasized and this to the point that within a successful venture, most probably a definite contribution of effective situation analysis has been conducted, whereas within a failed venture, it is rather probable that incorrect situation analysis has been performed. That goes to show not that all failed procedural attempts may be traced to situation analysis mishaps, but only that effective situation analysis will forecast any pertinent issue to the point that if the venture is attempted, the path followed will be carved not from blank stone, but with the ally of effective consult.

On the one hand, it may be observed that situation analysis is a constant requirement to sustain viability within a changing environment, and on the other, that this process presupposes an indicative and effective strategic foresight constituent. If a venture is to be set out, then situation analysis is the prerequisite; since an effective strategic foresight parameter is a prerequisite for situation analysis, then a relational characteristic can exist between the venture and strategic foresight. This relation has a deepened, profound, and catalytic function, for it suggests that strategic foresight may be the latent factor responsible for the effective realization of the venture, since it is in twain essential. The importance of strategic foresight can be dismissed or strengthened with evidence-based research, wherein case studies may play a crucial role. These pertinent case studies would benefit from a dichotomous approach, to correlate venture effectiveness with the level of strategic foresight. The estimate as of now is that either way, the results may be extremely interesting. If the presence of a determinant factor of strategic foresight is correlated with competitiveness, thence the theoretical model wherein strategic foresight is truly an integral component of nearly any competitive venture, can go undisputed. This instance would come as probably expected. But in the far more interesting outcome that strategic foresight may not be indispensable, further research must be conducted to extract the systemic parameters wherein foresight *will* provide contextual meaning.

A first glance of situation analysis produces the notions that on the one hand it is utilized in a practical perspective, almost with disregard of the limitations due to the absence of analytical constituents, and on the other, that it pertains to a research topic within a purely analytical domain, almost within a mathematical context. An even superficial observation of this situation may return the view of maybe attempting to bridge these extremes, to procure instruments for situation analysis that include analytical constituents and remain applicable within practice, insofar that their analytical constituent does not hinder functionality and usability.

A determinant presupposition is that there can surface a trade-off between analytical capability and applicatory potential. If this territory does exist, then it will hold the potential to facilitate the creation of a discrete body of knowledge that can pertain to analytical instruments for situation analysis in clusters with a simultaneous market contribution potential and not an exclusively academic scope and contribution.

As was referenced above, these instruments may be well extracted and put to the test through actual cases, for the latter may signify the target audience as well. The strategic foresight constituent may be investigated as well, though its inclusion within these constructs and this general process, may signify yet another novel research domain.

Forecasting shares the same hardship with respect to the applications referenced above, with an analytical constituent many times burdening applicatory potential. Instrument formulation procedures need to keep in mind that forecasting should be implemented with dare, for it is within itself conflicting. This goes to show that in its core and from a deterministic perspective, absolute forecasting is no more possible than being able to predict anything and everything. Its basic limitation is infused, and best described, in the proverb 'forecasting is akin to driving a car through (only) the rear-view mirror.' As a materialistic scenario of this instance would be unthinkable, to say the least, the outmost consideration must be given to ventures with a forecasting characteristic and their practical application.

All instances pertaining to the inclusion of a forecasting constituent within practical applications must adhere to the materiality principle. Therein an inclusive approach as to the limitations and risks of adamant relinquishment of guiding directions that rest solely upon forecasting processes, must be conducted. Decision making could maybe benefit from the guidance of strategic foresight, but this within a cautious perspective; if caution is not an operational constituent, thence adverse results may be exhibited. Bearing this in mind, the proponent of the inclusion of strategic foresight as essential within situation analysis is undisputed, though this process should include its own fail-safes. The latter may be in the form of preventative measures, or indeed lined within the rudiments of the instruments formulated, since they may pertain to a typology of scenarios, rather than absolute directions. These reservations stand for the frameworks and models developed herein, as well.

The links and resonance of the array of instruments with respect to situation analysis and industrial clusters should result and be extracted without any hurdle. As industrial clusters are as living organisms, with absolute interdependence to their topology and environmental locality, it is evident that instruments, typologies, and applications with respect to situation analysis provide a crucial component for the analytical direction regarding competitiveness within industrial clusters. An industrial cluster is a construct that bloomed within a region due to an abundance of consequential and contextual factors, all of which reside within the general scope and acute interest of situation analysis, and strategic management, in its entirety. In addition, industrial clusters provide a practical haven of competitiveness that may be sustained only through effective situation analysis. We are led to observe that an industrial cluster setting is an excellent playground for strategic management topics, irrevocably linked with knowledge creation and innovation, as analysed above. The lateral impact of strategic foresight surfaces as well, for within industrial clusters, and especially since such a plethoric manifestation of completive behaviour is discharged, the topic of effective strategic foresight may be of paramount value.

Strategic foresight instruments to be utilized within industrial clusters will find dedicated applicatory potential and evolution nonetheless, since within the volatile confines of an industrial cluster, strategic foresight will aid towards the sustainability of competitiveness. Since sustainability resonates with the componential characteristics of industrial clusters, strategic foresight will find synergistic capabilities with a cluster's elemental foundations, given of course that its inherent constraints are considered. The last instance may prove to be of importance, since innovation and knowledge management capacity does not inevitably imply sustainability. The latter will be procured through an arduous and complex process wherein strategic foresight may hold a definite role. It may be of substance to conjecture that a dedicated body of instruments may be formulated, pertaining to specific industrial clusters' topics, always with respect to strategic foresight. Thereby, forecasting within maritime clusters may prove to be a vital instrument for sustainable competitiveness.

Within the context that industrial clusters can provide, instruments for situation analysis and forecasting are more than welcome, to say the least. We could move so far as to ascertain that their effective utilization will act as a fortification for the in-effect materialization of sustainability. The culture within an industrial cluster would greatly benefit from any analytical instrument that may facilitate its endurance, for culture within itself is an inventory of values and convictions that serve as the practical nexus between cooperation and competition. An industrial cluster's culture will alleviate any apparent paradox within a practical perspective and will serve as the backbone for the cluster's healthy operations. At the same time, the culture of mutualism within an industrial cluster will foster the systemic eventualities that are externally observed as collective manifestations of prosperity. This culture of respect of the cluster's specifics is thus the vanguard of the cluster's sustainability. Culture thence seems to perform within a dualism of roles, at first pertaining to the characteristics that formulate the foundation of a cluster's operations, but at the same time composing the leading edge of the cluster's distinctive characteristics.

It would not be extraneous to formulate the notion that in practice, culture is an inherent systemic parameter rooted within any operation of a cluster; so much so that if the question as to what is the competitive advantage of the cluster construct ever had a unique response, that would have to be, culture. Especially because of the importance of culture within a maritime cluster and its plethoric manifestation, analytical methodologies that may map this culture and its relational characteristics with competitiveness, would be extremely beneficial.

Within the common ground that industrial clusters' culture shares with the range of applications of situation analysis, the former's sustenance will reside. This conclusion is reinforced through the conceptual thesis of dynamic interaction, for culture is the practical incidence of a nearly static set of principles that survive within a dynamic environment. Therefore, the dual nature of culture is apparent, for on the one hand values are not values at all if they are accustomed to erratic change and on the other, they are not values if they don't prove materialistic in their manifestation. The manifestation that will occur and guide a single value's practical eventuality, always happens within an ever-changing context. Culture may pertain to an inventory of values that could be mapped, consolidated, and categorized, but its practical manifestation is everything but static. It rather resembles an industrial cluster's ability to evolve and adapt, through perpetual adversity; it is as though culture provides the fuel of sustainable change. At the same time situation analysis cannot but be inherent in any aspect of operations that pertains to change and its management. For this reason, situation analysis may be defensively considered as the proponent of culture.

After the realization that situation analysis is a prerequisite if sustainability is to be pursued, comes the arduous task of its fulfilment. It becomes needless (if not unfeasible) to reflect upon the systemic complexity of all the pertinent environmental factors, their extraction, their linkages, and their impact. The scope of parameters is just too great and furthermore, which of these will present any form of pertinence, by what means, and through what framework, is just impossible to contemplate in totality. Once again, the forecasting parameter is attested, for whence tasked to analyse the external environment with respect to an internal environment, strategic foresight as to the specialized critical factors that will meander between and within the two systems, must be implemented. Less analytical breadth would render the analysis a failure, whence more analysis might prove irrelevant, and costly.

Besides foresight, situation analysis must provide a very light and veiled equilibrium between the internal and external environment. Thus, the importance and challenge of effective situation analysis, surfaces as evident. Beyond the fact of its eminent importance, it should be held dear that situation analysis is a potent instrument that should be utilized with care. If not, it would render conflicting results and would undo any inherent benefit it beholds. For all these reasons, the focus should be placed not upon the fact that situation analysis is utilized, but upon the process wherein its directions are crafted and pursued.

An initial venture as to map the environment and provide the first stepping-stone for situation analysis would effortlessly be the objective to extract environmental factors that are pertinent, lest that the environment is not envisaged correctly. Therefore, the actual prerequisite of situation analysis is the pertinent representation and definition of what exactly the object of analysis incorporates. The exact scope of environmental factors may be tailored with respect to the venture at hand, whereas a pertinent typology of environmental classifications is already within the armoury of strategic management. Even more important is the selection of the exact environmental parameters that are to be analysed; and slowly it becomes apparent that objectivity may arise as an issue.

Of course, if situation analysis were an exact science, thence failure would be absent, but exactly because of this disadvantage the opportunity of analytical frameworks' inclusion is born. Analytical frameworks will reinforce the previous effective environmental conception. The latter though should be conducted in twain, since there is an environment that requires a certain analytical perspective, but at the same time there exists the environment of the entity and/or system that will tackle the venture that requires situation analysis. This environment pertains to none other than the internal environment. Situation analysis in all its applications, whether in the most elementary that may be required in simply crossing a street, to carving strategy with the objective of tackling a predominant niche, always refers to the reconciliation of the internal and external environment. This stands as the determinant reason behind the fact that the instrument is of such importance within industrial clusters.

Sequential to the environmental definition, comes the factorial categorization. The rational strategy would be to start with a qualitative segmentation at first and thence proceed to quantitative interpretations. The most basic of qualitative categorizations is dichotomous and pertains to the recognition of a factor as beneficial of unfavourable. This initial categorization is extremely favourable, as it is akin to decision management specifics, for an action as well follows a dichotomy of states, albeit to halt or proceed. Therefore, the link between effective situation analysis under the dichotomous principle and the pertinent decision process is evident, but furthermore, therein lays the importance of the materiality principle. The latter must be infused within proceedings, for it alone will warrant the correct and mutual accordance of a decision and its traceability to apt analytical beginnings. Because the result of this procedure will vindicate the correlation of the qualitative characteristic with the direction attended, an initial effective framework is imperative. The dichotomy is simple and clear, but many environmental factors may hold obscure characteristics that render their respective classification nearly impossible. Through this prism, if there is any documentation of monitoring the degree of uncertainty, this should be portrayed as well.

The benefits of an effective qualitative categorization are numerous and mainly suggest a complementary approach as to the environmental factors. If this extraction includes the dichotomous accounts of factors that originate from the external environment as well as the internal environment, thence we are referring to the technique generically acknowledged as SWOT analysis. The latter offers an inventory of the influential strategic factors within a dual categorization, with respect to environmental origin and regarding the dichotomous qualitative trait. This analysis will provide a consolidation of the effective appraisal of the environmental taxonomies that will assist the (later) stage of strategy formulation.

Within the context of strategic management, the analysis would conclude the first and probably the most important step in the analytical process, for if situation analysis is not effective, strategy will never materialize as warranted. Given the risks, an incisive approach as to the benefits that this process may procure, will extract the notion that it is vital to approach situation analysis with the outmost of care. This care is required as to the conceptualization of the significant factors that will form the foundation of decision and strategy. The first benefit arises from the static and exclusive existence of the inventory. The successive utility though, is generated from their interrelation. Surely the mere existence of the analysis will provide such a resonating manifest of factors, to the point that the beholder will hold the keys to effective dissection of environmental and systemic rudiments. What may prove more useful though, is the interaction of the factors between and among their discrete categorization. Thence the value of the analysis shifts towards the repercussions within the volatile analytical inventory. The form in which the items of the inventory will interact is going to provide the initial foundations and directions for strategy to thicken.

Needless to reference that there is a temporal perspective in strategic analysis, or better yet, an expiration risk, for the inventory is valid at the point of its formulation. Just as the internal environment will change along with the external environment, so will the relevance of the factors within the inventory be remiss of their initial validity and this fact must follow the analysis as a practical disclaimer. The validity of any instrument cannot be contested merely since temporal authenticity has been surpassed and exactly here the importance of the materiality principle within the proceedings resides. The materiality principle alone will be able to separate the wheat from the chaff in an efficient manner. Thus, to infuse any sense of diligence, each strategic factor must include a temporal identifier, with respect to its margin of effectiveness.

If all the strategic factors within an inventory enjoy temporal effectiveness, thence the possibilities are endless, lest the absence of categorization between them. This absence introduces the aspect of measurement bias, that type of systematic error that remains constant within an experiment and derives from instrument data skewing. In most cases, measurement bias can be reduced with calibration, a technique that formulates a query as to its applicability within situation analysis. Calibration is introduced in situation analysis through many analytical methodologies formulated. Lateral to this, another type of systematic error is also inherent within a strategic inventory, in the form of selection bias. Since there is no warranted action that may sustain the notion that all items within the inventory deserve their place, or that there is no item left out of the compilation, thence selection bias is in place. Regrettably, complete mitigation of these issues may not be feasible, but surely equilibrium may be achieved between the validity of an instrument and its different types of bias.

It should also be referenced that the existence of bias provides an array of analytical opportunity, within the domain of instrument and model formulation, that may tackle said bias. The composite instruments created to mitigate the generic issues of situation analysis compile a separate and dynamic body of knowledge. There is complacent indication that this collection may yet be sustainable, since it follows a pattern of generic evolution, with a clear correlation to effectiveness. This situation bears semblance to a central system, wherein the traditional analysis is at the nexus and a plethora of analytical techniques may be introduced within and carry on its potential.

Conclusion

The fact that situation analysis at its core includes a veiled culture of truth towards the self and profound knowledge of its environment, is maybe the reason it resonates in such a way with industrial clusters. As industrial clusters require an intrinsic culture of respect towards the environment so that they may be able to function and this fact pertains to their overwhelming advantage, so does situation analysis; at its roots it requires a culture of empathy, trust, and honesty. The result of situation analysis is the accurate representation of the external and internal environment. This result cannot be achieved without a culture of clarity towards the internal system, in tandem with a capability to address the determinant aspects of the external environment; what is colloquially referred to as empathy, at least in its practical sense. It would not be out of place to suggest that these two cultures are shared, at least regarding their guiding principles. These characteristics may be the reason that the two are mutually inclusive and beneficial whence intertwined. Industrial clusters validate the enormous utility of situation analysis and simultaneously provide a rich terrain for analytical experimentation of its instruments; the same utility may benefit the cluster itself, if situation analysis proves effective.

Situation analysis provides practical consolidation of all stakes, through the reconciliation of permitted ability, the former an extrinsic characteristic and the latter an intrinsic parameter. This may remind a cluster's reconciliation of collective prosperity and scarce resources, for congenial mechanics may guide the two. This reconciliation between the internal and external environment comes to provide a synergy with environmental limitations and systemic aspirations. The mere fact that these two must be documented and analysed provides an initial step towards strategy formulation and the subsequent realization of these aspirations. Whence the link between realization of a vision and the requirement of environmental reconciliation is achieved, a system may find promise in its operations and the scope of potential of situation analysis is grasped. The first step towards a systemic vision is that of situation analysis and because of this, it may be considered as the most important aspect of strategy. The foundations of all the aspects of strategic management will be produced upon the infrastructure that situation analysis dictates. This instance validates the concurrent eminence of the body of analytical instruments that are formulated to mitigate any issue and/or limitation that is inherent within traditional situation analysis. The importance of each instrument sustains its evolution.

A very basic advantage of the representation of external end external factors is systemic definition. Situation analysis is not able to discriminate with respect to the analytical stratum; this may be its most important characteristic and the key towards its versatility. Seldom does an instrument hint applicability within any systemic ordinance and situation analysis not only is applicable regardless of systemic boundaries, but necessary for their viable operation. As a strategic component, situation analysis may be conducted for any system that holds any specificity and boundaries from a specific environment. This prerequisite can attain a level of leniency, to the point that the system may be conceptualized as an environment, for as is referenced, situation analysis pertains to a dualism of environmental characteristics. Due to this specific type of leniency, or just the absence of rigid environmental and systemic definitions, situation analysis can find effective applicability in nearly every system. Its results can be influential whether it pertains to a system such as an individual, or a multinational conglomerate. This generalization stands and provides the ground for the formulation of many instruments for strategic management of industry clusters.

I (2) – The competitive advantage of maritime clusters

Economic theory has long been indulged with the study of industrial clusters. The standards, threads, and governing parameters of clusters provide a very fruitful area of study for a plethora of disciplines besides and beyond economics, such as strategic management, mathematics, life sciences, and organizational management in general. Industrial clusters hold such a prominent position as decision-affecting entities, that in many frameworks they directly influence national and international policy in a basic level, through their needs, and in a secondary level, through their linkages to other industries and their weight upon the economic cycle itself. Through this paper we attempt a critical examination as to the factors formulating the competitive advantage of industrial clusters and within a second focal direction, the competitive advantage of maritime clusters. This contributes to the body of knowledge with respect to maritime clusters from a strategic management standpoint.

Introduction

The study of the concentration of industries in a specific location with reference to the perspective of their synergies and complementary strengths has situated the interest of economists, economic geographers, analysts, and practitioners for at least a century and a half. The collective conclusion of this accumulated interest and knowledge has led to a bi-fold situation today. From the one hand, there is a plethora of instruments and empirical benchmarks with which to analyse, map, categorize, consolidate and aggregate cluster analysis (herein the term is utilized as the analysis of clusters and not strictly as the mathematical data mining application), to the point that the analysis of clusters could be considered as a discrete domain and this from a range of process applications, their dynamics, mathematical modelling, strategic management, business management, policy drafting, and even cultural characteristics.

The abundance of entities, concepts, and corollaries that is evident as a prime characteristic of industrial clusters finds according expression in their theoretical and empirical analysis as well. On the other hand, clusters of industries have proven to be somewhat on the elusive side whence a thorough, complete, and uncontested understanding is ventured and this, as we will demonstrate, for simple reasons of natural compliance. We propose the term natural compliance with exact reference to the compliance to nature, natural circumstances and/or, natural governing parameters, for in nature we find similar instances of clusters or indeed of manifestations of abundance through one too many paradoxes. The same holds true for industrial clusters. The empirical evidence is plethoric and finds impacts of resonating capacity in almost every aspect of the natural and manmade environment. That said, all clusters have one very mesmerizing thing in common. Whether we are referring to natural clusters of insects, or industrial trans-national clusters, there are governing paradoxes in the brew. Through the ever-constraining scarcity principle we witness the paradoxically abundant (if not saturated) presence of entities that are there for the kill, but paradoxically said principle makes them all healthier, more dynamic, and stronger, simultaneously.

The road to cluster understanding has not yet found a decisive destination and is paved with a diverse materiality of paradoxical and stochastic output. But like almost all natural or quasi-natural systems, within the chaos there is wisdom and within the absence of the deterministic there is order. The notion of paradox is one that germinated through the instigation of industrial clusters' analysis and has accompanied their body of knowledge in every aspect as an intrinsic parameter ever since. We could venture to state that it's not the analysis of clusters that research is after, but the resolution of the paradoxical predisposition of clusters themselves.

In this paper we attempt to map the literature extracts concerning the competitive advantage within industrial clusters and through these to be led towards those applicable to maritime clusters, which pertain to a very interesting industrial cluster divide that has been the focus of multi-level attention in recent decades. Through the reference of the origination of cluster theory within economics, we visit the causes and factors that make clusters so unique and worthy of such devoted analysis and attention. From these we attempt to extract those more pertinent with respect to a sustainable competitive advantage. The elements of the compiling theories that are prevalent today and their novel constituents formulated by modern research are attended as well. As will effortlessly surface, it seems that the threads of competitive advantage within industrial clusters are as elusive as they are evident, so as within any attempt to explain a complex conceptual or physical construct, prudence and materiality are required within our analysis, if our theoretical or empirical results are to be of utility.

Cluster theory

Though von Thünen's 1826 work 'Der isolierte Staat' (The Isolated State) has been given credit with respect to the pavement of the threads of modern cluster theory (Andersson et al. 2004), the majority of researchers consider Alfred Marshall as the forefather of industrial cluster theory and this because in his 'Principles of Economics' (1890/1920) he provides a discrete chapter on 'The Concentration of Specialized Industries in Particular Localities.' Even from the chapter's name we can extract one major pillar of his theory, that of competitive advantage through specialization, and this to find interesting direct contrast with Jacobs' (1969) diversification theory, to the point that the two may be considered as distinctively separate schools of thought. These two theories even today are put to the test with conflicting results, for some studies favour the one, where the rest, the other. As is evident in the literature apart from the divide, there are instances where both sides play their own part in competitiveness, so maybe in the end they are not conflicting, but complementary theories.

Marshall's work finds such a prosperous gathering of acceptance for he introduced the parameters that are coined as agglomeration economies (that act as the trigger of localized prosperity) and consist of: better access to skilled labour (labour market pooling in proximity-locality), specialized suppliers (shared inputs-local supplier linkages), and knowledge spillovers (local) from competing firms. These factors (in addition to physical conditions, referenced by Marshall as a 'chief cause') as discrete economies themselves and/or as externalities, find a plethora of research potential today for they are considered as the drivers of industrial clusters' competitiveness.

A venture to speculate that Marshall's work may pertain to a more fruitful extraction, lateral even to modern cluster theory, is attempted, for one of his main arguments is the importance of 'creating new wants.' One could presumably argue that 'new wants' is exactly the practical function of innovation and to strengthen this argument, the statement that "if one man starts a new idea, it is taken up by others and combined with suggestions of their own; and thus it becomes the source of further new ideas" points to the existence of a network that facilitates the constant germination of new ideas. But this is only referring to what today we coin as the 'system of innovation.' Another Marshallian reference is to the 'character of people' and to the institutions that formulate the cultural milieu. Akin to this extract, today's theory places institutions, governments, consortia, and agencies as central stakeholders with important roles in cluster well-being. Simultaneously, the holistic and inclusive definition of effective cultural surroundings and intricacies is found to facilitate cluster formulation and play a major part in its effective function. As a parting note from Marshall's work, we would be remiss if not referencing his "are as it were in the air" mention referring to trade skill-set acquisition deriving from localization. We observe that Marshall, though analytical throughout his work, does not leave out the trace of the mysterious and paradoxical; this, in synergy with the explicit. As we will observe, the mutual existence, acceptance, and dedication of radical extremes (such as analytical rigor and theoretical paradox) are key elements towards the understanding of functional industrial clusters.

Whence referencing the paradoxical and mysterious within the context of economics, one cannot but recall Adam Smith's 'invisible hand,' that even though was only a reference distraught from explanation and analysis in his work, has come to be a distinct economics' benchmark. We could attain the argument that it's not a coincidence that the one reference of the 'invisible hand' in the Wealth of Nations finds expression within the reconciliation of individual interest with collective prosperity (which as it appears is a central cluster paradox as well); yet pertains to another instance whence the good of the part is directly linked to the good of the whole (cf. with scarcity theory), even if the whole is responsible for the framework of adversaries and finite resources that situates the part. Smith also utilizes this reference whence analysing his 'domestic industry,' so it's maybe not erroneous to attribute this as a component of a clustered industry within a geographical concentration.

Whilst providing fabulous taxonomies and pertinent typologies, the latent, obscure, and paradoxical factor has not been left out of cluster theory and this maybe because the former attributes are simply not enough to grasp in entirety the rudiments of geographical concentration and its intricacies. Modern cluster theory finds its contemporary backbone in Michael Porter's 'The Competitive Advantage of Nations'

(1990). In this work Porter provides a model (the diamond model) that compiles the components of the competitive advantage of a cluster, or indeed any entity's 'locational competitive advantage.' This model though not barren of critique, is widely accepted and utilized today by researchers, practitioners, and policy makers, whence there is a need to analyse an industrial cluster's competitive position and to present an overview of the factors addressing it themselves.

Porter (2000) also analyses the 'location paradox' that is present whence the evident globalization and out-sourcing can co-exist with locational complementarities, to very elegantly conclude that "paradoxically, the most enduring competitive advantages in a global economy seem to be local." This phrase summarizes in near perfection the arduous and conflicting task of the analysis of industrial clusters and this because within a strict analytical framework, researching clusters is always an attempt to find normality in the odd and standardization within paradox. With a few exceptions, one may state that no definitive and general statement of an industrial cluster can be formulated, without including in some way or form an underlying paradox. It could be that it's just the way clusters are wired and by extension, where even though the presence of any paradox may be a nightmare from an analytical and decision-making perspective for it harbours uncertainty, it simultaneously is the guiding principle that renders clusters so fascinating.

We also wish to reference Porter's theory of competition that drives cooperation and vice versa (if not an additional paradox thence a contradiction that enjoys materiality nonetheless), or the aspects of a system that includes competition and cooperation under the same roof, nurtures and cares for both, so that instead of contradictory they become complementary. Cluster health and the definition of competitiveness through productivity and cultural norms are mentioned in Porter's work, as well. Regarding business strategies, Porter analyses how the firms within a cluster instead of focusing on low-cost business strategy shift towards differentiation and this, through innovation pressure. We finalize the section that pertains to this work as extracted from Porter's analysis with the need for efficient communication networks and trust. We can conclude that cluster theory is a rich and diverse construct of many (and at times, conflicting) components, that within a paradoxical setting, complement instead of engulfing one another.

Industrial clusters and competitive advantage

The factors that will create the paradoxical circumstances wherein the actors within an industrial cluster will flourish are expressions of innovation, trust, knowledge creation, and sharing that are interwoven in the theory, so much so that they can be considered as industrial cluster dimensions. Amin and Cohendet (1999) investigate the factor of proximity with reference to the formulation of competitive advantage to conclude that location does indeed affect competitiveness and Lin et al. (2006) utilize system dynamics to extract the factors that shape the competitive advantage of industrial clusters, focusing on the competition arising between clusters themselves. They move to point to the factors of inter-organization, productivity, and innovation. It seems that the network dynamics and linkages within the cluster along with its culture and innovation potential directly influence its prosperity.

Pinch et al. (2003) provide a pertinent analysis as to the competitive advantages of industrial clusters and the importance of knowledge management therein, whereas Roveda and Vecchiato (2008) raise the point of competitiveness, knowledge creation, and innovation capability from a foresight perspective. The widely accepted importance of knowledge creation, sharing, and innovation is attested. Zhang (2014) focuses on the competitive advantage of a specific firm within an industrial cluster perspective that adds beneficial aspects to its operations and Lima and Carpinetti (2012) investigate the dynamics of knowledge management and performance in an industrial cluster setting; these two concepts seem to be sharing common ground as well. Lai et al. (2014) investigate innovation performance from the perspective of the management of knowledge, to conclude that industrial clusters do facilitate knowledge creation that in turn drives innovation performance, for knowledge management presents itself as the vessel of innovation performance. There seems to be collective convergence as to the factors directing firms' competitiveness within an industrial cluster setting.

Zhang and Zhang (2008) investigate the competitive advantage of industrial clusters within a network environment perspective and Cai et al. (2010) provide insight with respect to the competitive advantages of several aspects of supply-chain industrial clusters. Networks of all sorts, including unofficial networks between the cluster's actors or the formal framework utilized for logistics missions, seem to play a crucial part in industrial clusters. Zhang (2011) analyses a case of an industrial cluster regarding its competitive advantage and Jing (2011), for the same analytical base, extracts a total of six latent factors upon which the competitive advantage of a maritime cluster is founded: the external scale economy, the scope economy, the regional resources, the government function, the reduction of transaction costs, the effect of learning and innovation, and the coordination mechanism of the cluster. The potential of typology extraction as well as the instruments regarding it find fruitful ground, both from past research and present potential. As we will observe, the theories and models applicable are numerous as well; the interesting eventuality is that they all share many if not most of the aforementioned dimensions. Zhou (2011) investigates the derivation of innovation capability as a governing parameter of the competitive advantage of industrial clusters utilizing an evolutionary game model, whereas Hsieh and Pai (2010) investigate the differentiation of service-oriented clusters to return the notion of co-branding alliances. It seems that concepts of competitive advantage are closely related to industrial cluster manifestation, so much so that we could relate to an industrial cluster through the presence of distinctive competitive advantages of all firms within. Research fortunately supplies a plethora of instruments and typologies that will facilitate industrial cluster analysis with respect to the threads and intricacies of competitive advantage. In addition, as has been mentioned above, nearly all share common values.

Hill and Brennan (2000) devise a methodology for identifying the sources of the drive within industrial clusters and Li and Ran (2009) explore trust complementarities through the social network within the cluster. We extract that the networks that clusters count upon are but a function of trust within and between their functional components. Chen and Xie (2009) investigate the dimension of an enterprise belief level within an industrial cluster setting and Li and Li (2007) provide a structural analysis of the instigating factors of rural industrial cluster competitive advantage. A divergence of models can be instituted to analyse a broad range of clustered constructs. Wilson and Spoehr (2010) investigate clusters' competitive advantage that derives from knowledge sharing and Lin and Sun (2010) investigate the correlation of competitive advantage on a national level, along with industrial cluster manifestation, referencing the importance of 'innovation culture' and of 'self-reinforcing' factors along with 'factor conditions'; at the same time they stress how internationalization can be inversely correlated with culture as a driving force. This could be perceived as an instance of Porter's 'location paradox.'

Galazova and Panfilova (2014) examine cross-border development of clusters and identify competitive advantages within these systems. Spillover theory is actively playing a role within cluster dynamics and this with relevant and respective boundary crossing. Akoorie and Ding (2009) study regional competitive advantages that derive from industrial cluster formulation and more specifically the culture of entrepreneurship, networks, and government support. These three pillars provide their own dynamic into the emerging potential of an industrial cluster. Kuo (2013) analyses the dimensions of market orientation, organizational performance, and organizational commitment through an industrial cluster basis and underlines the importance of the commitment of the human factor for the sustainability of a cluster's competitive advantage. We may observe that cluster analysis invites multi-dimensional models, as their population and pertinence enjoy abundance. Molina-Morales and Expósito-Langa (2012) link innovation to cluster dynamics and research and development intricacies and Clancy et al. (2001) utilize the diamond model and its applicability within specific case studies for the extraction of a national competitive advantage. The attainment of the latter as we can so far extract, depends on a finely tuned inter-dynamic of interaction between the basic constituents of clusters.

Brown et al. (2010) investigate externalities with respect to marketing whereas Felzensztein et al. (2014) analyse the co-operative strategies of clusters from a marketing standpoint to conclude that knowledge sharing adds significantly to a competitive position, even internationally. As was stated above, clusters affect the holistic system they encounter and not only particular functions therein. Rudi and Antrosio (2009) investigate linkages between 'cultural commons' and the economy within the context of obtaining competitive advantage through cluster manifestation, whereas Piperopoulos and Scase (2009) explore the growth and competitiveness of small and medium-sized enterprises in a cluster setting, utilizing a model of innovation within the cluster. Though innovation is the basic prevalent factor extracted from the analysis of industrial clusters, culture (as a discrete dimension) does play a crucial role as well; though the two seem to be interconnected.

The extracts from literature may formulate a truly diverse context, though the pillars of competitive advantage seem to stroll around cluster network dynamics, and cluster qualitative specifics, such as innovation, trust, and knowledge sharing; these not as mere constituents but more as interwoven elements that are altogether responsible for the magnificence of an industrial cluster. Though there may not be complete agreement with respect to the presence, magnitude, and importance of all the above, most theoretical and empirical and indeed most conceptual and physical analyses point to a diverse set of factors that interlock to lead to cluster opulence. This may be the reason that so many naturally formed clusters thrive while their orchestrated formulation is considered a very daunting and arduous task that many times does not achieve fruition (Andersson et al. 2004). Again, we can observe a natural and a paradoxical element.

Deriving from the pillars of economics and based on modern cluster theory, we could summarize that an industrial cluster is a function of the variables that are the system of innovation, cultural dynamics, trust, cooperation, competition, and oversight; these in tandem and harmonious co-existence with interwoven intrinsic paradox, as well as linkages to physical conditions.

The competitive advantage formulated within maritime clusters

Not one of the concepts within the previous section can be regarded as irrelevant with respect to the maritime industry and maritime clusters in particular; we could make the argument that they would even be more favourable, for maritime firms may provide a fertile ground for prosperity and sustainable competitive advantage within a cluster setting. Zhang and Lam (2013) provide insight as to maritime cluster evolution through a ‘predator-prey’ model; their correlation of maritime clusters with an ecological model based in natural systems is quite inspiring. Jin and Zhen (2013) similarly investigate maritime cluster dynamics utilizing ecological models to extract and compare competitive advantages. It is interesting to witness ecological models used with respect to manmade systems, but even more so whence clusters are concerned. It seems that clusters of any kind find themselves composed of nature, or at least centrally infused with natural elements and functions, one way or another.

Othman et al. (2011) provide an overview of the Malaysian maritime cluster with respect to competitive advantage and its implications regarding policy. The aspect of policy is a major one, for governance is an important aspect of the health of a maritime cluster, as it plays its part accordingly. Benito et al. (2003) analyse a maritime cluster based on the diamond model and Monteiro et al. (2013) provide a benchmarking analysis utilizing a factor framework and reconceptualise the diamond model. Porter’s diamond model provides a prevalent practical framework for the extraction of the dimensions and the factors affecting locational competitive advantage. Brett and Roe (2010) research Ireland’s clustering potential and Jenssen (2003) investigates how innovation can be sustainable in order to foster competitiveness for the Norwegian maritime cluster. Many maritime clusters’ studies utilize national clusters as a base of analysis, a fact that is extremely interesting as to its effect on the analysis itself. Pinto and De Andrade (2013) study maritime clusters’ innovation drivers to return the notion that maritime clusters have similar innovation capability. Exactly because of the fact that innovation is considered as a prime ingredient of the competitive advantage within industrial clusters, this find could lead to the formulation of different typologies of the innovation system, based on diverse industrial clusters, thus adding to the body of knowledge preoccupied with innovation systems from an industrial cluster perspective.

Laaksonen and Mäkinen (2013) investigate the drivers of maritime clusters' competitiveness and reference the holistic environment that the clusters' health is dependent upon. At the same time, they analyse the competitiveness of the clusters in the Baltic Sea region utilizing the diamond model. Again, the importance of conflicting stakes all materializing within a cluster perspective as a symbiotic manifestation is evident. Makkonen et al. (2013) investigate the different types of innovation in a maritime cluster; the parameters of intra-firm as well as extra-firm collaborations are supported and with respect to innovation, it is incremental innovation that is favoured over radical innovation. At this point we could state that the thesis with reference to a pattern (that though holds definite and distinctive differences in its practical applications, does indeed seem to share common values, dimensions, and drive) guiding cluster dynamics may be supported further.

Kraaijeveld (2012) analyses the Dutch maritime industry regarding cluster formulation potential and Doloreux and Melançon (2008) investigate the innovation capability of a maritime cluster exploring the effect of knowledge management, firm size, and cluster dynamics. They move to stress that from a policy drafting standpoint, mitigation strategies cannot consider the cluster concept as a panacea, but that research pertaining to region-specific solutions must be the priority, and that caution is required whence applying cluster theory to maritime industries. This culture of prudence should be pursued further, for every theory has intrinsic limitations and cannot be universally uncontested, even if its applications enjoy celebrated opulence.

Ortega et al. (2013) investigate the potential emergence of maritime clusters. This work references the divide of industrial clusters that were fabricated and not only supported by policy and oversight. Isaksen (2009) analyses innovation dynamics and finds that they are greatly facilitated by a system of innovation; region-specific knowledge, culture, and trust are also referenced, as well as the importance of governmental national policy. We could exclaim that maritime clusters share more similarities than differences with their generic industrial cluster counterparts.

Jansson (2011) investigates the correlation of innovation and engineering capability whereas Lee et al. (2014) perform a competitiveness analysis utilizing a model of present and potential competitiveness within a framework of factors that affect said competitiveness. As mentioned, innovation can be paired with a plethora of dimensions and the theory exhibits a substantial potential for model formulation. De Langen (2002) analyses maritime cluster competitiveness through a model and renders a cluster construct including the 'cluster core' and 'relevant cluster region' and presents the factors that affect maritime clusters' performance. Doloreux and Shearmur (2009) explore the relation of policy effectiveness and innovation dynamics within maritime clusters. The importance of a culture of entrepreneurship and collaboration that will serve as a basis of effective cluster policies is stressed. Shinohara (2010) introduces the constituent of sustainable competitiveness for maritime clusters and points to the necessity for governmental support (especially in the cluster formation process), for networks with strong relationships and ties, and for a collaborative spirit (cf. with common values and culture); these elements surface as essential for a maritime cluster's sustainable competitive position.

The factors pertaining to the formation of competitive advantage within a maritime cluster are of the same stock as whence analysing industrial clusters in general. It would maybe be interesting to provide more insight as to the horizontal differences of the various cluster formations, for we can expect that their collective drivers are trust and innovation, cooperation, competition (and cooperative competition or competitive cooperation per se), culture (whether in norms, customs or context, but definitely fertile and potent in its roots), and specialization (cf. with the business strategy of differentiation, as well as with the extracts of harbouring a culture of liberal specialization; the latter will bloom into a plethora of specialized components that are quite diverse between them), as well as knowledge creation, knowledge sharing, and knowledge management. Maritime clusters seem to be yet another instance of industrial clusters that includes a streamlined dynamic crystallization of competitive advantage.

Critical review and discussion

From cluster theory we may be able to procure an indicative extract of the factors that formulate competitive advantage within industrial clusters, to be led to a review concerning the competitiveness of industrial clusters in general. Through this process we ultimately arrive at the topic of maritime clusters. Though many industrial cluster settings seem to hold the same or at least similar characteristics, it would be fruitful to investigate how diverse industrial cluster architecture affects competitive advantage of the firms within. From literature we cannot extract definite characteristics that set maritime clusters apart completely; there are some fine differences especially in the topics of structure and linkages, but what keeps them together with other cluster families seems to be stronger than what sets them apart. From the analytical standpoint it is very interesting to observe that regardless of cluster function, the interlocking framework seems to be very similar between clusters; though this theoretical assessment should be strengthened or dismissed through empirical analysis.

A major component of the competitive advantage of the firms that are active within an industrial cluster setting that manifests itself as a competitive advantage of the cluster itself (if without harm to the concept itself we are allowed to generalize), is the generation of new knowledge, that exactly because of a culture that fosters prosperity of ideas and mutualism (culture does remind us of a catalyst's features), leads to distinctive blossoming of parallel innovation. This to such an extent that in modern analysis the component of innovation is generally considered as a sine qua non of industrial cluster activity.

The basic question would be if innovation really is in the heart of all cluster manifestation and if it was taken away as a characteristic, if it would render the cluster in paralysis. This could be extracted from cluster comparison within a broader scope, for maybe this point could be intricately correlated with other clusters, from a natural origin. Ants formulate natural biological clusters coined as colonies; the use of the term cluster is valid though, for they do form a geographic concentration of (physically and conceptually) interconnected entities, in a (literally) field wherein they are found to compete but also cooperate. Therefore, we may not be able to readily discard cluster theory specifics applicable wherever there is abundance and prosperity among different actors and roles in a cluster wherein cooperation and competition are prerequisites, at least on a theoretical basis. Although we should investigate innovation with respect to our natural cluster example. From a sterile perspective an ant abides to its instinct and tries to do its best to survive; this interpretation leaves no room for a tiny creature to exhibit any trace of creativity and divergence from the norm.

In reality (and akin to business reality), an ant is facing a diverse and abundant array of hurdles against its survival, including an ever-changing environment; through eons of evolution of its species, the secrets of survival have been delivered through learning processes, network dynamics, and adaptation within a given geographical concentration and these in order to better exploit natural resources within a completely sustainable perspective; not to mention nature's utility for the ants' role in the grand scheme of ecosystemic interaction (and interdependence) that is definitely an innovative function. Thereby, an ant innovates in perpetuity to pursue its survival. Evolution is nature's intrinsic application of innovation, for innovation and evolution share the same vision: convenient survival through contesting the old and adapting to change. In nearly all applications, teams are formulated to pursue common objectives and through the consolidation of the former within a temporal perspective, a shared vision is communicated.

The above happens to be what business is about, as well. To share a vision that results in creating collective wealth. Through the oversimplifying natural example above, we move to contemplate that we maybe should not dismiss the thesis that innovation is the unifying constituent within all clusters. There is still much to research, but it is suggested that the analysis of clusters on the base of competitive advantage therein will provide the key that will unlock most of their intricacies. From the conceptual standpoint, the inventory of items with respect to competitive advantages within industrial clusters would be compiled with innovation based on the culture and structure that fosters it on the centreline; either if this culture regards to a competitive framework for cluster dynamics, or that including fertilization of entrepreneurship. Culture (within any context) seems to provide the fuel for clusters' viability. In addition, within the intricate network of the cluster's entities there seems to reside an abundance of trust, knowledge sharing, and cooperation, along with competition. Along these lines, complementary and constructive oversight can be incorporated as the final touch.

Clusters are an instance wherein two sides of a divide (such as competition and cooperation) find reconciliation and simultaneous synergistic manifestation. Whence the objective is based on understanding the necessity of collective health, competition can materialize through mutually benefiting instances and results. It could be that clusters are the practical application of an enduring cooperating strategy; regardless of scope, clusters surface as a holistic systemic approach towards not only survival but wellbeing within a eusocial (adapted, generalized, and inclusive use of the term) understanding. It seems that whenever a foundation consists of mutualistic threads, thence even pure competition of the actors will lead to systemic flourishing. These specifics are intrinsic within symbiotic concepts; cooperation can be extracted through a diverse and sometimes superficially conflicting manner that does not render itself readily apparent due to system complexity. But there is wisdom and order in the deep and whence clusters are concerned, even from their initial analytical step, all concepts have to factor in the most daunting of factors, that of paradox (that manifests itself with such opulent confidence that should probably be considered as a separate dimension itself).

There is also evidence that pertinent oversight is required and that governmental agencies, organizations, and/or other supporting institutions play a major role in cluster sustainability; of course, this is one of the main reasons that the field of industrial cluster policies is diverse and extensive, yet experiencing growth. The novel approach to the consideration of economic activity, by letting go of the industrial taxonomies and instead regarding the former as the function of an organism is truly a marvellous step towards more effective decision making. The symbiosis of all systemic entities may find little ground in common with many traditional theories, but it seems to be the way of the world, the way of nature; to achieve permanence through constant innovative evolution. If firms wish to partake, thence the theoretical corollaries should be held high.

One cannot pardon paradoxes from our study though we must stress that it's within these paradoxes that competitive advantages reside and flourish. The days of the survival of the unilaterally fittest have long come to pass, for the fittest have become grotesquely bloated existences and the not so fit have managed to survive through adaptation and the creation of new needs, markets, and values; all through what made them unfit in the first place. Thus, the definition of 'fit' has changed, leading to a clear shift of paradigm. This shift seems more intimately related with a humane approach as its predecessor. Within a jungle where the strongest calls the shots and monopoly is king, this turn of events is truly very intriguing of not hopeful.

Cluster theory may hold the potential to transform firms, industries, nations, and above all, people and pass on the torch of mutual benefit through competitive symbiosis, rather than zero-sum games and guerrilla tactics. This theory may pertain to a major shift in business, akin to the shift that the human relations' school was responsible for and instigated in 1930. The huge interest of so many and diverse levels towards clusters just documents the need towards a more systemic, holistic, and organic way of interpreting the world and human activity. Networks may be ready to embrace change for the benefit of all and through this paradox to constitute a new era of prosperity and abundance where everything conceivable is possible and within arm's reach, even if it's intangible. It is through the acceptance of paradox and the celebration of its persistence that clusters thrive.

In no context should industrial clusters be considered as the golden rule, for all systems of agglomerations do sustain their own constraints and caveats. From a completely theoretical scanning and static retraction of further analysis, two types of hazards can be extracted that seem to be lurking, ready to undercut cluster benefits for loss and turmoil. The first one resides within clusters themselves; it may appear that industrial clusters are the vanguard of collective innovation, but it may be that this is true for innovative activities within a certain context and culture. The attempt to innovate despite context may not find adequate acceptance and be stifled, leading to isolation, whereas if the entity attempted to innovate elsewhere, it could have held a greater chance of survival. Clusters may present themselves as the astonishing solution to make everything and everyone better, but absolute generalizations may prove to be erroneous, for in any case there are no guaranties. An industrial cluster setting may provide a more dynamic and satiable environment for sustainable cooperation and complementary competition, but in no way does it provide a deterministic baseline for success. Not only there are no absolute certainties for any and indeed all members of a cluster, but the same holds true for the cluster itself. This may be the final paradox accompanying industrial clusters.

The second hazard is conceptual and regarding the theoretical infrastructure with respect to industrial clusters. Cluster theory specifics are with an intrinsic danger of hinting to universal applicability whence their viability may be nothing but local. That said, attempts to duplicate location-specific competitive advantage may face catastrophic failure and the application of the theory itself may be erroneous. Cluster manifestation may be generally accepted to provide extended benefits for its geographical concentration of entities, but that is not to say the same benefit, or even any benefit per se, will be manifested in any other geographical location. It maybe would be more beneficial and even more substantial to follow the cluster parameters of component cooperation within a sustainable symbiotic sphere, than to begin analysis by fixating on the cluster concept by itself. So maybe the most prudent suggestion is that we extract the pillars that make the cluster concept great, instead of arbitrarily forcing the theory wherever and pondering upon its potential whence it is not naturally applicable. Maybe clusters are there so that we can see and understand exactly that, the framework of values within them, the threads that make them function so efficiently, and the need for the establishment of a culture of mutualism, rather than their absolute formulation as entities with implicit nominal and universal benefits.

The fixation thence should be upon creating collective insurmountable pristine value through symbiotic principles rather than anything else. Maybe the lesson to be learned is that it is natural to have paradox dwindling in economic activity rather than rigid specifications; that through fuzziness will come greater reward (if there exists a foundation of mutualism), but most importantly, that our sworn competitor can be a trusted ally, for within their wellbeing lies our own sustainability. Exactly here lies the core of the cluster concept. Cluster manifestation is the reward of fertile componential operations through the acceptance of the operations of the environment; and possibly this is what cluster theory is all about: the respect and celebration of a diverse structural configuration that understands the necessity of collective health from an oversight perspective and from the firm’s level, the need to embrace all kinds of our environment, for only within its viability will we get closer to our vision.

The heart of the cluster’s competitive advantage is the acceptance of our surroundings and the necessity that these environmental components accordingly choose their destiny for themselves, for our stake is not at what they choose, but in the fact that they are there to make an unbiased choice in the first place. The crucial parameter is the intrinsic understanding that managerial entities may not be able to analyse and extract all actions of their environment in a wider context and in perpetuity. What may seem to be a damaging eventuality from our competitors may prove to be the reason we tapped in a new market. So, in the end, the key of industrial clusters is one of mutualism and enduring synergistic acceptance of our task environment. It could be considered as a truly valorous concept, that through other entities' sustainability we will achieve more within a scarcity perspective, but it's not valorous, or gallant, or even intricate or sophisticated. What it is consists of nature's recipe for true permanence. This formulates the cornerstone of competitive advantage; the drive for evolution and prosperity should many times be passed beyond the confines of our operation rather than within them, for our direct and indirect competition is a prerequisite of our efficient operation, even more than we can ever perceive.

Conclusions

Within a cluster one expects, among other things, sustainable competition that will not lead to monopolies but will rather embrace radically novel prospects through the infinitely generous palette that is innovation. The fate of industries is no longer consolidation but rather dynamic differentiation and through this, a collective abundance of prosperity may be achieved. Of course, for all the above to reach any level of materiality, competitiveness is the prerequisite. From the present review we venture to propose that the competitive advantage of industrial clusters and maritime clusters in particular lies within themselves, their systemic origin, and holistic manifestation; so much so that maybe we should not concern ourselves with the competitive advantage within a cluster or that emanating from a cluster, but regard the cluster itself as the competitive advantage. This because competitive advantage within itself is a consolidated dynamic inventory of an entity's competencies and if the latter are distinctive, they will lead to a sustainable competitive advantage, i.e. the exact effect of a healthy cluster.

We venture to extend an interpretation of the pinnacles of disciplines such as strategic management, marketing, business management etc. as the manifestation of competitiveness. If we were to seek similarities throughout all components of a productive entity, from the janitor to the directors and from the clerk to the executive officers, we should share exactly this: the dynamic link between them is the vision of a sustainable competitive advantage for their operations. Clusters promise just that: a sustainable competitive advantage that will derive from synergies, complementarities, cooperation, and rivalry, as well; this within a shared and holistic framework. It is as though the cluster provides the base of sustainable freedom of expression tagged with optimism of operations, for any cluster component is free to manifest itself as long as the cluster is respected and at the same time all components are savouring the exclusive conditions within the cluster; even if this means not only proximity to competitors, but the sustainability of their competitive advantage as well. Cluster dynamics remind us of an inclusive centralized framework wherein the power and industrial consolidation of monopolistic abundance is paired with mutualism and a symbiotic population interaction.

With this work we have made the attempt to tap into the competitive advantage of maritime clusters through theoretical analysis and literature review. We return the notion that maritime clusters though holding their distinct differentiation of operations from other industrial clusters are not that different from a cluster theory approach and this because clusters seem to exhibit similar (if not same) patterns of dynamics, advantages, and governing parameters. A very promising aspect of this theory is that though it has gathered attention and is holding a body of knowledge of its own, there is much potential in truly numerous aspects of analysis; albeit theoretical or empirical, we could maybe state that it is still dawn for this theory's life-cycle. Future research can focus on (including and not limited to) typologies extraction, instrument formulation, theoretical cultivation of dimensions, and experimentations involving the cluster concept. More specifically, another point of interest would be the formulation of an inventory of models dealing with the interconnection of learning, knowledge creation and knowledge sharing, innovation, and competitiveness within their industrial cluster settings. Meta-analysis would be a definite direction for future research in order to further explore the instruments of competitive advantage from an empirical standpoint.

As with indeed nearly all reviews there are strings attached. Conclusions, extracts, and analyses are destined to be restricted within the scope and depth of a specific analytical framework. Though we have tried to provide a concise yet inclusive approach to investigate the competitive advantage of maritime clusters, this work should be considered as a dynamic sample of theoretical analysis that should be constructively contested and put to the test in order to investigate its reliability and validity. In tandem with the limitations of research, it is a privilege to at least attempt to steer through the murky waters of maritime clusters' competitive advantage, trying to make sense out of conflict and paradox and conceive order in the manifestation of the stochastic. But therein lies the challenge, promise, and charm that has driven research interest to industrial clusters; the fact that no absolute statement may stand in perpetuity, but little by little we may be able to tap into this fascinating phenomenon and slowly but surely understand it and even recreate its marvel, so long as we always keep in mind and accept that paradox may not be a hurdle, but an opportunity to broaden our horizons; and this because at their core, that is what all clusters are, an assertive manifestation of the reconciliation of paradox.

I (3) – The culture of maritime clusters

Industrial clusters have been considered to hold the keys of sustainable competitiveness, for firms, sectors, and regions. These constructs of industry are very important for research, policy, and practice, since within them, a network of members cooperates and competes within a mutualistic understanding that leads to innovation. The dynamics within clusters more closely resemble a healthy and dynamic society, than an agglomeration of businesses. These dynamics surface as a collective culture within clusters of many industries and sectors. A case of clusters that pertains to special interest is that of maritime clusters. Due to the importance of the maritime sector for regional economies, as well as the types of societal dynamics that exhibit themselves within the maritime industry, these specific types of clusters can be considered as cluster benchmarks. Through a structured literature review, an attempt is made to uncover the threads of the culture of mutualism within these types of clusters.

Introduction

In recent decades there has been a positive shift of varied interest with respect to industry clusters, as these manifestations of economic activity seem to harness collective sustainability. From the birth of industrial cluster theory, its poise was exhibited as descriptive, for industrial clusters hold a plethora of impressive and indelible qualities. Maritime clusters have been the object of multifaceted studies, for they may incontestably sanction prosperity. The positive externalities of maritime clusters have captured the ambition of practitioners and the attention of policy, to the extent that memorable effort has been directed towards reconfiguring and creating these clusters ex nihilo. Simultaneously, research has attained a better understanding of these entities of industry, though the book of industrial clusters is far from complete. Within this body of knowledge, the analytical review and consolidation of the latent constituents that fabricate maritime cluster affluence is relatively scarce, hence the aim of the present work.

Within a global environment of adverse and dynamic competition, supply chains of all industries are constantly striving to remain competitive. This volatility has presented itself with major shifts of power with respect to the perpetual cycle of manufacturing and consumption. The bridge between these functions - that of transportation and logistics - has gained indicative importance within many aspects of analysis, as it may hold the key towards sustainable operations. The competitive advantage deriving from the optimization of transportation and logistics can manifest itself within the context of firms, nations, and global supply chains, accordingly. Sustainable transportation can ‘make or break’ a supply chain, and for this reason, cases within the transportation domain that foster healthy operations, are of interest. One of these cases considers the agglomeration of industrial activity within a given location and sector, coined as an industrial cluster. These bundles of interconnected entities manifest health and competitiveness, through the catalyst that is innovation. Componential characteristics of transportation may formulate industry clusters, as is exhibited within many cases of transportation, distribution, and logistics clusters.

Among the differentiations of cluster types, there are some threads that seem to be common among them. The most prevalent of these, as it seems, is culture. The culture within industrial clusters renders a system of innovation capable of circumventing the scarcity principle within a locality, to the point that many firms with conflicting stakes may thrive simultaneously. This culture is not left to chance, but is forged through contrast and adversity, with the fuel of strategy. Strategic management within industrial clusters is a predominant characteristic that can decide the viability of the cluster itself. At first this may seem paradoxical, but culture within clusters provides the kindling of strategic planning, so that all members of the cluster may strive towards their respective vision, and at the same time not threaten each other. The collection of values and convictions within a cluster formulates sustainable strategy that germinates into a constellation of systemic innovation that remains unparalleled.

An indicative case within this domain refers to clusters centred on maritime activities. Due to the individual characteristics of the maritime industry, the gravity of maritime operations for regional economies, and the type of competition within, maritime clusters formulate exemplary cases of industrial agglomeration. The culture of strategy within a maritime cluster has fostered sustainable competitive advantages for regions and nations altogether. Through a systematic review of literature, the attempt to relinquish an effective strategic management framework based upon the culture of maritime clusters, is contemplated. Within an analytical approach, the threads of effective culture within maritime clusters are investigated, and their strategic counterparts assessed. This assessment generates the components of strategic management that resonate with sustainable transportation, to formulate a framework that can be applicable within transportation clusters. Through this process, there will hopefully be rendered a generic concept that can be applied towards sustainable strategy for transportation and logistics operations.

To render this framework, a systematic literature review is conducted. This review starts with a wide scope, concerning the generic theory of industry clusters, continues to transportation and logistics clusters, to arrive at maritime cluster theory. Through this methodology, generic traits of industry clusters can be paired with those found only within a specialized manifestation of a sector. The framework formulated herein, will include the rudiments of culture that make maritime clusters so successful. The attempt to recreate cluster dynamics would then be facilitated, as clusters' governing aspects lie within their latent culture. This may be one of the reasons that cluster creation is presented with so many hurdles. These constructs are not the sum of their parts, as what holds them together is not some tangible structure, but the culture that the whole cluster shares.

Indeed, one of the predominant paradoxes that manifests itself within nearly all industrial clusters, is the fact that within a bound geographical region where resources are finite as per the scarcity principle, all the entities within the cluster seem to thrive, at the same time. Where competition would otherwise lead the industry from fragmentation to consolidation, within a cluster, strategies of differentiation seem to guide a perpetual momentum towards continuous diversification. This, to the point that new markets and industries are created, instead of leading the industry to maturity and decay. This mechanism is facilitated through the catalyst that is innovation. The latter helps to circumvent the scarcity principle, and in its place, create new opportunities for the cluster's members, instead of pointing them towards zero-sum games. This type of innovation dynamic is perpetuated through the shared values and convictions within a cluster that do not seem to manifest themselves elsewhere. Industry clusters seem to portray a kind of silent understanding among their members, that leads them to collective and mutual decisions that will benefit the cluster (i.e. each other), rather than competing for the same resources that will render the cluster inefficient.

Therefore, within industrial clusters, there seems to be exhibited a culture of mutualism that benefits all members simultaneously and leads them to thrive, collectively. In addition, all members seem to respect and reinforce this culture, as they are aware that it is a prerequisite for the cluster's (and their own) health. Through this work, an attempt is made to map this culture that stands as the lifeblood of an industrial cluster. Should the attempt be considered successful, the framework of culture traits can be utilized to provide a better understanding for an industrial cluster's dynamics. In addition, the framework may facilitate strategic management within industry clusters, since it will provide the necessary structure that the management of strategy must adhere to, so that it remains effective.

Industrial cluster theory

The theory of industrial clusters does not pertain to one academic discipline, rather, it holds a more interdisciplinary character. For this reason, its origin may be set upon a sphere of interpretation, provided by respective points of view. These may include economics, behavioural economics, location theory, and economic geography, among others. Within the differences that may surface with respect to the theory of industry clusters among, or even within, disciplines, there are similarities, as well. One similarity that will be included within any attempt to explain the phenomenon of industrial clusters, is that of the inclusion, or rudimentary existence, of paradox. Clusters seem to manifest themselves within paradox, and exhibit their arsenal of particularities, within an array of paradoxical circumstances. As already mentioned, a basic paradox of industrial cluster activity, is the circumvention of the scarcity principle that is a basic notion for the whole domain of economics. When referencing paradox and economics, one would be remiss not to include Adam Smith's (1776) 'invisible hand' that is considered to guide prosperity within a regional economy.

Though Adam Smith has not been coined with a formal contribution to industrial cluster theory directly, the resonance with paradoxical behaviour within an industry, and his 'invisible hand,' is obvious. The same way that there exists an invisible hand within a regional economy that will facilitate a domestic industry in aligning individual interest with the benefits of the greater system of the economy, as such will the culture of an industry cluster provide collective benefits for its members. The absence of a direct contribution of Smith to the theory is referenced, as indirectly he is indeed coined, through the work of von Thünen (Clark 1967). The Thünian system (1826) provides a benchmark for location theory and carves the rudiments of centralization for clustering, within a region. This system is governed by many parameters that include the shelf life of commodities, perfect competition, and ceteris paribus dynamics. The aspect of perfect competition is reflected within the dynamics of maritime activity that also are considered to exhibit (near) perfect competition. In addition, the centralization aspect of the Thünian system is found to be active within many modern industry cluster analyses, as will be documented below. The model presented in von Thünen's work was criticized for absence of universal applicability (Chisholm 1969), though seldom do models hold any aspiration towards the capacity of complete generalization. The Thünian system concerns the philosophy of cost minimization, as that of Weber's (1909) that pertains to the inverse problem to that of von Thünen (Chisholm 1973). It is interesting to note that the peculiarities of agglomeration make do for allowances within analyses, as these are reflected with notions 'without claiming completeness' such as Weber's "this book is expected to be a beginning, not an end."

Weber did contribute significantly to the theory, not to mention his 'economy of agglomeration,' with pure disposition to modern theory, as well as its linkages to economies of scale (and other types of economies). Within his formulation, there are agglomerative factors that will facilitate cluster formulation and de-agglomerative factors that hinder an industrial cluster's health. A very important aspect of today's theory - that of proximity-driven-cooperation - can be traced within his work about social agglomeration, as well as his important concept of ‘social concentrations.’ For Weber, agglomeration will lead to technical specialization that gives birth to novel ‘auxiliary’ industries (we could coin this as specialization-driven-innovation). Even though the developed industries are new, they still have linkages with the cluster. Positive externalities with respect to acquisition costs are referenced and agglomeration provides a more viable supply chain. Another important aspect within his work is the three-tier classification, albeit ‘general or special,’ ‘regional or agglomeration,’ and ‘natural or technical.’ The indicative weight of the minimization of transport costs is included as well. This may very well pertain to a precursor of the importance of transportation and logistics clusters. The correlation of centralization and spatial proximity was further strengthened by Christaller (von Böventer 1969). The Thünian and Weberian systems concern the primary and secondary economic activity sectors respectively, while Christaller’s central place model involves the tertiary sector (Pinto 1975). Christaller’s model included three basic constituents, the market, traffic, and separation (administration). Again, transportation and logistics aspects are seen to hold important roles within the agglomerative forces of economic activity.

After the contributors of location theory that offer a facet towards industrial cluster theory, the first of the neoclassical economists, Alfred Marshall (1890/1920), provides the basic factors that will drive prosperity through regional agglomeration. These are coined as ‘agglomeration economies,’ that are better access to skilled labour (regional labour market pooling), specialized suppliers (shared inputs), and local knowledge spillovers. Agglomeration is explained due to the cost reductions that result from the economics of agglomeration (McDonald and McMillen 2007). Beyond the explanation for regional agglomeration that Marshall provides, an important contribution of his work pertains to the 'patronage of a court' that may provide some semblance to policy and governance. This would be added to the social forces that constitute the cluster that include cultural dynamics of shared values and convictions that fortify agglomeration effects. To conclude with Marshall's seminal contribution to the theory of industrial clusters, comes his reference to the skills that are passed on between generations within a cluster of industry that are "but as it were in the air, the children learn many of them subconsciously." Many aspects of his contributions to the theory hint to the latent culture within an industry cluster that will sustain its dynamics.

Moving on from Marshall's agglomeration economies all the way to today's theory, we observe a shift of importance and focus, towards a more strategic approach with respect to industrial clusters. This shift can be exhibited within M. Porter's (2000) contribution that includes his 'location paradox' regarding globalization and regional importance. Obscurity and paradox seem to be intertwined within the germination of the theory. One of the reasons behind this instance is that industrial clusters are not manifested as a straightforward construct of activity, but rather of a relational society, active within a distinct sector. This society manifests traits of effectiveness and mutualism, to the point that we may consider it entailing a culture of trust within. Through this effective and healthy culture, an array of traits can bloom and manifest within competitiveness and sustainability, for firms, as well as for the cluster itself. The threads and rudiments of this culture would be very beneficial for the study of clusters, though to attempt this compilation, would mean delving into focused extracts of the theory as a prerequisite. After the main extracts of the theory, a more detailed examination as per the referenced culture is ventured and included in the section that follows.

The culture of industrial clusters

Industry clusters have provided pertinent cases of study, since they seem to portray and provide added value and benefits to their members, and localities. Clusters of industries are very important for regional economies, from a variety of perspectives. These include policy and governance, research and higher education, strategy and competitiveness. Clusters portray differentiations based on the core industry that has provided the kindling for the cluster, in addition to many variations exhibited within clusters of the same industry, or type. What may be introduced at this point as simple conjecture, is that regardless of cluster type, there exists a closely-knit culture within its societal dynamics that is responsible for its distinct manifestations. Shared values and convictions may both explain many paradoxical cluster traits, along with their externalities. An important step towards the investigation of this point is the relevant review of the theoretical and empirical investigations available, within the formulated body of knowledge that concerns clusters of industry.

The concentration of economic activity coined as industrial clustering, may pose a stand for research opportunities with much potential. Though the concept itself is not without pitfalls and ambiguity (Gordon and McCann 2000). Its drawbacks and obscurity may serve as a stepping-stone to gather more information and develop frameworks and models to understand the phenomenon with more detail. Many industries, regions, and localities are found to portray clustering effects; these include cultural and creative industries (Evans 2009; Lazzeretti et al. 2012), in addition to (developing) countries (Bair and Gereffi 2001; Bell and Albu 1999). Firms may find the need to co-locate, for a variety of reasons (Stuart and Sorenson 2003). Clusters are found to operate differently, whether referencing intrinsic or extrinsic dynamics, such as their inclusion within global value chains (Humphrey and Schmitz 2002). All the while, their impact on innovation capacity is considered important (Furman et al. 2002), in addition to their lateral effects on firm performance (Bell 2005).

The topic of innovation dynamics within industry clusters is a volatile one, and is far from complete (Hjalager 2010); evidence may point to the fact that proximity bottlenecks may hamper cluster externalities (Baptista and Swann 1998). The queries with respect to innovation may lead to distinctions and differentiations of innovation systems within different types of clusters (Asheim and Coenen 2005). Research suggests than not only is a cluster able to impose changes on systems of innovation, but that knowledge creation specifics may impose change to the cluster itself (Giuliani and Bell 2005). These traits of knowledge creation, learning (Amin and Cohendet 1999), innovation (Whittington et al. 2009), and dynamics (Swann and Prevezer 1996) within clusters are not homogenous, and require scrutiny, since generalizations with respect to the whole cluster may be erroneous (Giuliani 2007). Indeed, separate clusters seem to deem distinct investigation (Birkinshaw and Hood 2000). What may be concluded though, is that industry clusters provide a plethoric framework for the analysis of knowledge transfer and innovation networks (Sammarra and Biggiero 2008).

The externalities of clusters may formulate and have effect upon novel benchmarks and specific concepts, such as collective efficiency (Schmitz 1995a; Schmitz 1999) and collaborative innovation (Zhang and Yu 2013). The network of cluster members and their relational characteristics formulate relevant themes for investigation (Wolfe and Gertler 2004), in addition to cluster typologies, classification methodologies (Iammarino and McCann 2006), and templates (Feser and Bergman 2000). Each member of the cluster may contribute towards its culture, as different types of members may support diverse facets of culture; for instance, entrepreneurial culture may play a pivotal role (Feldman 2001), due to the importance of entrepreneurship in cluster formulation (Feldman et al. 2005), as well as due to the impact of clusters on entrepreneurship (Delgado et al. 2010). In addition, the social networks created within clusters impose constraints as to the entrepreneurial activities outside the cluster (Sorenson 2003). Knowledge sharing within networks of trust are important for the effectiveness and health of an industrial cluster (Dahl and Pedersen 2004). Collective action and shared sociocultural identity have been found to play their distinct part within clusters (Schmitz 1995b), in addition to intrinsic cluster characteristics (Giuliani 2005).

It seems that the societal dynamics that are active within the cluster drive its constituents towards the beneficial effects that are so sought after, that include advancement and evolution of the social capital within the cluster (Chen and Chen 2008). The constellation of actors within a cluster seems to formulate a network of trust (Dong et al. 2008), within its socio-cultural ties (Schmitz 1999), that shares and creates new knowledge, that in turn is transformed into innovation. In addition, the aspect of trust is of paramount importance for the promotion of the cluster (Das 1998). Trust is attained through complex and diverse processes that include the specifics of managerial factors (Juceviciene and Jucevicius 2014); its results can impose effects upon the cluster's effectiveness, as well (Mueller and Jungwirth 2016). The aspects of organizational trust and knowledge management are directly correlated (Niu 2010), and therefore pertain to extreme importance within a cluster. The relational characteristics of these elements are the object of study and relate to varied and interesting results (Niu et al. 2012). The latter circumvent the scarcity principle within a regional economy and lead to competitiveness of the firms that constitute the members of the clusters. Thus, the culture that is prevalent among the actors seems to portray a hue of sustainability, as mutualism and collectiveness prevails over zero-sum and cutthroat predatorial business tactics. It could be conjectured that the threads of this culture may be extracted, to further understand the specifics of clusters and maybe recreate its beneficial results.

Transportation, logistics, and maritime clusters

The transportation sector, including almost all its constituents, finds indicative resonance with topics of clustering and agglomeration. It has been demonstrated that clusters may provide an array of benefits to logistics functions (Rivera et al. 2016) and can stimulate their subsequent evolution (Rivera et al. 2014). Logistics operations clusters provide not only the generic cluster benefits (Keller et al. 2015), but also a fertile playing field for topics pertaining to academia (Elsner 2010; Jing and Cai 2010). The domain of researching transportation and logistics clusters can delve into many issues, that include their potential (Juchelka and Brenienek 2016), work force dynamics (Chhetri et al. 2014), fourth party services (Jensen 2012), and sustainability (Deng et al. 2013; Prause 2014). The aspect of policy is very important for both constructs (Nowakowska-Grunt et al. 2014) and can find distinct correlations with strategy (Chung 2016). The culture that nurtures cooperation, competition, and trust is prevalent (Rivera et al. 2016), in addition to regional competitiveness complementarities (Jaffee 2015; Sheffi 2013; Trupac 2008). The vast sector of transportation not only can support healthy cluster formulation, but both the sector and the cluster concept can work in synergy and complement one another. One explanation for this situation could be that the intrinsic efficiency demand of transportation that leads to a quasi-perfect competition context can pair with cluster externalities that harbour collectiveness and mutualism. Therefore, the analysis is once again provided with a propitious niche that derives directly from cluster culture. As perfect competition is referenced, one cannot leave out a domain that seems to thrive on it, the shipping industry. Therefore, the query is born, if the kind of resonance exhibited with transportation and logistics clusters will be apparent within maritime clusters, as well.

Maritime clusters have provided research with the potential to develop frameworks (Monteiro et al. 2013; Stavroulakis and Papadimitriou 2016; Zagkas and Lyridis 2011), models (Jansson 2011; Stavroulakis and Papadimitriou 2017; Zhang and Lam 2013; Zhang and Lam 2017), as well as theories (Jin and Zhen 2013). The evolution (Salvador 2014), critical mass (Doloreux and Melançon 2006), and mapping (Pinto and Cruz 2012) of maritime clusters are prevalent research topics, as well. The culture of maritime clusters in all its forms (Halse 2017) can affect regional and national strategic management topics (Valadas-Monteiro 2014), as well as transnational factors (Batur 2010). Maritime clusters have also provided viable cases for industrial cluster topics and the relevant body of knowledge is portraying significant growth in recent years.

The literature pertains to extracts with respect to policy and governance (Colbourne 2006; De Langen 2002; Doloreux et al. 2016; Laaksonen and Mäkinen 2013; Ortega et al. 2013; Sornn-Friese and Lversen 2014), as well as to the network that will germinate the culture of collectiveness (Amdam and Bjarnar 2015; Benito et al. 2003; Fløysand et al. 2012). Maritime clusters exhibit the generic cluster traits of innovation types (Jenssen 2003; Makkonen et al. 2013), dynamics relevant to the work force (Mitroussi 2008), career development (Mack 2007), sustainability (Shinohara 2010), strategy (Brandt et al. 2010; Fernández-Macho et al. 2015; Pinto et al. 2015), and competitiveness (Brett and Roe 2010; Doloreux and Shearmur 2009).

It is not yet clear if specific cluster types are able to portray extremely divergent characteristics from their generic counterparts and this can be the object of future research studies. It is clear though that all clusters types include a network of members that compete and cooperate (Mäkinen et al. 2014; Monteiro 2016) within a culture of trust that collectively benefits the whole cluster. One could deliver the notion that all clusters may share a basis of characteristics that is further enriched by the hue of its central industry. For example, maritime clusters may include the networks of knowledge creation and innovation that may be included in all clusters; additionally, these clusters may bear the traditions and culture of the maritime industry that have harboured respect and a hint of romanticism, for centuries. On the one hand, the shipping industry is fundamentally cyclical and within this governing parameter, many visionaries have been able to thrive. The maritime sector, in addition, does not carry attractive returns, from a fiscal perspective. Yet again, many entrepreneurs, even within these fundamentals, have been able to not only grow, but excel. These traits may have been carried within the culture of maritime clusters and may facilitate their beneficial attributes. An initial thought then, to generalize this notion, would be that each cluster is able to exhibit the culture of its core. Research could relinquish interesting results if this practical direction was ventured and assessed.

Conclusions

Industrial clusters have come to be considered very important for the economies they relate to, for a wide array of reasons. From the standpoint of the practitioner, an industry cluster holds the promise of a sustainable competitive advantage as the outcome of a bizarre and remarkable process. This process surfaces as the practical manifestation of true mutualism that seems predominantly paradoxical within any corporate setting. But that is exactly what is achieved within and by an industrial cluster; the eventuality of the belief insomuch else than zero-sum games. Amidst the practitioner, the policymaker intends to facilitate, enhance, and fortify the cluster phenomenon, because it is well observed that an arid region, barren from natural and/or other resources, is well able to thrive when an industry cluster finds itself located within. This phenomenon would go to show that maybe the cluster itself is the natural advantage and as such, it is nothing but local; this may be the reason residing within the notion that cluster fabrication may be ambiguous. The final pillar that interests the work herein is that of the researcher, whose role is to provide theoretical and empirical understanding with respect to this agglomeration of economic activity. Thankfully, the rudiments of the theory are set and relatively stable, so that modern research may lead the way towards the exciting venture of unlocking the rest of industrial clusters' mysteries.

Clusters seem to portray healthy and efficient social dynamics within, to the point that these resemble shared values and convictions that can be described as a common culture. To answer the research question, if the traits and rudiments of this culture can be extracted, a structured literature review is performed. From the relevant body of knowledge with respect to industrial clusters, factors that relate to any interest to the domain of the societal dynamics within the cluster members, are extracted. These are included in one of three categories, per their differentiation. These categories of literature extracts formulate three sections herein. They pertain to generic cluster theory, societal traits and dynamics, and specific extracts from logistics, transportation, and maritime clusters.

The conjecture that specific cluster types, and maritime clusters especially, formulate singular cases with interest to the culture exhibited, may be supported. The threads of said culture are extracted and presented herein. Hopefully, they will facilitate towards the manifestation of a stepping-stone for a more relevant understanding of maritime cluster culture, for research and practice. The limitations of this research are that it pertains to a sole methodology. A broader investigation as to the applicability of the traits presented herein should be conducted, to challenge and/or enrich the findings presented herein. The threads of the culture exhibited within maritime clusters can be used as a benchmark for transportation and logistics clusters to further attain competitiveness and sustainability, for the global supply chains of the future.

I (4) – Short sea shipping: the baseline for regional maritime clusters

Industry clusters provide a novel framework for interpreting industries. They offer a penetrating understanding as to the rudiments of economic activity within a region. There has been a substantial drive in recent years to research and support the cluster concept, though this process is far from delivering an understanding without caveats and restrictions. Clusters can provide valuable insight within industries, as they pertain to eventualities that harbour collective health, for many organizations. This instance summates the basic strength, but also, the elementary weakness of the concept. At the same time, caution should be applied as the construct is not straightforward and is many times left to selective interpretation. This paper aims at investigating the complementarities of strategic planning of short sea shipping, within a maritime cluster perspective.

Introduction

The present section begins with an analytical approach with respect to industry cluster theory and proceeds to bridge its extracts with short sea shipping concepts. Modern research concerning clusters is almost required to take heed of Michael Porter's contributions. His definition of the construct is that "clusters are geographic concentrations of interconnected companies and institutions in a particular field" (Porter 2000). From this definition there may be extracted three main cluster pillars. One concerns the regional hue of a cluster that relates to a defined (and probably bound) geographic location. Therefore, a cluster should be geographically allocated and exhibited within a distinct concentration. The scope of this concentration could be the object of interpretation; though the statement, even implicitly, restricts the environmental aspect to a regional basis. As per the Organisation for Economic Cooperation and Development, "geographic concentration indicates the extent to which a small area of the national territory accounts for a large proportion of a certain economic phenomenon" (OECD 2003). Thus, not only does a 'geographical concentration' imply a distribution of activity within a nation, it should bind and adjust itself to a 'small area.' Not that this bears a negative implication in any way; on the contrary, it allows for one of the cluster marvels to surface, as will be explored ahead. Moving from the pillar of geographical proximity, one arrives at the element of the cluster members' interconnection.

Porter's definition suggests that the national region of concentrated geography will exhibit some arrangement of relational capacity, to the extent that this can be considered as a connection. Therefore, cluster members are linked, in some way or form; the concept is distinct from that of networks, as the latter may imply a predetermined exchange of data, information, or indeed some tangible or intangible interchange. One should note that the prefix inter- in this context solidifies the mutualistic approach of the relation between the cluster members. What is meant by 'interconnected' forms the basis of the collective aspect of a cluster that may manifest in a variety of forms. This can range from a viable agglomeration of entities that cooperate and compete simultaneously, to blooming constellations of volatile innovation that carve excellence and global leadership within a sector. The common theme within this relational capacity is that the cluster will form a system that transcends its boundaries. These can be geographical (to an extent), resource-based, business-oriented, and/or strategy-oriented. As clusters can exhibit signs of extreme diversity in their manifestation, there are some traits that remain constant. One of these is that within clusters of industry, the interconnection of the members spawns into a constellation of cooperative culture that formulates the basis of innovation. The nature, both of the 'interconnection' and the shared culture of the cluster's members, belongs to the same domain. The ties and bonds among the members permeate and transcend usual business practice and relinquish a system of trust that pushes the industry and market to new frontiers.

The subtext of the mention of both companies and institutions hints to another part of the second pillar of the definition; the fact that clusters will include an array of members. Once again, the inclusive nature of clusters is left to surface. A cluster will include not a narrowly defined collection of entities, but a system of organizations. This will embrace public and private entities, cluster organizations, policy making entities, manufacturing, distribution, services – indeed, anything and everything that will manifest through a relational capacity with the cluster in the region. The regional constraint leaves a basic caveat of the cluster, un-investigated. Porter's 'location paradox' dictates that within a global economy, location should not make much difference, since, due to (mainly) technology, distances are nullified. Yet, location has never been as important as it is today. Thus, an inquiry may surface as to the inclusion of an entity, within a cluster, whose base of operations is outside the region. That is, would one consider an organization with a very close relational bond with the cluster's members that resides outside the cluster's regional scope, a cluster member? The answer can be left to the discrete capacity of the case at hand. From the strict sense of Porter's definition, all parameters should be valid, for the cluster to be defined. Maybe though, the cluster can be well-defined through these and allowances as to the members that can be included within the cluster can be granted.

For instance, there can be a cluster manifested within a region and following Porter's definition, portraying all parameters, valid and correct. Still, a firm outside the region can be providing a substantial contribution to the cluster's health. Excluding the contribution to a cluster from entities outside the region, would introduce substantial bias in the analysis. This would skew the understanding of a cluster, from its relational pillar, to its locational one. To circumvent this hazard, one solution could be to include the possibility of direct and indirect locational capacity in the cluster. There could be members of the cluster within a direct locational basis and those with an indirect base of operations. Another solution, if one was to shift from the relational to the locational, would be to define the cluster based on its location, strictly. But, to not exclude entities outside the location that have substantial ties with the cluster, these could be designated as contributors, not members. Therefore, two types of entities may benefit the cluster: the members that are based within the location and formulate the cluster and all those who have cluster ties but are situated outside the cluster. Of course, per analytical breadth and scope required, this selection can be left to a case-by-case basis.

From an introductory analysis of a prevalent cluster definition, there can be extracted an array of issues that should be dealt with so that the analysis can benefit from validity and reliability. The last component of the definition and the one more relatively straightforward than the rest, is that of the activity within a sector; the 'particular field.' This designation would give the cluster its classification that may reside outside its relational and regional ties. A shipbuilding cluster, per promotional and public relations' purposes, may regard itself as a maritime cluster. The same notion may be valid with a maritime services cluster, a maritime education and technology cluster, a fisheries cluster, and a port cluster. The cluster's designation would include a parameter of vision, with respect to the cluster's image of itself. Another aspect that fortifies the designation of a 'particular field' that can be further used as the qualifier of the cluster, is that of centralization. Clusters seem to bloom around a central activity and this parameter can be traced in the birth of the theory. Though, as in the relational aspect, in the centralized aspect as well, the notion is not without caveats, as one cannot exclude a cluster member, if its activity is divergent from that of the cluster. To entertain a factual example, a teashop active within a maritime cluster may provide a valuable cluster service, as staff from many different firms may use its surroundings as a platform to exchange ideas and best practices. This process would act as a catalyst of cross-fertilization between the cluster members and as an instigator of knowledge creation and knowledge management; the kindling of innovation. Following this avenue of thought, if one was to undo the teashop, the cluster would suffer. Therefore, the analytical aspect as to the cluster members' accordance should be disposed not only from what types of firms' profiles are active within a cluster. The analysis should include all entities that provide any type of value-added service to the cluster's health and/or hold a substantial relational capacity with the cluster.

In the over-simplistic example of the teashop, one can extract that a superficially non-cluster-based activity may be able to provide a seminal and governing contribution to the cluster. The selection of the example is not arbitrary, as history has indeed shown that seemingly non-consequential activities may provide relevant thrust towards a cluster's health, stability, as well as, its birth. The teashop (in a factual case) was actually situated within a maritime manufacturing context, where it provided the (very necessary) common ground for sharing ideas and building ties of trust, that would later facilitate the process of knowledge sharing, cooperation, and competition, that could lead each cluster member to its own trend of innovation activity. For a reason outside of the members influence, the teashop was relocated and after this relocation, a direct fall in innovation was witnessed in the members. The venue for building social ties and sharing common experiences seemed to not only provide a relaxing atmosphere for staff and executives to unwind, but also offered a crucial service for the cluster's stability. If the temporal aspect is to be introduced to the analysis, then the paradoxical and maybe, the chaotic nature of relational features within a cluster, cannot be overstressed. To cite a prominent example that exhibits the importance of the common social ties that may be founded in an institution outside the 'particular field' of the cluster, London's maritime services cluster, a global leader in maritime services, can be considered to have bloomed from Edward Lloyd's coffee house, established in the 17th century. If not stemmed directly from it, then certainly, Lloyd's contribution to the manifestation of the sector cannot be overshadowed.

One can conclude from this preliminary analysis of the cluster concept, that though caution is required at venturing to tackle the construct, it may provide the reference point for many interesting reflections. A major one will include the insertion of the relational aspect within an analytical ramification that carries the weight to offer novel insight to a specific cluster case. In the same manner, a cluster will pertain to valuable insight with respect to short sea shipping activities, as the complementarities of the two constructs are more than abundant. Short sea shipping provides a modal choice that, though within the transportation sector, is predominantly regional. Through the advancement of this mode, or rather, the study, understanding, and evolution of conduct with its respect, its ulterior (and sustainable) state, albeit implicit or explicit, is to create short sea shipping clusters. These can include maritime clusters that hold a short sea shipping element, and/or clusters with a centralized aspect of short sea shipping activity. Exactly because short sea shipping pertains to a situational restriction, that of coastal navigation, it can include a grave impact on regional economies; exactly in the same manner that a cluster of industry may pose upon a region. Therefore, when attempting to introduce and analyse the benefits of this modal choice, the emphasis could be placed upon its relevant contributions to the health and evolution of maritime cluster regions. Within this understanding, short sea shipping will be acknowledged not as a mere transportation selection, but as a relational component of a pulsating maritime cluster, that will drive regional innovation and prosperity. The factors that will affect the complementarities of short sea shipping-driven maritime clusters are analysed in the section that follows.

Economic factors that affect short sea shipping

Short sea shipping may constitute a very simple and clear-cut facilitator for freight transport, but its simplicity is determined by the state of existing transportation characteristics, policies, infrastructure, and public perception. A given supply chain or transportation framework may prove rigid as to the inclusion of a novel maritime component, as is many times the case with the introduction of short sea shipping within modern logistics networks. Dedicated infrastructure with respect to ports, cargo, and modality must be designed. At the same time, policy and governance should coordinate the short sea shipping transportation system and not hinder its development. Any analysis cannot leave out the final consumer and the public at large, that formulate a strong stakeholder in the favourability of any mode of transport and may be proven to have enough power to drive change. This is because consumers will require cleaner, safer, and more efficient means of transport that will lead to competition among firms and novel policy initiatives that will guide the implementation of new investment strategies. These forces pertain to external effects from the short sea shipping market. They will pair with the market's internal forces and through their amalgamation, sustainability of the transportation system is to be pursued. Towards this objective, short sea shipping is capable to provide a substantial contribution, as its internal economic, social, and environmental constituents can benefit transportation systems, minimize negative externalities, and alleviate transportation infrastructure towards greater societal benefits.

Strategic complementarities due to the investment in short sea shipping have been researched extensively and their benefits can be considered implicit (Baindur and Viegas 2012; Özer et al. 2005). These are affected by an interconnected system of competitive markets and regulatory policies (Koliousis et al. 2013). Competitiveness of modes can pertain to the analytical aspects of comparison among different modal choices (Bergantino et al. 2006), as well as within a specific choice, such as the short sea shipping market (Russo et al. 2016). Research has shown that infrastructure investment for short sea shipping routes is feasible and may pertain to a multitude of benefits (Le-Griffin and Griffin 2010). In addition, many models have been developed that steer the way to assessing the multilateral impact of short sea shipping (Chainas 2017; Martínez-López et al. 2015; Puckett et al. 2011), even towards the sustainability of the transportation system (Kotowska 2015; Kotowska 2016). In addition, specific regional outcomes with respect to short sea shipping may be investigated (Arof and Nair 2017).

Policy will play a major role in the feasibility and implementation of any mode, but especially in short sea shipping, the fusion of policies can be especially beneficial (Casaca and Marlow 2007). As the topic of short sea shipping has been accorded academic review and its determinants can be considered as relatively addressed, one must not leave out that each region is different and may require a divergent approach if the implementation of novel short sea shipping routes is to be implemented (Md Arof 2015). The strategic planning element is emphasized (Paixão and Marlow 2002), as well as the need for planning in the long run (Psaraftis 2005).

In addition, the requirements that may boost short sea shipping intermodality, have been documented (Paixão Casaca 2008).

Short sea shipping provides a volatile research topic, from many perspectives. These include time at port (Suárez-Alemán et al. 2014), energy management and efficiency (Johnson et al. 2014; Schøyen and Bråthen 2015), vessel capacity utilization (Styhre 2009), fleet age (Wijnolst and Waals 2005) and reliability (Tzannatos 2005), pricing (Grosso et al. 2010), port legislation (Trujillo and Tovar 2007), and tourism (Baños et al. 2018). They come in addition to specific regional case studies, whether specialized in scope (Bendall and Brooks 2011; Casaca et al. 2013; Kapros and Panou 2007; Kroes et al. 2013; Mihaela Bukuaš Skočí and Jolič 2010; Val and Blázquez 2009), or broad (Seoane et al. 2017). These analytical approaches can involve a national scope (Casaca et al. 2017), as well.

The strategic decisions of firms that may want to adopt short sea shipping elements are very important, as they can determine the creation of opportunities and competitive advantages (Miguel 2013). These can include many constituents, such as corporate strategies (Novo-Corti and González-Laxe 2009) and CSR (Fafaliou et al. 2006). In an adjacent point, with reference to policies, the environmentally friendly nature of short sea shipping (Sanchez Rodrigues et al. 2015), especially when compared to road transportation, is exacerbated, within a temporal aspect (Hilmola et al. 2015). Since policy is intertwined with the beneficial aspects and critical discourse with respect to short sea shipping, decision-making processes are critical (Brooks et al. 2012; Martínez-López et al. 2015; Martínez-López et al. 2016). These can include specific domains with respect to modal choice, such as environmental profiling (Psaraftis and Kontovas 2011).

All these factors pertain to parameters that should be investigated, with respect to the general objective of the sustainability of the transportation system. They could be distributed per origin, to relinquish internal and external factors, if the analytical base was to be the short sea shipping market. A graphical representation of these is presented in Figure 1, as per the triple bottom line framework. The internal factors will intertwine with the external factors, each with its own societal, economic, and environmental effect, to guide and contribute towards sustainability.

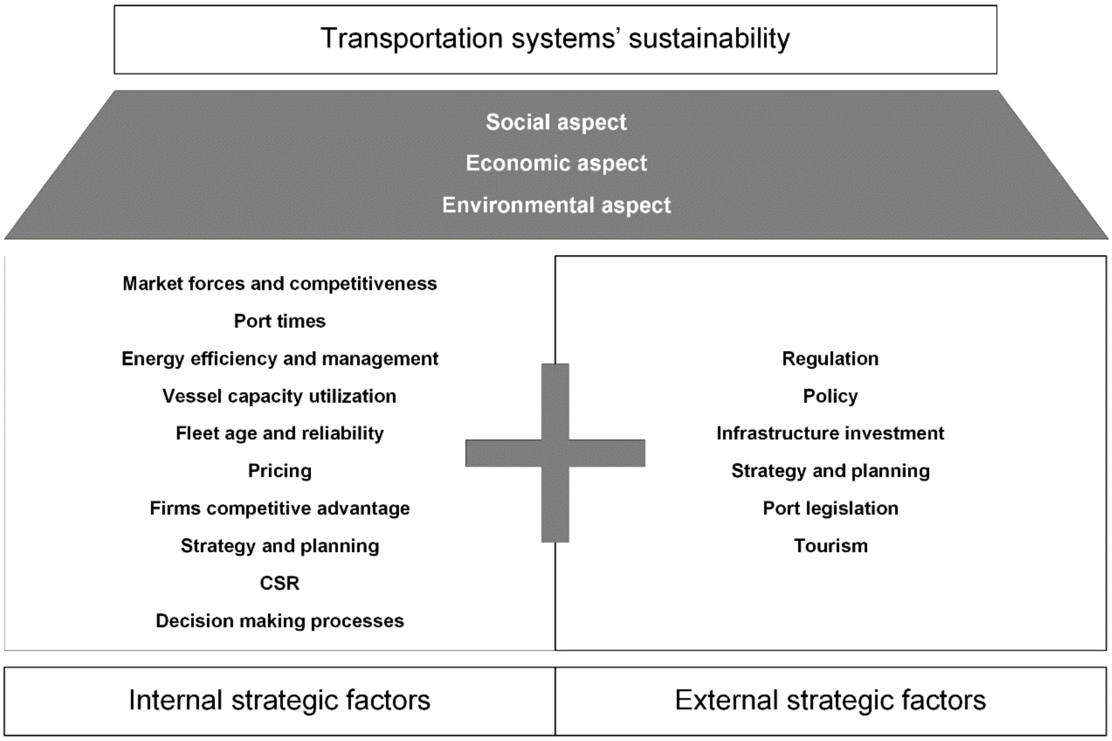


Figure 1: The factors that affect short sea shipping, as extracted from literature (Source: author).

Strategy and planning are included both in the internal and external factors, as they can be inherent in both pillars. It should be noted that by no means is this list exhaustive; it is merely indicative, per the literature review conducted. In addition, this would not mean that all factors are to be valid simultaneously, each with equal influence. Some factors may be included while others excluded and at the same time, they may hold different effects, depending on the case. Nevertheless, the basic framework to conduct a preliminary strategic analysis of short sea shipping strategy is relinquished. Paired with maritime cluster elements, the analysis may provide substantial outcomes. At the same time, it may be enriched and challenged over time.

Short sea shipping and maritime cluster complementarities

Industry clusters and maritime clusters as an indicative case, have presented themselves as interesting scholarly and practical topics, as they seem to harbour regional and collective competitiveness. Though the cluster concept goes not without criticism (Martin and Sunley 2003) and modern queries can even include its definition (Doloreux 2017) and dynamics (Koliousis et. al 2018a), clusters seem to define the playing field for regional innovation dynamics. Due to maritime industry peculiarities, such as its impact on regional economies, its competitiveness profiles, as well as its distinct social and cultural dynamics that are carved diligently through the millennia, maritime clusters are distinctly important. Many such clusters harness global excellence and leadership and their diversity provides the opportunity for extensive research, especially with respect to topics of strategy and policy (Koliousis et al. 2017). World renowned maritime clusters such as Møre (Fløysand et al. 2012), unofficial but dedicated (ownership) clusters such as Piraeus (Zagkas and Lyridis 2011), and maritime services clusters such as London (City of London 2004), provide marvellous cases of both shipping activity and cluster dynamics. Short sea shipping would greatly benefit from the cluster approach, as it pertains to the mode that will accentuate regional competitiveness, in semblance to the manner that a maritime cluster will. These complementarities provide a recurring theme between these constructs. The cluster concept includes not only maritime, but transportation and logistics activities in general, as will be analysed in this section. Each aspect though is applicable to short sea shipping implementation, within a viable and healthy maritime cluster.

Transportation and logistics activities provide a fertile ground for industrial clustering. There is not only evidence to support the claim that logistics activities benefit from clustering (Rivera et al. 2016), but even more so that clusters support their growth (Rivera et al. 2014). As may be witnessed with other cluster types, many opportunities for research are at hand (Elsner 2010; Jing and Cai 2010), in addition to the externalities and benefits of generic clusters, such as innovation dynamics, strategy, and foresight (Keller et al. 2015). Research can be seen to focus in dissecting logistics themes, with respect to employment (Chhetri et al. 2014), fourth party logistics (Jensen 2012), and sustainable transport (Prause 2014), among others. The sector's potential for future contributions (Juchelka and Brenienek 2016) should be stressed, as well. Regional clusters' competitiveness can be assessed to draft policy (Nowakowska-Grunt et al. 2014) and strategic recommendations for the future (Chung 2016). Again, these types of clusters rely on networks of trust and collaboration (Rivera et al. 2016) and though they share common cluster traits, their contribution to regional economies may be extended (Sheffi 2013). The complementarities of the maritime economy, as it intertwines with transportation and logistics functions within respective clusters, may be considered as a proponent for regional growth (Jaffee 2015), competitiveness (Trupac 2008), and sustainable development (Deng et al. 2013).

At the same time, maritime clusters provide a viable territory for analyses of regional competitiveness, that include, among others, cluster structure and governance (De Langen 2002). These aspects facilitate the embellishment of an intrinsic culture and as maritime activities facilitate clustering, it can be accepted that they may facilitate and welcome this inherent culture. The ties of the cluster network that will present themselves as interdependencies, can be considered as cultural aspects, as well (Benito et al. 2003). As with other cluster types, maritime clusters portray an extrovert manifestation with respect to innovation (Jenssen 2003), including its different types and manifestations (Makkonen et al. 2013). A maritime cluster's growth is closely linked with its aspects of policy (Sornn-Friese and Lversen 2014) and governance (Colbourne 2006), that set to promote its competitiveness (Doloreux and Shearmur 2009); these notions should not exclude the possibility that policy may not present the effectiveness desired (Doloreux et al. 2016).

The effect of maritime clusters spills over to many regional intricacies, such as employment (Mitroussi 2008) and career experiences (Mack 2007). In addition, strong ties of trust and cooperation are required, and a 'long-term co-working spirit,' to promote the benefits and competitiveness of a maritime cluster (Shinohara 2010). Within specific maritime clusters' case studies, the aspects of their culture can be extracted (Amdam and Bjarnar 2015). Specifically, the shared values and the feeling of collectiveness among firms present themselves as prevalent (Fløysand et al. 2012). The concept is seen to be supportive of growth strategies among many nations, such as 'Blue Growth' (Pinto et al. 2015) and relevant transnational strategies (Fernández-Macho et al. 2015). Once again, the resonance with short sea shipping is apparent.

Maritime clusters have provided the ground for developing and testing models (Jansson 2011; Stavroulakis and Papadimitriou 2017; Zhang and Lam 2013; Zhang and Lam 2017), frameworks (Monteiro et al. 2013; Salvador 2014; Stavroulakis and Papadimitriou 2016; Koliousis et al. 2018b), as well as theories (Jin and Zhen 2013). Policy implications are important (Pinto and Cruz 2012) and research can focus on the development and prosperity of specific maritime cluster regions (Doloreux and Melançon 2006; Doloreux and Shearmur 2009; Laaksonen and Mäkinen 2013;

Pagano et al. 2016; Salvador et al. 2016). Research is witnessed to focus on promoting the competitiveness and potential of regional maritime clusters (Brett and Roe 2010), in addition to studying clusters to extract potential hurdles for their manifestation (Ortega et al. 2013) and health (Laaksonen and Mäkinen 2013). Maritime cluster mapping (Pinto and Cruz 2012) and evolution (Salvador 2014) hold distinct potential, as well. In addition to a maritime cluster's generic characteristics, its critical mass cannot be overlooked (Doloreux and Melançon 2006). It is of importance to reflect on how research extracts dictate the instances where maritime cluster strategy manifests itself collectively (Brandt et al. 2010) and with respect to its 'macro-culture' (Halse 2017).

The practicalities and threads of a maritime cluster's dynamics can be described as 'competitive cooperation' (Monteiro 2016) that drives a maritime cluster's culture. Strategy of maritime clusters may present opportunities for inter-cluster cooperation (Mäkinen et al. 2014), as well as pertinent regional strategic vision (Valadas-Monteiro 2014); this may not be restricted within a region, but may provide trans-boundary opportunities, as in the case of the European Union (Batur 2010). In addition to generic industrial cluster traits, logistics clusters, transportation clusters, and maritime clusters, seem to exhibit specific manifestations of an extrovert and volatile culture that leads their members to collective prosperity. The binding agent of this shared culture could be the manifestation of short sea shipping routes that will interconnect regions and clusters, thus facilitating communication and trade. All these elements are included in Figure 2 that portrays a graphic representation of the factors that will pertain to inputs, cluster traits, and cluster outputs.

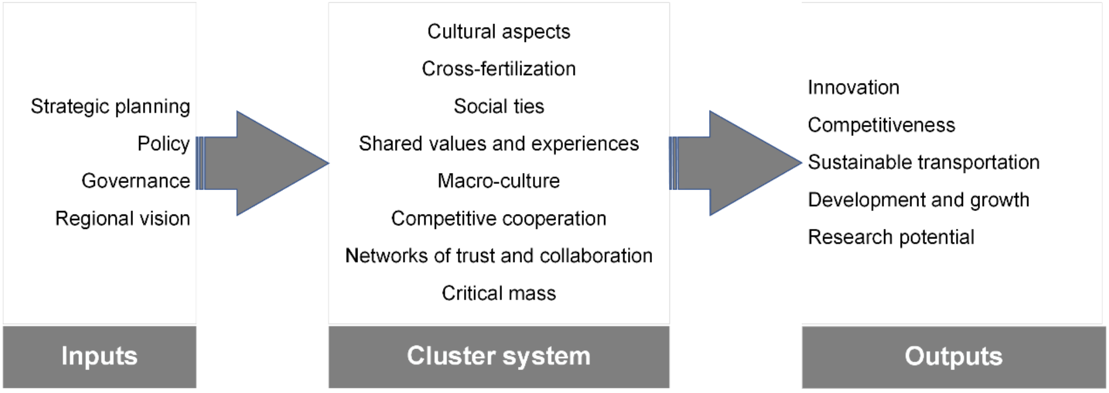


Figure 2: The cluster inputs, traits, and outputs (Source: author).

Short sea shipping has provided tactical advantages for many regions, due to its ability to interconnect coastal geography and thus, present an array of regional opportunities. Its effect in including specific ports is thought to boost their competitiveness (Castejón Arqued 1996). Its complementarities with respect to maritime clusters, though referenced (Chang 2011), has not been researched extensively; as such, it presents a distinct opportunity in linking and thus, projecting, maritime cluster benefits; short sea shipping has done so in many times in the past. The manifestation of these benefits can be clearly and accurately exhibited in many points in time and in various regions.

Many historical examples are of interest, especially since the modern negative externalities of the competing modes of transport that short sea shipping may minimize, were absent. Trading networks are closely linked to regional economies and thus, to maritime clusters. Inadvertently, short sea shipping may provide the connecting tissue of maritime clusters and per their relational constituent, pose as the lifeblood of their collective health. An example that surfaces from medieval Europe that portrays the linking agility and strength of short sea shipping routes as a catalyst of regional development, as well as their ability in enhancing the health of discrete maritime clusters, is that of the Hanseatic League of 15th century Europe (Figures 3 and 4).

The point to be extracted is that the League presented itself as an ‘inter-regional structure,’ with a self-enforcing profile (Fink 2012). This touched on many issues, including methods of communication (Braunmüller 1997) to establish trust, social norms, and contracts (Fink 2011) that pertain to central cluster aspects, as well. Short sea shipping connected the territories of the League, thus creating a super-cluster. This, in an era of European history where disease, famine, and resource scarcity drove exports and trade downwards. The people of Europe in the 15th century where so used to the instability of the food supply, that many times were driven to cannibalism (Johnson and Percy 1970). Food stocks would not be traded because of the fear of some potential increased demand due to unexpected shortage; European ports were especially susceptible to diseases, making for an exceptionally inefficient transportation economy.

Figure 3: The Hanseatic League, 15th century (Wikimedia Commons file: Ausbreitung der Hanse um das Jahr 1400 - Droysens_28 / CC BY-SA 3.0).

Regardless of this context, skilled traders used the power of guilds to shield their stakes. The era also gave way to entrepreneurship that many times threatened the guilds. Under these conditions, cities of the north part of Germany and the southern part of the Baltic created the Hanseatic League (that could be considered as centralized around the port of Lübeck), that imposed its control on Baltic trade and connected two hundred cities for three hundred years. This agglomeration was eventually broken by English and Dutch influence. Although the Hansa may bear fascination from a plethora of perspectives, an attribute that could be considered to remain unexploited, is that its power was fuelled by short sea shipping. It may well pertain to a strategic benchmark of short sea shipping clustering and strategic policy as well.

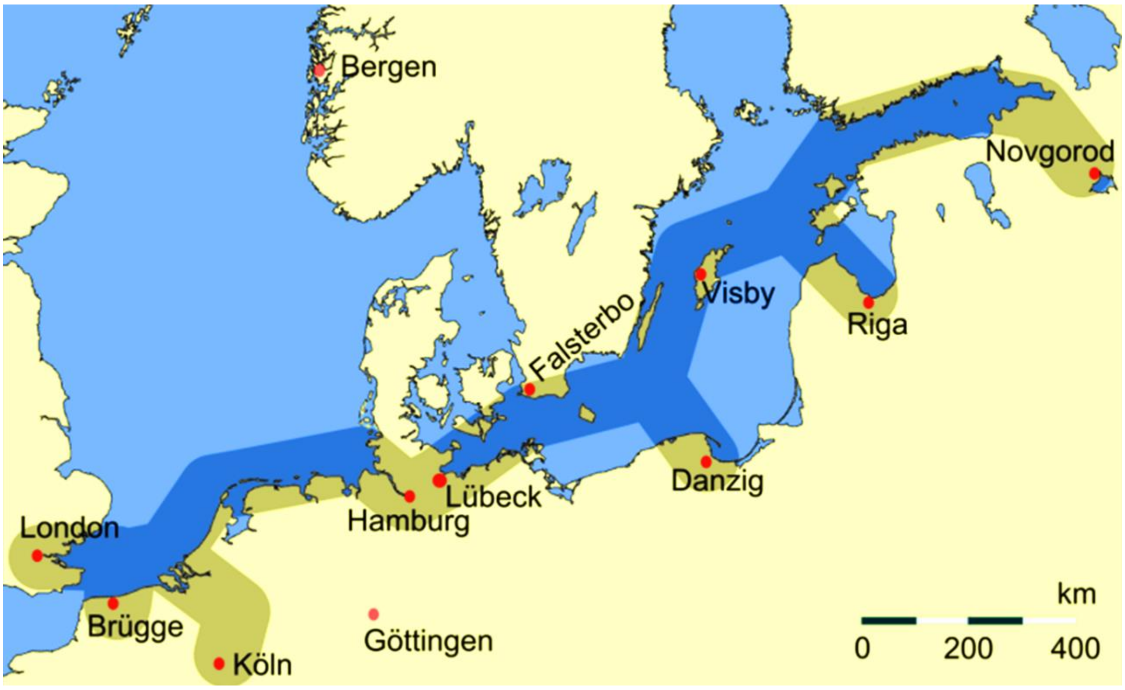


Figure 4: The short sea shipping routes of the Hanseatic League (Wikimedia Commons file: Haupthandelsroute_Hanse / public domain).

The stakes of regional clusters were united through short sea shipping and monopolized trade in an era where technology was restricted, health and hygiene were substandard, and safety and security were riddled with volatility. Yet, short sea shipping provided the tactical advantage in circumventing any prevalent threats, to drive these clusters towards prosperity and unity.

Conclusions

The cluster concept may prove beneficial in interpreting short sea shipping dynamics. Even more so, the objective, since there is definite interest in maritime cluster progression and health, should be that short sea shipping routes provide the relational connectivity between maritime clusters. This has been exhibited with many benefits in the past. Although short sea shipping and maritime clusters both pertain to volatile topics for industry and academia, their complementarities have not been researched extensively. In this work, a preliminary investigation as to the factors that affect short sea shipping within maritime clusters is attempted. Hopefully the synergies between the two constructs will surface, as research gains more ground and short sea shipping is considered as a substantial element for the health and prosperity of any regional economy that includes a maritime cluster ecosystem.

I (5) – Scarcity theory and maritime clusters

Clusters of industry are widely accepted as important aspects of the regional economies wherein they are disposed, since within them, complementarities of the cluster members are witnessed to provide synergies and positive externalities. These forces deliver the cornerstone of collective sustainability that is exhibited within healthy industrial clusters. One type of clusters that is deemed of distinct reputation is the sort that is formulated around a core of maritime activity. Maritime clusters are distinct and volatile cases of the concept, since the maritime sector bears exemplary effect on any given economic cycle and simultaneously, markets riddled with shipping activities portray near-perfect competition. Maritime clusters have provided research and practice with a fertile ground to formulate and assess theories, though we are far from a unifying one. In addition, the literature is not without paradox. One paradoxical instance that affects all clusters is that of the scarcity principle's applicability within a cluster, as it pertains to a domain that hasn't been researched extensively. This work relinquishes a baseline model that deconstructs the scarcity paradox within maritime clusters that will hopefully provide a feasible stepping-stone for further theoretical and empirical research, with implications for management and governance.

Introduction

Clusters of industry comprise an agglomeration of relational firms, agencies, and institutions that support a central activity and/or industry, in a specific locality. Within this general interpretation, the distinction of firms and institutions is present, to portray the characteristic of operational diversity within an industry cluster. Many clusters exhibit semblance to centralized constructs, as the sum of their operations revolves around a unifying activity. The core can bear the role of the cluster instigator as well and can be assigned not only to an economic entity, but to a tertiary education institution, a research centre, or, recently, a cluster organization. Each type of member within a cluster has its own role in solidifying and sustaining the health of the collection of entities. In addition, the outcome of cluster health will contain not only each member's contribution to the cluster, but all the members' relations with each other. The three pivotal roles within a cluster are used in the representation provided, to symbolize the most basic of cluster characteristics, that of relational proximity.

Firms compete and cooperate with one another to innovate and create the marvel of dynamics exhibited within a cluster. Knowledge creation institutions are active within a cluster to provide the necessary kindling for the system of innovation to begin its dynamic expansion. Simultaneously, agencies (governmental, international, or even private bodies) are necessary to provide the cluster with discrete governance and policy. The qualifier 'discrete' is used, since policy alone can only assist and facilitate operations, not dictate them. If anything, when a cluster is formulated, it has a will of its own, that not one member within it, no matter how important, can twist it towards its own accord. The types of cluster members presented above, are merely indicative; knowledge creation can originate from firms and policy can remain a latent quality. In addition, cluster members can evolve and interchange roles and operations within a cluster, since nothing within a cluster of industry remains static.

Clusters expand their function within a region to such an extent, that they may overshadow any other operation; to the point that the region itself is characterised by the cluster's principal industry. Examples such as Hollywood and Silicon Valley are particularly familiar. This would seem as a predominant characteristic of cluster manifestation: the locality wherein its activity resides is painted with the colour of operations within the cluster. These operations include the centralised effect referenced in the classification provided, as clusters seem to include a centralised activity, where all the cluster branches stem from. The final analytical aspect that should be referenced as per the provided cluster description, is the relational characteristic. Each cluster member forms proximate and diverse relations with other members, to provide an interconnected system very similar in function to a super-system such as an ant colony, a beehive, or a living organism. Within a diverse array of subsystems, the cluster member performs its own respective function, but also cooperates with its environment, to fulfil the existential purpose of the system. Therefore, all members of the cluster have their own duty to perform, towards the cluster’s strong constitution. Simultaneously to their function, they hold their respective stake that most always involves the well-being of the other cluster members, as well. With this rationale, the necessary culture of mutualism within a cluster of industry derives even from the simplest notions, based upon a generic representation, such as the one presented at the beginning of this section.

The problem with clusters arises, as with many circumstantial topics that may gather popular attention, with what they encompass; and that is the promise of prosperity, given that the cluster culture is respected. Understandably, in recent years, public policy in many regions has focused in cluster manifestation, providing a range of effectiveness within its results (Yin et al. 2018). Research has shown varied outcomes as to the concept that cluster manifestation is better left to systemic, or natural circumstances, away from policy and decision-making. But this would not mean that the drive to investigate the phenomenon should be left to halt, but rather that, if clusters are understood in more depth, then maybe their threads can be recreated. For this reason, towards the investigation of clusters’ governing dynamics, any review of the respective body of knowledge will uncover, that, in many cases, the theory is riddled with paradox. If not paradox, then contrast, and at the very least, obscurity.

To tackle this issue, at first a theoretical investigation of the paradoxical instances of the theory would require assessment. The outcome of this process would then facilitate the formulation of frameworks and models that may serve as a stepping-stone towards greater insight regarding the rudiments of industrial clusters. Such an attempt is relinquished within this work. A conceptual analysis with respect to the obscure characteristics of the theory is provided, to subsequently render a model that explains an elementary paradox within industrial cluster dynamics; one that concerns scarcity, as the latter is at the forefront of attention with reference to any manifestation regarding populous proximity. The process of modelling scarcity to deconstruct paradox is rooted in acknowledging maritime clusters as the instigators of the conceptual definition with respect to the scarcity paradox that is exhibited in all clusters. The model formulated herein aspires to contribute towards a better understanding of the dynamics that are encapsulated within clusters of industry.

Industry clusters and maritime paradox

The theory of industrial clusters includes many extracts that could be regarded as ranging from mysterious, to paradoxical. Even from its conception, the theory manifests signs of paradox. Alfred Marshall's (1920) 'economies of agglomeration' provide an effective framework to analyse clusters, yet in his work, Marshall mentions 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." An industry's expected evolution, according to the context set by strategic management, will move from fragmentation towards consolidation (Wheelen and Hunger 2013). This due to the reason that common business practice will inevitably yield a consolidated result, as mergers and acquisitions will set the foreseeable norm as an industry evolves. The aberration of clusters skews part of this evolution inversely. A cluster could be thought to begin as a consolidated formation that will in turn strategically evolve into a fragmented state which will be brought up by the novel industrial activity generated through its system of innovation. That's just one more instance of clusters' paradoxical health through not only not playing by the rules, but instead thriving through the direct inversion of expected business dynamics.

Many industry cluster characteristics, such as centralization and agglomeration, competition and cooperation, globalization and localization, specialization and diversification, and creative destruction with respect to innovation (Abernathy and Clark 1985), seem to share conflicting features, as they formulate bipolar dynamics, thereby harbouring paradox. The latter appears to be imbedded within the theory of the former that has even been coined as chaotic (Wang 2010). Globalization, as Porter (2000) points out in his 'location paradox,' should foster the demise of regional importance. Yet, the volatility of clusters seems to be directly correlated with globalization (Bathelt 2004; Watkins 2010); insofar that locally sourced competitive advantage resonates on a global scale (Rədulescu et al. 2015). Another paradox set by Porter that is analysed within the literature (and relevant to scarcity as well), concerns the mutualistic coexistence of competition and cooperation that is documented within clusters (Nadvi 1999).

Cluster paradox can entail the issues of a central governance mechanism, as discrepancies arise from its tension among networks of trust (Hsu 2004). Contradiction in clusters bears many facets and many times surfaces as 'empirical paradox' (Malmberg 1998). Another relevant cluster paradox is the simultaneous existence of "over-embeddedness and under-socialization" within local industrial sectors. This is coined as the 'distanced neighbour' paradox that exposes inconsistencies of regional specialization paired with paradoxical instances of isolation (Bathelt 2005). The ‘distanced neighbour’ paradox may come in tandem with ‘urban paradox’ in industrial districts, when rural and urban populations overlap (Carmo and Da Costa 2016). The role of entrepreneurship in industrial districts may allow instances of paradox, as it is fused with occurrences of ‘organized anarchy’ that are witnessed in clusters (Johannisson et al. 1994). Paradox resonates with industry clusters of many sectors, yet one could assert that there is a sector which thrives on paradox and simultaneously delivers clusters of global distinction. Maritime clusters exhibit paradoxical traits, yet at the same time they are considered as beacons of excellence for regional economies, as well as indicative benchmarks for cluster theory.

As mentioned, the maritime sector is not devoid of paradox. Instances of paradox within the literature include the international dimension of maritime heritage (Maarleveld 2012), in addition to paradox in the representation and perceptions of seafarers (Begiato Bailey 2015). The prerequisite of environmental strategies in conjunction with the accentuation of global maritime cargo flows (Svindland 2015) creates paradox; the same stands for maritime-cargo-dependency in contrast with low infrastructure development (Setti et al. 2011). The sector homes paradox with reference to technological maritime advancements and required skilling (Bhardwaj 2013), in addition to many paradoxical instances with respect to maritime transportation safety (Størkersen et al. 2017). The ‘energy paradox’ within transportation systems (Balland et al. 2015) involves the maritime sector, in addition to the ‘globalization paradox,’ as global governance specifics intersect with maritime security operations (Aarstad 2017).

Paradox can be distinctive of maritime affairs and partake in a region-specific hue, such as the ‘Arctic paradox’ (Palosaari 2011). Instances of maritime-driven-growth clashing with issues such as deficits in trust and political discrepancies are prevalent (Togo and Naidu 2014), along with apparent ramifications of national maritime strategies (Rehman 2017). Paradox in the maritime sector may even extend to maritime sustainability issues (Voisin et al. 2005), risk management (Morel and Chauvin 2006), piracy (Cordonnier 2001), and refugee flows (Koh 2012), and social practices (Mendoza 2015). In addition, paradox can be present in the rudiments of specific maritime clusters, through the fusion of positive externalities with perceived vulnerabilities, such as in the maritime cluster cases of Singapore (Heng 2013), Portugal (Salvador 2015), and Piraeus (Pardali et al. 2016).

An indicative research question with respect to maritime cluster paradox would involve the governing dynamics of scarcity within a cluster. Maritime clusters provide viable benchmarks for cluster conceptualization and definition (Doloreux 2017; Fløysand et al. 2012), models’ (Rupo et al. 2018; Stavroulakis and Papadimitriou 2017; Zhang and Lam 2017; Zhang and Lam 2013) and frameworks’ (Koliousis et al. 2018; Koliousis et al. 2017; Monteiro et al. 2013; Stavroulakis and Papadimitriou 2016) formulation, yet maritime cluster theory is barren with respect to the applicability of scarcity within the threads of a cluster. This concept is rightfully interesting, as the state of scarcity within a cluster gives rise to a novel domain of research potential, especially when concerning the maritime sector; this because the latter includes markets of near-perfect competition, holding a definitive stake in regional growth, and giving birth to some of the most legendary and record-setting narratives in international business.

Scarcity is relevant to regional economies and especially to the maritime domain, for clustering of maritime activities produces many positive externalities that play an important role in a locality's competitive position, within the globalized economy (Laaksonen and Mäkinen 2013). Thus, the maritime industry, industrial clusters, and scarcity, are indicatively relevant, when merged conceptually. This goes not to state that scarcity may not be resonant to any (if not all) other clustering cases; just that the maritime domain bears an exemplary point of reference to study industry cluster paradox, especially with reference to scarcity. As regional maritime economies expand to give way to flagship maritime clusters, scarcity is put to a revealing practical trial. Therefore, it is not surprising that the one sector that stands as the backbone of global trade is able to provide the conceptual kindling for the investigation of scarcity within its cluster formulations. The research query initiates by addressing scarcity within a maritime cluster, wherein paradoxically, regional resources may be capped, but populous proximity flowers amongst entities that venture for these identical resources.

The scarcity paradox in maritime clusters

One of the elementary economics' concepts of rational thought, is that of scarcity. The scarcity principle sets the tone for much of business policy and serves as a bridge for prudence. It pertains to a critical element of modern discourse, as a conceptual instigator for the basis of rationality (Martins 2011). Scarcity can be considered for many applicable topics, including products, natural resources (Smith 1978), commodity pricing (Mueller and Gorin 1985), franchising (Alon 2006; Baena Graciá 2010; Choo et al. 2007; Flint-Hartle and de Bruin 2011), income (Tinbergen 1977), and capital (Chimeli and Braden 2009). For products especially, the scarcity principle stands to many times dictate consumer responses, to the point of achieving a competitive advantage within itself (Brock 1968). Types of scarcity, such as demand- or supply-driven scarcity, can have different effects upon the economic cycle. Studies demonstrate the varied effect of scarcity to consumer decisions, with respect to exclusivity or popularity and the exhibition of important spillovers to functions such as marketing (Thompson et al. 2014; Van Herpen et al. 2014).

The importance of the concept seems to transcend an explicit domain, such as economics; its effects are visible in many tangible and intangible factors, such as sexual risk and HIV prevalence (Jennings et al. 2017), depression (Haggag et al. 2011), sleep patterns (Barnes et al. 2012), personal freedom (Gholipour et al. 2013), conflict (Gleditsch et al. 2006; Theisen 2008), and strategy (Díez de Castro et al. 2008). When introducing the principle, many disparities may be explained, as per the influence of many factors to behavioural and decision dynamics (Wakita et al. 2014). Different approaches are introduced, as to the considerations of a scarce resource. For example, labour can be coined to include aspects of efficiency and knowledge creation (Kirshin 2013) that are considered central industry cluster aspects, as well. In addition, the concept of scarcity may be closely linked with innovation (Swami and Khairnar 2003), a core cluster function. The pervasiveness of scarcity does affect its evaluation, even within a social context (Ditto and Jemmott 1989), whereas with respect to efficiency, it portrays a direct correlation (Luptáčik 2010).

The theory of scarcity has been investigated in tandem with many other theories, such as, property rights theory (Hussain and Windsperger 2013), role expansion theory (Lau et al. 2014), social constructivist theory (Leavitt et al. 2017), risk-sharing theory (Sun and Lee 2016), conservation of resources theory (Allen et al. 2016), institutional theory (Hachemi Aliouche et al. 2015), agency theory

(Castrogiovanni et al. 2006; Combs et al. 2004; Tracey and Jarvis 2007), equity theory (Thompson et al. 2014), and surplus theory (Martins 2011), as its predecessor (Martins 2013). It would seem as though scarcity is a catalyst, a benchmark, and a kind of Rosetta stone for exploring, interpreting, and testing theories. Though this may be true, its impact on industrial cluster theory has not been adequately investigated. This stands even from the most preliminary perspective, that of conceptual friction and model development; even though the primary conundrum with respect to an industrial cluster emerges as the clash between abundance and scarcity. Thus, the theory of industrial clusters stands in wait, with respect to the applicability of scarcity theory within, as it provides an instance where the latter is one of the fundamental ideas that are breached (or portray paradox), at least conceptually. In this work an explanatory model is extracted, revealing that not only is the principle of scarcity not fragmented, but that within clusters, it is reinforced, as well.

Among its manifestation within a given (regional and/or national) economy, scarcity may be important because of its implications to societal and decision dynamics within and among firms. At the one hand, the principle may dictate an acceptance of the limitations inherent within a region and at the other, it may stand as the motive behind zero-sum games. At a conceptual level, the scarcity principle would merely exhibit the instinctive reality, that within a given locality, resources are not infinite. This notion would give way to the school of thought with respect to conservation; though at the same time, this would lie across from many resource cycles exhibited in nature, wherein resources are not depleted (McDonough and Braungart 2002). Contrarily, nature shows extreme abundance within a variety of many (if not all) cases, since the process of resource allocation shows periodicity. Thus, there must be present a distinction between the processes that consume and deplete resources within a region and those that have the power to regenerate and utilise a resource in a perpetual manner. Processes that pertain to industries are predominantly considered of the former kind and rationalism within a modern industrial sector is mainly dictated by the generic scarcity principle.

Within the drive for efficiency that sets today's business context and amidst crises, systemic failures, and fault lines within economies, regions venture to capitalise on resources to remain competitive. In each geographical region, the scarcity principle will dictate that economic entities must compete for the better utilization of the resources within. The 'pie' analogy to describe the finite capacity of an economic cycle, is pervasive. The query (and simultaneous research question that is put to rest with the model developed herein) then as to the resource dynamics within a maritime cluster, would be, at least, commonsensical. Why is there, in a world where resources for industry are at a steady course of constant depletion, that one may witness regions that can harbour an extreme concentration of sustainable industrial activity?

An evident answer would be that natural resources would warrant the aggregate. But many regions that sustain maritime clusters do not harbour any source of natural resources, that at least at first glance, can provide the sustenance required for all the entities active within the cluster. Furthermore, there are cases where a maritime cluster was provided an initial source of natural resources, where, after their depletion, the cluster not only survived, but strategically evolved (Bjarnar 2009). To make matters worse, not only may natural resources be absent, but the entities within the cluster seem to thrive, grow, and prosper, simultaneously. When direct competitors not only exist, but flourish collectively, and the cause is not an overabundance of a natural resource (cf. with the main standpoints of the 'new economic geography,’ that are practically convergent to the above), the scarcity principle is put to the test.

Thus, a maritime cluster seems to portray a scarcity paradox, since within a given region, for no apparent and straightforward cause, an abundance of firms is situated within the direct proximity of an excess of competitors. These maritime firms are active in the same field and theoretically compete within the same markets, for the same resources. But instead of merely competing, they are found to make up a cluster that guides the prosperity and competitiveness of the whole region. Rather than hostile tactics, these entities make use of constructive competition and synergistic cooperation that formulate a culture which, in terms of resources, resembles the cyclical and perpetual motion of nutrients’ flows embedded in nature’s paradigm; and this, through the catalysts of knowledge creation and innovation.

Therefore, as per the business context wherein a cluster is active, resources are indeed finite, but at the same time these exact resources can sustain an overabundance of industrial activity; as much as is required for the whole world to notice and as much as is required to generate interest in practice, policy, and academia, to study and possibly recreate the phenomenon. The reason behind this multifaceted interest has hid in obscurity and is none other than the scarcity paradox. The mere existence of the scarcity paradox is what generates and fuels the attention exhibited towards clusters; if it was not for this paradox, any cluster would be a matter of business as usual. As a result, reasoning to investigate the scarcity principle’s applicability within a cluster should surface both as relevant and important; an initial resolution of this query would result from modelling the scarcity principle and considering its applicability within an industrial cluster. Herein, the maritime sector has formulated the case in point, where through paradox, a novel approach as to the rudiments of clusters is provided.

Scarcity paradox modelling

Per scarcity principle designation, resources within a given region are bound by an upper limit and are not endless. At first, one should consider the representation of a 'given region.' This would entail a context that is fixed, with clear boundaries: a given geographical area, defined and bound, either by natural geography, and/or sovereignty. The point to be made is that the region may not be altered, no matter what has created its boundaries. For systems' theory, if the region was to be considered a system, this would be (geographically) isolated. Thus, the regional setting of the model would resemble an isolated system that does not allow any exchange, at least with respect to its land mass. The next formative component of the model should pertain to the substantiation of the conceptual framework of scarcity, its upper limit, and the finite nature of resources. If one was to utilize a mathematical notation, this instance would be represented by the simple summation found in Equation 1, where 'R' denotes a resource.

Equation 1: A simple summation equation.

$$\sum_{i=1}^{n} R_i = const, n \in \mathbb{N} \qquad (1)$$

As per Equation 1, the summation of resources for the isolated system is a constant. One would gather a finite sum of resources, wherein these may be converted over time, but their total sum would have to remain constant. Without a large stretch of speculation, the scarcity principle, within this portrayal, bears attractive semblance to the law of conservation of energy. The law, a fundamental component of modern physics, states that energy within an isolated system (wherein no transfer of matter or energy may take place) remains constant. Energy may not be created, nor destroyed, but rather, transformed. In this system, the sum of energy and mass must remain constant. If one was to represent only the energy aspect of the law, this would be portrayed in a summation, such as the one within Equation 2, where ‘E’ denotes energy.

Equation 2: The energy equation.

$$\sum_{i=1}^{n} E_i = const, n \in \mathbb{N} \tag{2}$$

The identical nature of Equations 1 and 2 is inescapable. At least within a modelling perspective, the scarcity principle seems to behave as an application of the law of conservation of energy, for a geographical system; much as the law of conservation of energy behaves for a thermodynamic system and is transformed to the first law of thermodynamics. Through this relevant understanding, the scarcity principle is modelled due to its semblance to the law of conservation of energy and maybe, any prospective synergies among the two should be further considered. The finite resources will formulate a common pool wherein any entity within the geographical district may tap, to fulfil its mission. Within the simple application of the conservation of energy, each resource may be utilized and transformed, so long as the summation of resources remains constant. The cases of thereafter utilization, or life cycle termination, would be a matter of the culture within the district. Exactly within this understanding does the relevant interpretation of the scarcity principle with reference to the law of conservation of energy lie.

The value system within the region will dictate if within the process of resource transformation, the latter will be utterly spent, or pertain to resource intake for a subsequent procedure. But this kind of resource pooling and systemic allocation, or rather, this distinct conceptual regard towards resources would give way not only to a unique culture of proximate dynamics (that needn’t be considered universal and thus are admired and sought after), but also to a fundamental fracture within the applicability of regional scarcity. That said, if the scarcity principle is an application of the law of conservation of energy for systems of economies, the relevant scarcity paradox within maritime clusters would have to violate a fundamental law of nature. The investigation into the components of the law of conservation of energy sheds light into this dilemma.

The law of conservation of energy can include many forms of energy that may be converted into one another, so long as their sum remains constant. If an object falls within a gravitational field, its gravitational energy is transformed into kinetic energy. If it hits the ground, its kinetic energy is transformed into heat, that is, molecular kinetic energy. All the while, types of energy are converted; no energy is created, nor destroyed. A form of energy that is relative to where an object of study is positioned and may interest scarcity principle modelling, is potential energy. This type of energy was coined by Rankine in the 19^{th} century and has its conceptual basis within Aristotle's theory of potentiality. Within this context, there are two constructs, potentiality and actuality. The former considers the capacity of the materialisation of an event, whereas the latter, entails the fulfilment of this capacity. If the conceptual analogue of energy for economics is a resource, then the notion of the case of potential energy should be recovered. Thus, the equivalent of potential energy within a maritime cluster, or indeed any cluster, would manifest as a potential resource.

In all fairness to the theory, the dynamics within a maritime cluster could provide a conceptual parallel to potentiality, without violating the scarcity principle. One could consider that the resources within a cluster are finite, but that, at the same time, there also exists a mechanism within that uncovers potential resources. This can be conceptually justified by the fact that within a maritime cluster, the culture of mutualism and collectiveness gives birth to a system of innovation that reveals these, otherwise hidden, potential resources. Without loss of generality to the theory of potentiality, one can safely prompt the suggestion that within a maritime cluster, innovation transforms potentiality into actuality. The potential is situated within the region all along, but a culture of collectiveness, mutualism, and innovation is required so that the resource is positioned into a focal point. One could ponder as to the capacity of this culture in reviving regions whose economies are considered toxic.

Therefore, even with full consideration of the scarcity principle, a cluster can sustain a culture that may nurture innovation that will act as the catalyst in spelling out and guiding the process of uncovering and utilizing potential resources. In the modelling respect, a distinction should then be provided for this mechanism to bear a different representation, other than the one of conventional resources. This could be embodied with a construct pertaining to the coexistence of resources, both conventional and potential. This accord would include the existence of two sums. The first would encompass the generic sum of resources that is in sync with the scarcity principle and equal to a constant, as presented in Equation 1. In addition, a second term must be included, that represents the potential resources, let it have notation 'PR.' For this second term to comply with the principle of scarcity, its sum should be a constant as well. Thus, both sums are equal to a constant, as portrayed within Equation 3.

Equation 3: The summation of regional resources.

$$\sum regional\ resources = \sum_{i=1}^{n} R_i + \sum_{j=1}^{m} PR_j = const, n \epsilon \mathbb{N} \qquad (3)$$

The conventional resources would then be utilized in tandem with potential resources, but the overall summation would have to remain constant, to conform to the scarcity principle. Of course, even if these sums are both constant, the sequence of factors within may not be analogous. Conventional resources may have a finite sum, as well as a finite sequence of terms. But if, on the other hand, within the cluster, the system of innovation uncovers resources in a cyclical manner, then this would mean, that, at least theoretically, the summation of potential resources could be infinite. Then, the sum of Equation 3 would encapsulate a finite summation and an infinite summation, that when added, should result to a constant. Since the total resources are equal to a constant and the potential resources must remain constant as well, one may render the portrayal in Equation 4 for the summation of potential resources.

Equation 4: Total potential resources.

$$Total\ potential\ resources \equiv \sum_{j=1}^{\infty} PR_j = const \tag{4}$$

Equation 4 may generate the query as to its manifestation feasibility within a regional economy, as it is a constant summation of infinite factors; though calculus has already evaded this dilemma, through the theory of infinite series (that have many applications beyond pure math, in physics, economics, etc.). The construct for mathematical analysis that pertains to an infinite summation that is equal to a constant is none other than a convergent series. Let $\{a_n\}_{n=1}^{\infty}$ be a sequence within ℕ = {1 2, 3, …}, or ℤ ≥0 = {0 1 2, 3, …}. This sequence is a function f: ℕ → ℤ, since its range can be positioned within real numbers. The limit of the sequence is $\lim_{n\to\infty} a_n = L$ if for every $\epsilon > 0$ there is an $N > 0$ so that whenever $n > N$, $|a_n - L| < \epsilon$. If $\lim_{n\to\infty} a_n = L$ exists, the sequence converges. An infinite series is an expression of a sequence $\{a_n\}_{n=1}^{\infty}$, such as the one within Equation 5.

Equation 5: An infinite series.

$$\sum_{n=1}^{\infty} a_n = a_1 + a_2 + a_3 + \cdots \tag{5}$$

The sequence $\{a_n\}_{n=1}^{\infty}$ involves an N^{th} partial sum as is included in Equation 6.

Equation 6: The partial sum.

$$S_N = \sum_{n=1}^{N} a_n = a_1 + a_2 + a_3 + \cdots + a_N \tag{6}$$

The sum of the series $S = \sum_{n=1}^{\infty} a_n$ is equal to the limit of its partial sums, as in Equation 7.

Equation 7: The sum of the series.

$$S = \lim_{N \to \infty} S_N = \lim_{N \to \infty} \sum_{n=1}^{\infty} a_n \tag{7}$$

If this sum exists, the series converges. For the scarcity paradox to be modelled effectively, this process is rather reversed. Through the mathematical robustness of the proof sequence, calculus infiltrates the priority of the process to the existence of the sum, whereas for scarcity modelling, the analysis begins with the fact that the sum exists, since it refers to the upper limit of the regional resources. The issue with the scarcity paradox is that the infinite sum of the resources must be equal to this constant. But as the summation in Equation 4 is equal to a constant, through the theory of infinite series, calculus generates the possibility that there exists an infinite series which converges to this same constant. In this manner, a maritime cluster's potential to uncover resources and accommodate a populous concentration of activity is explained, without violating the scarcity principle.

With this justification, the scarcity paradox has been deconstructed. Not only this, but the model demonstrates that the cluster can uncover potential resources in perpetuity and that their infinite summation may be equal to a constant, simultaneously. Through this prism, not only is the scarcity principle not breached by innovation, but the latter enforces it, as well. The culture of collectiveness within a cluster can relinquish a system of innovation that taps into an infinite constellation of potential resources. At the same time, innovation may transform potentiality into actuality in perpetuity, in a sum that remains constant; all the while there may exist an infinite series that converges to the same constant as the sum of potential resources. Through this understanding, the infinite summation of potential resources can be denoted as in Equation 8.

Equation 8: The infinite summation of potential resources.

$$S_{PR} = \lim_{N\to\infty} S_N = \lim_{N\to\infty} \sum_{n=1}^{\infty} PR_n = PR_1 + PR_2 + \cdots + PR_n + \cdots = const \qquad (8)$$

Consequently, a model for resource allocation within a maritime cluster has been delivered, that explains innovation dynamics in complete accordance with the principle of scarcity. Therefore, with this model, a pillar is set for explaining and modelling innovation and scarcity. Notwithstanding, this first attempt could provide the necessary foundation that may bloom into further empirical investigation. The latter may serve to formulate a framework that can sustain different aspects of the model for diverse case studies, whereas the former can assess the effectiveness of these constituents. For instance, based upon this model and apart from studying its applicability within maritime cluster cases, specific infinite series that converge may be put to the empirical test. One may model exactly how innovation may present a multiplier effect through the Fibonacci sequence, where the infinite series of reciprocals converges to the reciprocal Fibonacci constant, ψ (=3.359885…); thus, the model will render Equation 9.

Equation 9: The series equal to the Fibonacci constant.

$$\sum_{n=1}^{\infty} PR_n = PR_1 + PR_2 + \cdots + PR_n + \cdots = const = \sum_{k=1}^{\infty} \frac{1}{F_k} = \psi \qquad (9)$$

What may stand between the Fibonacci sequence and innovation, may bridge the latter with factorials. Through the modelling perspective, this infinite series will converge to Euler's number, e (=2.71828), as in Equation 10.

Equation 10: The series equal to Euler's number.

$$\sum_{n=1}^{\infty} PR_n = PR_1 + PR_2 + \cdots + PR_n + \cdots = const = \sum_{n=0}^{\infty} \frac{1}{n!} = e \tag{10}$$

Alternating harmonic series may as well model resource depletion along with innovation externalities, whilst sourced from the initial modelling aspect formulated herein. The list may not be endless but is surely diverse and abundant. Through the formulation of this model, a novel direction for the empirical investigation of the fundamentals of maritime (and notwithstanding, all types of) clusters is provided.

Conclusions

Paradox in cluster theory could be expected to hinder its validity, yet it can be utilized to bridge theories concerning clusters, thus creating synergies (Virta and Lowe 2017); the former can relate to viable strategies that can tackle many relevant conundrums within management science (Beech et al. 2004; Clegg et al. 2002; Ford and Backoff 1988; Lewis 2000; Smith and Lewis 2011; Quinn and Cameron 1988). The scarcity principle dictates that the amount of resources within a given district is not infinite and that the entities within must compete for the sustenance these resources promise. This notion gives way to rational thought and to strategies of prudence. But it does not explain how, within a given region with no apparent distinction to any other locality, an overabundance of entities with parallel objectives, profiles, and requirements for resources, may thrive simultaneously. Thus, in maritime clusters a kind of scarcity paradox is prevalent. This paradox seems to circumvent scarcity and lead to collective prosperity. Its governing parameters could be theoretically explained with many constructs, such as innovation and culture. Innovation may guide cluster members to tap into resources that were never acknowledged, whereas culture may provide the necessary societal dynamics that will lead to a practical manifestation of industrial mutualism. Indeed, research shows that maritime cluster members seem to regard each other and their cluster, as kin. Yet, in the modelling respect, the scarcity paradox within maritime clusters has not been investigated.

A principle that provides much semblance to that of scarcity, is the law of conservation of energy. They both portray the fact that within a given system, the amount of available and exploitable potential, either exhibited as energy (for physics), or resources (for economics), is not infinite. If one was to build upon this notion, for the sake of model formulation, they would have to tap into its components. Immediately, one concept that surfaces to provide much interest towards cluster dynamics, is that of potential energy. The equivalent within a cluster would consider a potential resource; one could form the conjecture that the mechanism of cluster culture, along with the system of innovation within, may uncover potential resources that would otherwise remain obscure. This understanding provides a plausible framework to explain the scarcity paradox, but it leaves out the fact that based on the scarcity principle, the sum of resources is not infinite, but a constant.

At the one hand, a maritime cluster may be able to uncover potential resources in perpetuity and at the same time these resources must sum up to a constant. This behaviour can be portrayed effectively through the formulation of the model relinquished herein. The model contains two aspects, the sum of conventional resources that is finite and the sum of potential resources that entails an infinite summation. This summation can very well be assumed to encapsulate an infinite series that converges to the same constant as the sum of potential resources. This understanding, though inclusive of modelling allowances, could provide the basis for the utilization of infinite converging series to model maritime (as well as generic) cluster dynamics. This work provides a baseline for the explanation of a rudimentary paradox for industrial clusters that may prove to serve as the initiation of many pertinent empirical and theoretical studies, in addition to bearing distinct contributions to management, governance, and policy. As a lateral contribution to the literature, the correlation of the scarcity principle with the law of conservation of energy is documented, as well.

Through this work, the body of knowledge with respect to industrial, and more specifically, to maritime clusters, is enriched. Not only is a rudimentary cluster paradox identified and analysed, but at the same time it is deconstructed through a pertinent calculus instrument. In addition, the latter can prove to have many other applications in scarcity theory. The paradox that lies within fundamental notions that concern clusters is one step towards interpretation, since from the modelling perspective, one can demonstrate that not only can scarcity exist within a cluster perspective, but that it may be modelled effectively, through an infinite converging series.

This research can be the starting point of investigating which series can properly model the different typologies of industry clusters and furthermore, if cluster dynamics welcome any other modelling aspect with reference to scarcity. Notwithstanding, by considering the conceptual infrastructure of clusters and providing modelling instruments, the intrinsic benefits and positive externalities of the latter may move one step closer towards replication. Therefore, this work may provide characteristic future potential not only for research, but practice, as well. As the maritime sector resonates with many relevant cluster elements, it can continue to deliver the groundwork for recreating the cluster prodigy that is responsible for so much creative growth and multilateral interest portrayed from academia, business, and policy, alike. The work herein can substantially contribute towards this direction.

I (6) – Strategic correlations for maritime clusters

Maritime clusters formulate appealing objects of study, for many viewpoints. At the same time, the theory is not homogenous nor compartmentalized, although some main themes do seem to be prevalent. The latter include innovation, competitiveness, strategy, and policy. Through an inclusive analysis of the literature, data mining is attempted within this body of knowledge. A dominant instance within the literature is the existence of a strategic case, along with the fact that this is rooted within a recurring constellation of topics vested within strategic management. These occurrences are categorized per generic premise, according to a coding protocol. The data is then adjusted into dichotomous variables, to investigate dependent samples' correlation. The aim of this methodology is to examine association between the categorical variables of academic impact and the presence of a strategic case. The results of the analysis are statistically significant. This research can provoke novel directions with respect to strategic and tactical decision making, for academia and practice. In addition, this work provides a rudimentary inventory of the literature of maritime clusters that can aid the formulation and investigation of further statistical hypotheses.

Introduction

The synergy of proximity within industrial clusters has long been an object of recognition from a plethora of standpoints; interest from researchers, policymakers, and practitioners converges towards an appreciation of clusters, since the latter provide the backbone of collective prosperity, mutualism, and eusocial dynamics (Kumar et al. 2017). The root of the unique advantage of clusters is that in their manifestation they come to prove many well-accepted ideas and principles as moot. One basic concept within economics that is regarded as bypassed superfluously within industrial clusters is the scarcity principle; a principle so prevalent that it may be considered as self-evident. Yet, within industrial clusters, such a germination of (competing) activity occurs that the scarcity principle seems to impose reverse effects

(Koliousis et al. 2018a). Within an industrial cluster setting, all members of the cluster flourish whence all their competitors do so as well, to the point that utilized business tactics may not differentiate themselves from any generic ones, but, surprisingly, always lead to the result of mutuality, regardless if they are head-on attacks or guerrilla tactics. From the viewpoint of strategic management, where the generic evolution of an industry flows from fragmentation to consolidation (Wheelen and Hunger 2011), a cluster would be an aberration; as it seems, a cluster may initiate as a consolidated entity, but through its fruition, it provides kindling for indirect and induced regional growth, innovation, and excellence, which in turn lead to fragmentation.

Right off the bat, from a preliminary disclosure of the existential features of clusters, one is drawn as if hastily descending a rabbit hole of paradox and admiration. Why within the strategic context of evolution for industries, clusters are poised to reverse-engineer the process? And why, within a given natural principle such as scarcity, do clusters need to object? Strategy and culture, respectively, are the answers; the illuminating distillates at the end of the quest. Clusters are the offspring of the amalgamation of (a culture of) mutualism paired with outstanding strategic insight. There is no other way that a *typical* fishing village in a matter of years can become the largest shipbuilding cluster this world has ever witnessed; no other way that a collective of organizations can diversify in the face of adversity to an extent where its excellence and innovation inspires the globe. Clusters deliver sustainability and permanence through contesting individualism for mutualism and the established for the visionary. Clusters are beacons of popularity, as they prove to be exactly what is sought after and required from today's business context; the source of a sustainable competitive advantage not only for firms, but for regions and nations as well.

The governing parameters of clusters come to be true because within itself, a cluster provides the ingredients of prosperity, abundance, and resilience for all its members; so much so that competitors' tactics are rendered as irrelevant. Through the path that is innovation-driven-competitiveness, each member of the cluster will be given the opportunity of a propitious niche. This mutual advantage is relinquished through a mechanism that at first glance may seem paradoxical, though after an analytical consideration it surfaces as evident that only paradox is remiss of a cluster's intrinsic parameters. This because paradox is perceived only if the value-system wherein the analytical query performed differs from the one investigated. If one considers that under the scarcity principle, resources will not warrant a systemic concentration of entities within a given geographical location, then a cluster's manifestation seems paradoxical. But if one considers that eusocial synergies will emerge to compensate for resource scarcity and simultaneously innovation dynamics will set off to create wealth, markets, and resources out of thin air (where formally there were dead ends and no potential in sight), then the emergence of a cluster can simply be tagged as a systemic (and *natural*) instance.

An evident corollary of cluster manifestation is that a great deal of interest may be generated from the aspect of strategic management, as is indeed the case. A special type of clusters considers those formulated around a core of maritime activities and is the domain of the work herein. Maritime clusters stand out, both as cases of industrial cluster theory and as cornerstones of regional competitiveness. All the interesting, romantic, and eccentric dynamics of the maritime industry seem to transcend to these clusters, as well. Maritime clusters are volatile constructs that may pose as the analytical base for many interesting topics, for decades to come. Capitalizing upon the interest exhibited towards maritime clusters, industry and academia may tap within this domain and develop frameworks and models that will assist towards the analytical appreciation of these clusters of industry. Further analysis that will lead to understanding clusters is greatly required, as the topic is as elusive as it is interesting. At the same time, maritime clusters are used as a veneer buzzword, a contemporary definition of a sector of industry, and the path towards sustainability. To separate the wheat from the chaff, research in many directions is essential, to produce solid guidelines upon which practice and furthermore, society, may benefit. Maritime clusters hold the keys of regional development and innovation and as such, are pivotal to growth; through indirect impact, their repercussions and positive externalities ripple from regions to nations and beyond.

Within this introduction, two indicative characteristics of clusters have been presented. Their insubordination with reference to what strategic management considers the progression of an industry and their derivation from the scarcity principle. The explanation for these, was strategy and culture. Within this work, a first quantitative conclusion can be drawn as to the importance of the former, at least from an academic standpoint. The process towards this conclusion initiates with the extraction of an inclusive inventory of the body of knowledge with respect to maritime clusters that is also absent from the literature. Therefore, the contribution of this research is relinquished in twain. On the one hand, an inventory of maritime cluster literature is procured and on the other, variables' correlation is examined through a robust methodology, to examine the inference of the importance of strategy within the research of maritime clusters. Therefore, the research question as to the latter would be structured as 'is strategic context important for the body of research concerning maritime clusters?' Although the research conducted is inherent with allowances, as are all modelling constructs, the approach is indeed fruitful, as correlation is verified, and the research question addressed.

This work can pertain to a baseline for researching maritime clusters and industrial clusters in general, but furthermore, to policy drafting and managerial practice, as its conclusions are relevant with respect to these domains. At the same time, the methodology developed can be utilized for the investigation of association of other relevant categorical variables. This work is structured as follows. The current section is succeeded by the literature review that was conducted as per the guidelines for structured reviews in Jesson et al. (2011); the review documents the inference of strategy within the body of knowledge. Then, the 'materials and methods' section follows, wherein the methodological instruments utilized are presented and analysed. The section analysing the results of the statistical analysis follows, and the paper concludes with a brief discussion and recommendations for further research.

Literature review

From the Marshallian economies of agglomeration (Marshall 1920), to the analysis of industrial clusters with Porter's (1990) diamond model, academia has fostered a great deal of interest towards the entities of economic activity coined as clusters of industry. Clusters are important sources of knowledge creation (Asheim and Coenen 2005; Giuliani and Bell 2005; Lambrou et al. 2018; Pinto et al. 2018) and innovation (Baptista and Swann 1998; Furman et al. 2002; Hjalager 2010), to the point that they may harbour a regional, national, or international competitive advantage (Porter 1998). Within this scope, the domain of strategy is of distinct importance (Humphrey and Schmitz 2002). Although clusters do not provide deterministic conceptual entities (Martin and Sunley 2003), attempts at their classification and categorization may prove successful (Doloreux 2017; Gordon and McCann 2000).

The effects of clusters spillover many domains of economic (and other) activity, such as culture (Evans 2009), sustainable growth (Schmitz 1995), competitiveness (Bell and Albu 1999), network dynamics (Giuliani 2007; Wolfe and Gertler 2004), employment (Mitroussi 2008), and entrepreneurship (Feldman 2001; Feldman, Francis, and Bercovitz 2005; Stuart and Sorenson 2003). Within this context, governance and policy play a pivotal role (Davis 2011; Kuchiki 2011; Ninan 2005; Otsuka and Sonobe 2014; Ping et al. 2010; Russ and Jones 2012; Woo et al. 2017). Clusters have also provided research with a fruitful basis to formulate and assess models (Bell 2005) and frameworks (Iammarino and McCann 2006); especially if one considers their implications within strategic management (Lee 2006; Niu 2010; Pisa et al. 2017; Zhang 2004; Zheng and Liu 2015) and competitiveness (Chung 2016; Fang 2014; Kharub and Sharma 2017; Zhang and Zhao 2012), the impact of models and frameworks is particularly relevant.

Michael Porter's (1998) definition, as to the fact that "clusters are geographic concentrations of interconnected companies and institutions in a particular field" is an indicative point of reference. As the focus of the present research pertains to clusters active in the maritime sector, *maritime clusters* could be coined as geographic concentrations of interconnected companies and institutions in the maritime field; as stemming from M. Porter's generic definition. Although it is accepted that maritime clusters may provide important constructs for regional and national competitive advantages (Chang 2011; Doloreux and Shearmur 2018; Jenssen 2003), as well as for distinct sections of the maritime industry (Chang et al. 2017; De Langen 2004a; Shinohara and Saika 2018), their rudiments are still under investigation (Koliousis et al. 2017, Koliousis et al. 2018b). To this end, an inclusive inventory of the body of knowledge of maritime clusters would be relevant, if not required, for future research. From a review within the literature concerning maritime clusters, one can observe that the prevalent themes of general cluster theory are included within these distinct clusters, as well.

As Marshall and Porter can be considered pillars of the theory, one can witness that the Marshallian agglomeration economies are utilized and tailored to maritime cluster cases (De Langen 2002; Pagano et al. 2012) and Porter's diamond model is employed to extract conclusions as to the competitive position of these types of clusters (Benito et al. 2003). The study of maritime clusters can include a temporal analytical aspect, as per the effect of strategic decisions or external threats on specific clusters; such as the impact of the 2008 crisis (Simões et al. 2016), or the ramifications of infrastructure expansion plans (Pagano et al. 2016). Technology (Agatić et al. 2011; Aksentijević et al. 2014; Wang et al. 2016; Wang et al. 2015), innovation (Jenssen 2003; Makkonen et al. 2013; Monteiro 2016; Pinto et al. 2015; Pinto and De Andrade 2013), competitiveness (Kim 2015; Laaksonen and Mäkinen 2013; Mäkinen et al. 2014), policy (Doloreux and Melançon 2006; Makkonen et al. 2013; Othman et al. 2012) and governance (De Langen 2004b; De Langen 2006; Lam et al. 2013), economic development (Brandt et al. 2010; Bai and Lam 2015; Doloreux et al. 2016; Lv and Chang 2013), strategy (Salvador et al. 2016; Stavroulakis and Papadimitriou 2016; Yang et al. 2016), competition and cooperation (Dong et al. 2011; Jin and Zhen 2013; Kraaijeveld 2012; Shinohara 2009; Wang et al. 2012), and education (Ali 2009; Ana et al. 2006; De Langen 2008; Figari et al. 2015), seem to be the dominant themes within the literature of maritime clusters; as they are within generic industry clusters. Therefore, one may hazard that clusters portray some general characteristics, which then are tailored and exhibited as per the peculiarities of each central industry wherein the cluster is active.

Maritime clusters provide the ground where many instruments are developed, utilized (Morrissey and Cummins 2016), and/or tested (Deng et al. 2013) with reference to cluster classifications, typologies, theories, and evolution (Halse 2017; Ibrahimi 2017; Koliousis et al. 2018a; Koliousis et al. 2018b; Salvador 2014; Zhang and Lam 2017; Zhang and Lam 2013). At the same time, models (Iannone 2012; Jansson 2011; Ji and He 2010) and frameworks (Monteiro et al. 2013; Yap et al. 2011; Zagkas and Lyridis 2011) are developed, as they are important and applicable in many maritime cluster cases, albeit with measuring specific indicators within the cluster (Lv et al. 2010), or providing feedback for the cluster itself (Brett and Roe 2010; Shinohara 2010). Therefore, not only do maritime clusters exhibit the definitive industry cluster traits, but simultaneously, they provide a dynamic field for the development of qualitative and quantitative instruments. These instruments can bear applicability to maritime clusters, but their use may not be restricted to these, as they may find resonance in a distinct scientific domain, such as strategic management (Stavroulakis and Papadimitriou 2017; Stavroulakis and Papadimitriou 2016). Through their potential in developing theories, frameworks, and models, maritime clusters can effectively become agents of progression for many research domains.

A preliminary conclusion that can be drawn from the literature review is that on the one hand the major topics of interest within a maritime cluster are extracted and respectively allocated within the body of research, and on the other, that maritime clusters provide a dynamic arena of analytical potential, both qualitative and quantitative. On the antipode, a subsequent concern that arises, reflects the fact that even if the theme of the research does not explicitly state relevance to strategic management, the research may indeed be classified as a strategic analysis, or pertain to an important aspect of strategic management. It seems that many papers provide contributions to the domain of strategic management, even if this was not their primary intention. A recurring instance throughout the body of knowledge concerns the fact that innovation, competitiveness, cooperation, and/or policy may be discussed and analysed, and that the primary contribution of the research may indeed reside within any one of these respective sectors, but that laterally, the analysis concerns, or can be utilized for, strategic management. Therefore, a relevant issue and the research question within, concerns the impact of strategic management within the research corps of maritime clusters.

The venture to tackle the rudiments of this query would require compiling an inclusive inventory of the literature, given an accepted level of quality, as one that derives from a database that safeguards the maintenance of quality standards. Once the inventory is extracted, the body must be analysed given a structured protocol. At first, irrelevant studies and duplicates should be excluded and then, once the basic inventory of the literature concerning maritime clusters is extracted, an analysis and classification as to the strategic query above, should be conducted. Still though, through this process, one would only arrive at a list of contributions to the body of knowledge that can be relevant to strategic management. The importance of this observation would remain elusive.

To provide a definitive answer to the problem of investigating the importance (and thus tackling the nature of the basic query) of strategic management in maritime cluster studies, the solution could materialize as the analytical expression of association between two categorical variables. This, to perform a robust statistical decision test that can provide an answer to the research question, given an acceptable level of significance. Therefore, one categorical variable would have to be the ‘presence of a case relevant to strategic management’ and the other, the ‘academic relevance of the strategic management case.’ If correlation among the two categorical variables can be investigated, then the initial observation of the significance of strategic management for maritime cluster research could be substantiated and a relevant contribution to the literature produced; furthermore, strategic management of maritime clusters could surface as a distinct domain of importance for the research body.

A pertinent statistical decision test that will investigate this thesis as per an examination of independence and/or homogeneity between the two indicators must be selected. The latter should also take heed of the fact that the categorical variables stem from objects of investigation (scientific publications) that each constitute a contribution to an interdependent body of knowledge; a distinct contribution’s results are formulated and rest upon the whole body of knowledge, without which, the contribution could not have materialized; thus, the data cannot be considered independent (Breslow 1982; McNemar 1947). Simultaneously, one can observe that a kind of random pairing and/or matching occurs, as the samples bear similarities on all covariates except the exposures under investigation (strategy and academic impact). In addition, informative and structural elements of a publication such as the title, keywords, and references, could provide a level of domain similarity and to an extent, dependence (e.g. the publication titled ‘…using Porter’s diamond…’ is dependent upon the publication of Porter’s diamond). Latent to the above considerations, metrics of reliability should be extracted, to indicate the strength of the results. The next section provides the analytical foundation upon which the contribution of this research will rest.

Materials and methods

The preliminary task is to provide an inclusive inventory of maritime cluster research. Then, this inventory will be analysed as to the categorical variables produced, and a methodological instrument to examine association among these will be employed. For this end, a consolidation of the literature with respect to maritime clusters is procured, as per the systematic review conducted (Jesson et al. 2011); then, following a coding protocol, the literature is categorized, and relevant statistical decision tests are administered. The selection of the academic database was evidence-based (Falagas et al. 2008), to provide an academic index with extensive coverage, but without sacrificing consistency, accuracy, and quality. This selection could result in the fact that a relevant publication could be excluded from the inventory, but this is a risk that would be embedded in any trade-off concerning the consolidation of scope and quality. Consequently, a Scopus™ search within the scientific domain of the social sciences (‘Social Sciences,’ ‘Economics, Econometrics and Finance,’ and ‘Business, Management and Accounting’) for the fields of ‘maritime cluster,’ ‘seaport cluster,’ ‘maritime transport cluster,’ ‘port cluster,’ and ‘shipping cluster,’ is conducted. Then, the temporal range is limited to the papers published up to (and including) 2016. As academic impact formulates a variable under examination for the present study, one should allow a leeway for recent literature to be cited (or not). For this end, papers that were published after 2016 are excluded from the inventory, but their citations to the body of knowledge are not. Therefore, the inventory pauses at 2016, but the time for citations does not, allowing for many publications of even 2016 to be cited, as is indeed the case. Thus, the analysis holds its gross inventory that after the exclusion of duplicates and irrelevants, arrives at a list of one hundred and eighteen maritime cluster literature extracts, as rendered within Appendix C.

With the extraction of the inventory, the categorical variables must be developed. Corollary to the structured literature review is the fact that the literature, to an extent, bears a spillover capacity of contribution to strategic management. As mentioned, it seems that many publications are extremely relevant to strategic analysis, even if this was not their primary goal and/or focus. It would be of interest to support or dismiss this observation with a statistical method, one that can investigate variables' correlation. One variable would have to pertain to the existence of the premise of strategic analysis. The second variable would be a marker of academic relevance and/or impact that can be correlated with the marker of citations. To transform citation counts to a binary variable the evident solution would be to have two states, one for the presence of citations and one for their absence. With this rationale, one could venture to investigate the correlation of the existence of a tactical dimension within the literature, with the presence or absence of citations. A major drawback of this methodology would pertain to the temporal aspect of the citation count and if the body, especially recent, would have enough time to gather a citation.

Some citations of papers as included in the inventory are probably within others that are in their publication stages. But, as the analysis will inadvertently include the aspect of the present and the immediate, this is an allowance that would be inherent within the analysis, regardless. Implicitly, the categorical variables both include the statement of 'at this exact point in time.' Apart from this modelling allowance, the fact that the inventory's cut-off point was 2016 and many very recent literature extracts did indeed hold citations (whereas many earlier papers did not), may be indicative of the methodology's validity. At the same time, one will gather that another drawback of the study is the fact that the variable, as binary, reflects presence or absence of citations; under another perspective, the variable of academic relevance could still be categorical, but in order for a publication to count as relevant, one could consider the cut-off point of citations to be more than unity (although, zero citations do imply an outlier for a relevant and growing body of knowledge); this eventuality can concern a future study, that will document the convergence or divergence of its results with the results of the present work. At this point it would be interesting to mention that this research is an indicative case of the 'Hawthorne effect,' as with its publication, even the papers with null citation count will have a citation stemming from the present work. Therefore, this study will alter the behaviour of the inventory (and subsequent analyses) and will bear replicable results only if citation counts before its publication are utilized; although, as mentioned, the cut-off point for academic relevance can be selected to pertain to more than one citation.

To proceed with the analysis of the inventory, the categorical (and dichotomous) variables are formulated as 'presence of a case relevant to strategic management' and 'presence of citations.' Through this methodology and the statistical treatment of the variables, if these were to produce statistically significant results, a widely accepted aspect within the literature – that of the importance of strategy, would shift from the implicit domain, to the explicit; as backed up by the robustness of a designated statistical method. To proceed with the analysis, the publications have been coded following a designated protocol (Kitchenham and Lawrence Pfleeger 2003; Leonidou et al. 2010), per general premise and citation count. As per the citation count the analysis was relatively simple, as it required the mere coding of an apparent dichotomous trait, the presence or absence of citations; for the categorization of the research premise, the analysis was more elaborate and required the method of content analysis (Eteokleous et al. 2016). The body of research was analysed based on the protocol which comprised of the four pillars of Wheelen and Hunger's (2011) strategic management model. If a paper could be included (and/or provide a contribution) in any pillar of the generic strategic management model, it would be considered as applicable and relevant to strategic analysis. If not, the protocol would register the paper as out of scope for strategic management.

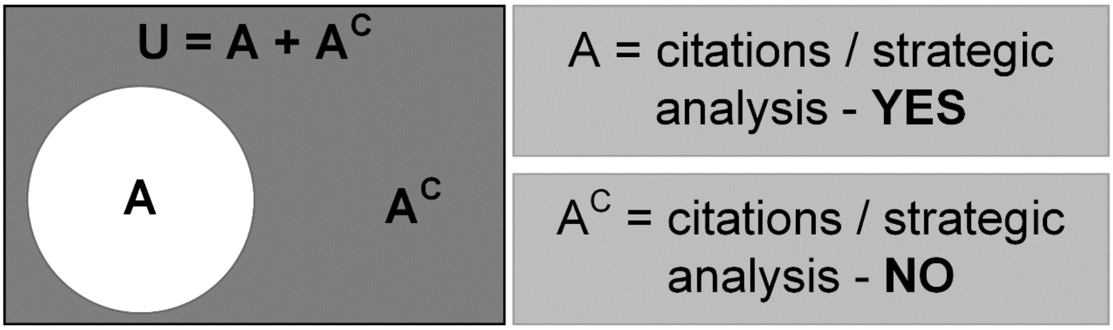


Figure 5: The dichotomous nature of the variables (Source: author).

The dichotomous nature of the variables places them in either one of two sets, that both belong to the universal set 'U' (Figure 5); either a literature extract may be applicable to strategic management (or not); and it may be cited (or not). When coding is complete, considering the dichotomization of the variables 'Strategy' and 'Citations,' the count of the variables compiles a two-by-two contingency table (Figure 6). The interest lies into understanding the nature of correlation (if any) among these two dichotomous variables; if these are independent (or not) and if relevant metrics pertaining to specific measures of association can be procured. The two measures of association employed are the odds ratio and the risk ratio (relative risk). The odds ratio (OR = a*d / b*c) indicates the likelihood of exposure associated to the effect (for this research, exposure signifies strategic premise and the effect is academic impact), thus quantifying the relationship of the two categorical variables.

The risk ratio (RR) is the ratio of the risk of the presence of citations within the publications inclusive of a strategic premise, to that among the ones without a strategic premise. It is calculated as the quotient of the risk of citations among publications pertaining to the domain of strategic management [= a / (a + b)], to the risk of citations among the publications with no bearing to strategy [= c / (c + d)]. The risk ratio, if greater than unity, will signify the increased effect of the presence of a strategic topic for the presence of citations. If it is found less than one, it will infer the adverse effect. In addition, the risk ratio can be utilized to indicate the likelihood that the association bears a causal relationship (Bonita et al. 2006; U.S. Department of Health and Human Services Centers for Disease Control and Prevention 2006). These measures of association can provide useful indications and quantify the effect magnitude that exposure to a strategic topic may bear upon the subsequent academic relevance of a publication.

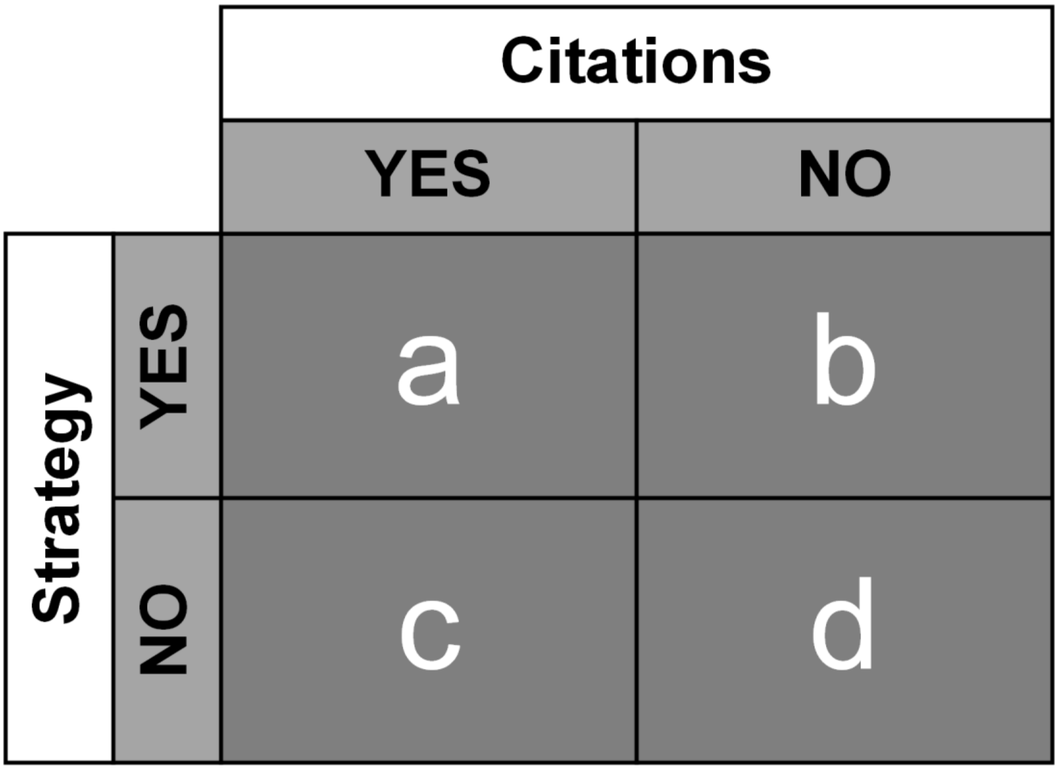


Figure 6: The two-by-two contingency table (Source: author).

To explore variables' correlation, i.e. if the premise of strategic analysis pertains to an effect, dependency, and/or association for academic impact, statistical hypothesis testing may be administered. Before said process, one must ascertain the nature of the samples within the crosstab as per their independence, as said attribute will govern the prudent selection of the respective statistical hypothesis test. The generic sample of analysis is a body of research that consists of publications. One must consider that each publication contributes to the body of knowledge based upon previous contributions to the same body; inadvertently, seldom can research be produced without precedent (methodological and referential). The extent of this precedent is documented by the mere count of referenced literature within a publication. Therefore, a preliminary indicator of dependency for a publication can pertain to its references. But this fact within itself produces the definition of dependency, in the sense that each publication is dependent upon the body of knowledge, i.e. other publications. In addition, since no authorships, affiliations, or classification of any kind is inherent within the present analysis (except the classification that concerns the variables analysed), conceptually, one can consider that the samples of the study reflect random pairing, as well. Therefore, one has ground to not only consider the samples as dependent, but as randomly matched.

McNemar's test (1947) for dependent nominal data is employed, to investigate marginal homogeneity (to determine equality of the row and column marginal frequencies) of the contingency table. The generalized version of McNemar's test supposes a test sample as $(x_1, y_1), (x_2, y_2), \dots, (x_n, y_n)$. The null hypothesis H_0 is $P(X < Y) = P(X > Y)$. Let $n_1 = \#\{i: x_i < y_i, i = 1, \dots n\}$, $n_2 = \#\{i: x_i > y_i, i = 1, \dots n\}$ and $r = \min(n_1, n_2)$, wherein n_1 is the number of cases where $x_i < y_i, i = 1, \dots n$ and n_2 the number of cases where $x_i > y_i, i = 1, \dots n$. The expected frequencies' (n_1 and n_2) correlation is 1:1, given that there is no factual divergence between the trials. The binomial distribution can investigate any discrepancy from the expected ratio. The (two-tailed) calculated probability is included in Equation 11.

Equation 11: The exact p-value.

$$Exact\ p - value = 2 \times \sum_{i=0}^{r} \binom{n_1 + n_2}{i} (1/2)^{n_1 + n_2} \tag{11}$$

For the two-by-two table, the null hypothesis asserts that H_0: $\pi_{12} / \pi_{21} = 1$, whereas H_1: $\pi_{12} / \pi_{21} \neq 1$. For an accepted significance level ($\alpha = 5\%$), if the p-value $< \alpha$, then one can ascertain statistical association. Therefore, if the null hypothesis of this statistical test were to be rejected, then this result would be important as to the fact that strategic management and academic relevance would share a dependent relationship. In addition, analysis as to the exact correlation could be conducted and reflected through the measures of association produced. Furthermore, the power of the statistical decision test should be computed, to bear an indicator of reliability. The results of the analysis are presented in the following section.

Results

As per the coding protocol, the inventory of maritime cluster literature is allocated in four groups that compile the distinct categories of a simple contingency table (Table 1). The initial observation of the literature review is warranted within the Table, as fifty-five out of the one hundred and eighteen papers can be regarded as applicable to strategic management and are cited simultaneously. Subsequently, it would be relevant to investigate the exact correlation of the existence of citations within the premise of strategic analysis. The reliability (statistical power) of the analysis would have to be computed as well, in the form of the probability of correctly rejecting the null hypothesis when the alternative hypothesis is true (the complement of a type II error). This power analysis shall be conducted both prospectively (a priori) to determine the necessary sample size to achieve an adequate power of the test and retrospectively (post hoc) to evaluate the power achieved with the actual sample.

Table 1: 'Strategy' and 'Citations' crosstabulation (Source: author, SPSS™ output).

Strategy * Citations Crosstabulation			**Citations**		**Total**
			yes	**no**	
Strategy	**yes**	Count	55	35	90
		% of Total	π_{11} = 46.6%	π_{12} = 29.7%	π_t = 76.3%
	no	Count	12	16	28
		% of Total	π_{21} = 10.2%	π_{22} =13.6%	1 - π_t = 23.7%
Total		Count	67	51	**118**
		% of Total	π_s = 56.8%	1 - π_s = 43.2%	

Within the crosstab, the probability π_{ij} signifies the respective probability of each state. To compute the power of the test based on the given sample size, one would have to calculate the probability of discordant pairs and the odds ratio of the proportion of discordant pairs, to denote effect size. The probability of discordant pairs is $\pi_D = \pi_{12} + \pi_{21} = 0.297 + 0.102 = 0.399$, whereas the odds ratio of the proportion of discordant pairs is equal to $OR_D = \pi_{12} / \pi_{21} = 0.297 / 0.102 = 2.912$. The total sample size (N=118), the level of significance (α = 5%), the probability of discordant pairs (π_D = 0.399), and the odds ratio of the proportion of discordant pairs (OR_D = 2.912), constitute the input of the retrospective statistical power calculation. The post hoc analysis that computes achieved power of the test, renders a result of 91.6% (Figure 7, Table 2). Considering that the academic standard for power adequacy is a value of 80%, then the statistical power of the study, i.e. its ability to detect a factual eventuality, is more than adequate. Thus, the present analysis has a very high probability to correctly reject the null hypothesis and a very low probability of a type II error.

*Table 2: Risk estimate and statistical power (Source: author, G*Power™ and SPSS™ output).*

Risk Estimate			
	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio	2.095	0.887	4.952
Risk Ratio	1.426	0.902	2.255
N of Valid Cases	118		

Statistical Power	**Exact -** Proportions: Inequality, two dependent groups (McNemar)
A priori: Compute required sample size	
Input	**Output**
Odds ratio = 2.095 α err prob = 0.05 Power (1-β err prob) = 0.80 Prop discordant pairs = 0.399	Lower critical N = 23 Upper critical N = 40 Total sample size = 78
Post hoc: Compute achieved power	
Input	**Output**
Odds ratio = 2.912 α err prob = 0.05 Total sample size = 118 Prop discordant pairs = 0.399	Power (1-β err prob) = 0.916086 Actual α = 0.029305

Considering an a priori analysis to determine sample size prospectively, the input will pertain to the level of significance ($\alpha = 5\%$), the probability of discordant pairs (π_D = 0.399), the odds ratio of the proportion of discordant pairs ($OR_D = 2.912$), and the requested power of the test. If one was to select a level of statistical power of 80%, as would be acceptable, then the total sample size would have to be $N_{80\%} = 88$ ($< N_{actual} = 118$), whereas the minimum and maximum critical values of the sample would be $N_{CRmin} = 11$ and $N_{CRmax} = 24$ respectively. With $N_{actual} = 118$, the sample of the study can be regarded as more than adequate, surpassing the academic threshold for statistical power. The power of the test is plotted against total sample size in Figure 7.

For a sample under sixty the power would bear at 60%, whereas for a sample over one hundred and five, statistical power exceeds 90%.

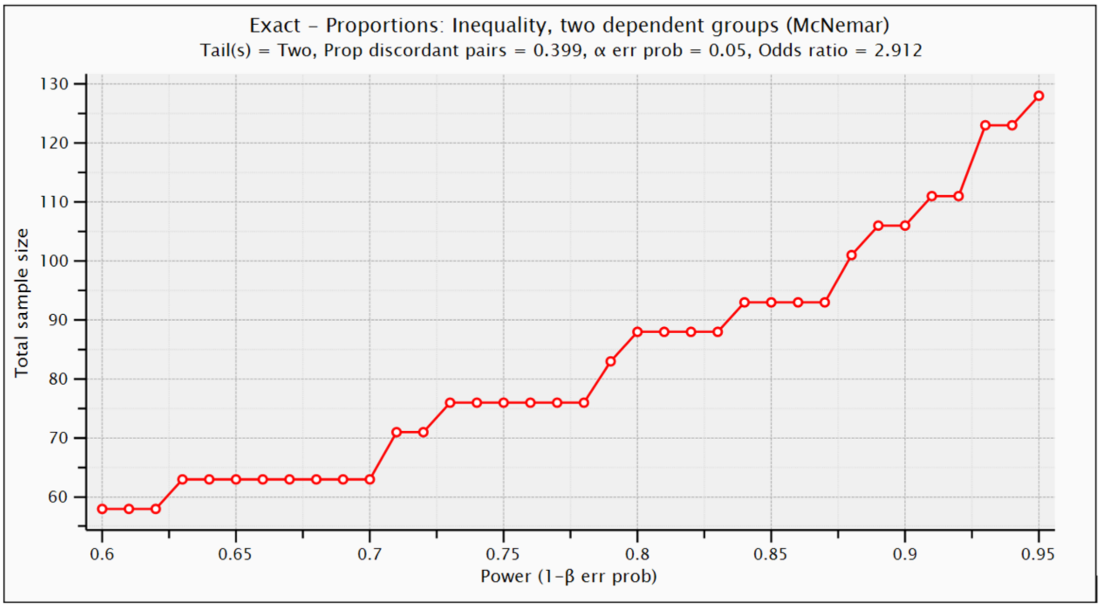


*Figure 7: Power of the test as per total sample size (Source: author, G*Power™ output).*

With an acceptable statistical power, one can proceed with calculating the measures of association, as well as with the statistical decision test. The 95% confidence interval for the odds ratio (OR) of the crosstab falls within the region of OR_{min95} = 0.887 to OR_{max95} = 4.952, with a value of OR = 2.095 (Table 2). This odds ratio pertains to a distinct indicator and is a different metric from the odds ratio of the proportion of discordant pairs in the previous calculation (that specified effect size); this odds ratio designates the odds of ‘exposure’ to strategy within the cited literature, to the odds of ‘exposure’ to strategy within the non-cited literature. Therefore, an OR = 2.095 signifies that the variable of (relevance to) ‘Strategy’ is associated with the variable of (presence of) ‘Citations,’ not in the sense that it proves that ‘Strategy’ causes ‘Citations,’ but in that ‘Citations’ are associated to ‘Strategy,’ in the manner that the presence of a strategic case raises the odds of citations (over two times), as compared to its absence.

A measure of association that is used in assessing the likelihood of an association representing a causal relationship, is the risk ratio. For the present analysis, the risk ratio is calculated at RR = 1.426, with RR_{min95} = 0.902 and RR_{max95} = 2.255. A value of the risk ratio above two is considered strong, wherein one could safely infer a causal relationship. At the same time, a weaker association (over the value of one but below the value of two) does not disqualify a causal relationship. As to the exact mechanism of causation, more research is required, although preliminary evidence of causality is relinquished herein. The exact calculation of the risk ratio signifies that given a publication with strategic relevance, the 'risk' of citations is 1.426 times higher (or 42.6% higher) than the risk of citations without a strategic case.

Table 3: The results of McNemar's test (Source: author, SPSS™ output).

Chi-Square Test		
	Value	Exact Sig. (2-sided)
McNemar's Test		0.001[a]
N of Valid Cases	118	
[a.] Binomial distribution used		

Given the dependent nature of the data, McNemar's test is administered, whose null hypothesis considers marginal homogeneity. It reflects the thesis that the probability of a case relevant to strategic management and absent of citations, will equalize the probability of the absence of a strategic case that is simultaneously cited. If these two events share commonality in their probability to materialize, strategy can hardly share an association, impact, or effect to the variable of academic impact. The opposite though, the rejection of the null hypothesis, thereby delivering statistical significance to the results, signifies statistical dependence (albeit causal or not) between the two variables. Rejection of the null hypothesis bearing evidence of the association of the variables is not a definitive indicator of causality. Although, especially with the risk ratio calculated over unity, there is evidence to indicate a causal relationship and warrant further investigation as to the exact nature of the association, through causal inference. The latter process will determine if the observed correlation is indeed causal.

The result of McNemar's test is included in Table 3. As the p-value of McNemar's test stands at 0.1% = p-value < α = 5%, the result of the statistical hypothesis test is statistically significant. The null hypothesis of marginal homogeneity is rejected; this result delivers strong evidence that, for the domain of maritime clusters, the premise of strategy and a publication's academic impact are associated. In addition to this correlation, the measures of association calculated reflect a quantitative approach as to the exact representation of this dependence (odds ratio) and provide preliminary indications of causality (risk ratio), as well. These results provide a stepping-stone for further research, to strenuously examine said correlation and (potential) causality, as the association between these variables can bear important contributions to the literature. This work has employed statistical method and provided results accompanied with solid statistical power, as to the indication that where there is presence of an analysis pertinent to the domain of strategic management, this seems to resonate with academia. Through this research, said indication has been substantiated.

Conclusions

Clusters of industry provide interesting analytical topics for academia and practice. They claim to harbour regional and/or national growth, competitive advantages, and sustainability, as they foster healthy competition and synergistic cooperation that drive value-creation and innovation to novel frontiers. Within the literature, clusters of many types can be found to bear significant impact upon the regions that include them. A category of clusters that has witnessed distinct popularity, is the one pertaining to the maritime sector. Although the influence and importance of maritime clusters is recognised, the literature with reference to these clusters has not been inclusively documented, categorized, and analysed. For this end, a structured review of the literature is conducted within this work. A preliminary extract from this review is that there is a high incidence of literature relevant to the domain of strategic management, notwithstanding the implicit or explicit inclusion of the latter. It would be interesting to initially document this incidence and subsequently investigate if this eventuality is important for academia. The first aspect of the study would require a categorization of the literature based on a dedicated protocol, to extract the publications relevant to strategic management. The second aspect would entail investigating the correlation of the occurrences of a strategic topic within the literature, with a marker of academic relevance and impact.

To explore this corollary, the aspects of interest are represented within two dichotomous categorical variables; the existence or absence of the premise of strategic analysis within a publication (relevance to strategic management) and the existence or absence of citations (academic impact). Subsequently, maritime cluster literature was coded per said study protocol and all cases were categorized as per their adherence to the variables, to produce a contingency table. With the extraction of the latter, measures of association and statistical decision tests can be applied. The odds ratio, a relevant metric that quantifies the strength of association shared by the variables is calculated, along with the risk ratio that indicates the strength of association between the variables; the latter is also extremely useful in assessing the likelihood that said association derives from a causal relationship. To investigate correlation of the categorical variables, one can employ a chi-squared test, although the independence of the samples must be determined. The present study concerns publications stemming from a body of knowledge wherein contributions are interdependent, as evidenced by cited literature, common aims and scope, and the approach of contributing to a specific body of knowledge. The very idea of contribution presupposes that there is a basis whereupon the contribution will rest; thus, the contribution is dependent upon the relevant body of knowledge. Therefore, marginal homogeneity of the crosstab is investigated through McNemar's test for dependent samples.

In addition to the measures of association and the statistical decision test, statistical power is calculated, both prospectively and retrospectively. The prospective analysis shows that the actual sample of the study is more than adequate to achieve acceptable statistical power, whereas the retrospective analysis returns a statistical power of over ninety percent. Therefore, one can conclude that the statistical hypothesis test has a very high probability of correctly rejecting the null hypothesis and consequently, a very low probability of type II error. The measures of association both indicate the strength of association between the variables. The odds ratio suggests that the presence of a strategic case within a publication raises the odds of citations, when compared to its absence. The risk ratio provides preliminary evidence of the likelihood that said association is based on a causal relationship. Finally, McNemar's test provides statistically significant results. All the techniques employed within point to the fact that for the domain of maritime clusters, the presence of an aspect pertaining to strategic management is important, as the incidence of an analysis relevant to strategy is correlated with academic impact and these two constructs may share a causal relationship, as well.

The contribution of this study, besides providing an inclusive inventory of the literature with reference to maritime clusters, is that it delivers strong evidence of correlation between the categorical variables of strategic management and academic impact. These results should be strengthened by future studies, with the further dissection of the literature and the investigation of confounding factors and effect modifiers within the variables. In addition, the causal inference of the results can be supplemented and evolve, stemming from the causation indications generated herein.

Publication list of Section I

(1) Papadimitriou, S., I. G. Koliousis, and P. J. Stavroulakis. (2016). "Analytical Competitiveness in Maritime Clusters." *University of Piraeus*.

(2) Stavroulakis, P. J., S. Papadimitriou, and Y. Koliousis. (2015). "The Competitive Advantage of Maritime Clusters." *SNAME 2015 Conference*, Athens, Greece.

(3) Koliousis, I. G., S. Papadimitriou, P. J. Stavroulakis, and V. Tsioumas. (2017). "The Culture of Maritime Clusters as a Paradigm for Competitiveness and Sustainability within Global Supply Chains." *ICTR 2017 Conference*, Thessaloniki, Greece.

(4) Papadimitriou S., D. V. Lyridis, I. G. Koliousis, V. Tsioumas, E. Sdoukopoulos, and P. J. Stavroulakis. (2018). "The Dynamics of Short Sea Shipping / New Practices and Trends." *Palgrave Studies in Maritime Economics.* DOI: https://doi.org/10.1007/978-3-319-98044-7_3

(5) Koliousis, I. G., S. Papadimitriou, E. Riza, P. J. Stavroulakis, and V. Tsioumas. (2018). "Scarcity theory and maritime clusters: From paradox to modelling." *Marine Policy*, 93: 40-46. DOI: https://doi.org/10.1016/j.marpol.2018.03.029

(6) Koliousis, I. G., S. Papadimitriou, E. Riza, P. J. Stavroulakis, and V. Tsioumas. (2019). "Strategic correlations for maritime clusters." *Transportation Research Part A* 120C: 43-57. DOI: https://doi.org/10.1016/j.tra.2018.12.012

Section II
Strategic analysis of maritime clusters

To further support the finding of the importance of strategy within maritime clusters, one would proceed to analyse maritime clusters from a strategic perspective. This analysis should include the extraction of strategic factors that enable competitiveness in maritime clusters, in addition to any qualitative and quantitative analysis these may foster. This section answers the second research question, of the (feasibility of) inventory compilation of competitiveness aspects for maritime clusters, and the (qualitative and quantitative) relationships among these. To venture towards this research question, a qualitative analysis within the theory is conducted to extract the aspects of competitiveness within maritime clusters. Then, an array of quantitative techniques is applied to these, with interesting results, some of which are expected, whereas others may be leaning towards the counterintuitive. The respective contributions of this section are as follows.

(1) The strategic factors shaping competitiveness for maritime clusters

Critically reviews the pertinent literature to extract the factors that formulate competitiveness in maritime clusters.

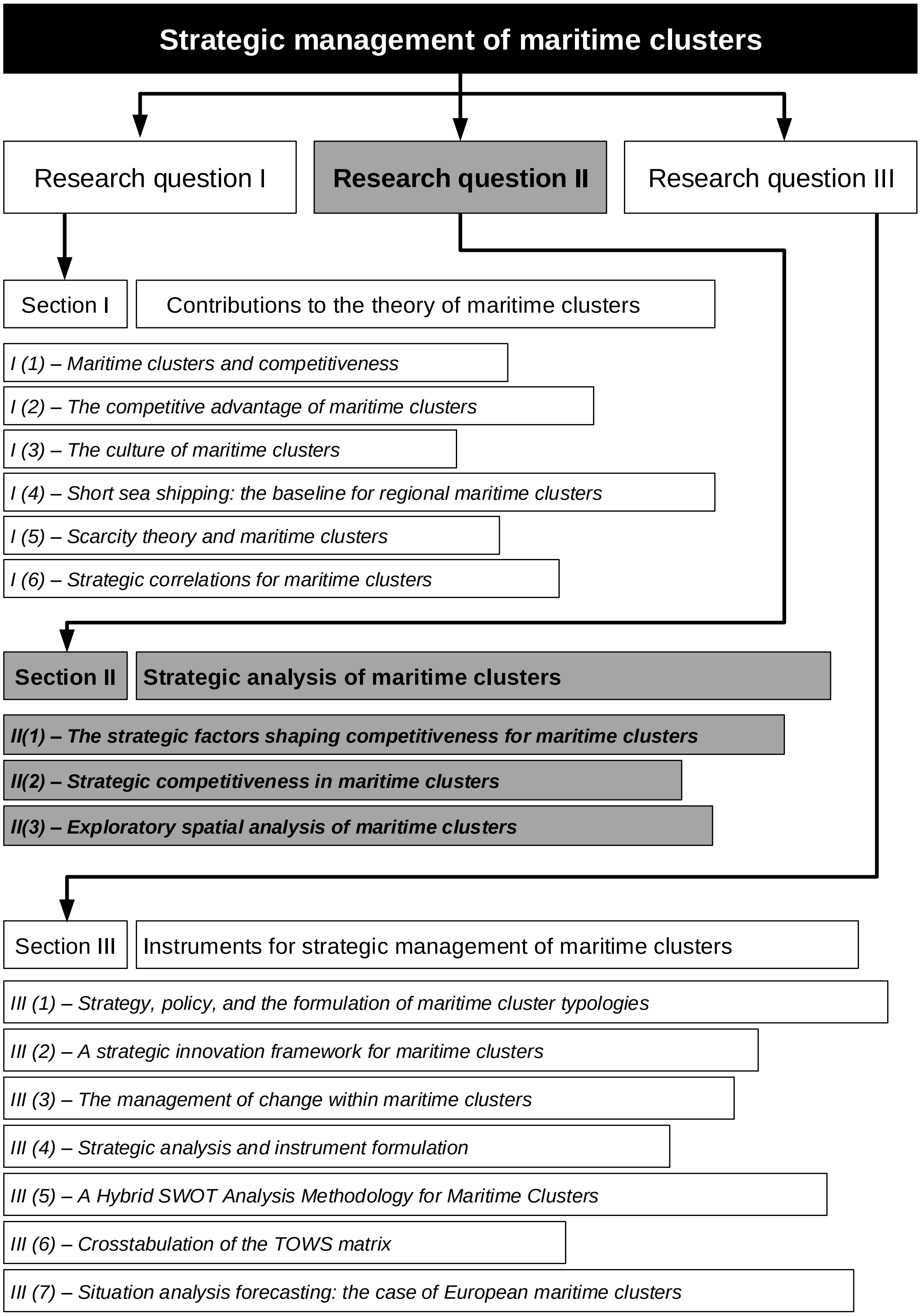
(2) Strategic competitiveness in maritime clusters

Provides a cluster analysis of the factors of competitiveness based on expert opinion, administered through questionnaire data.

(3) Exploratory spatial analysis of maritime clusters

Utilizing the questionnaire data collected, data mining is conducted to uncover any latent structure in the dataset, as per geographical origin, through factor analysis.

Thesis framework (Section II)



II(1) – The strategic factors shaping competitiveness for maritime clusters

Maritime clusters provide an attractive analytical base within a strategic management perspective, as they render a sanctuary for a plethora of strategic factors that sustain competitiveness. This fact is a direct corollary of the investigative potential that generic industrial clusters have provided for decades. Through the critical review of this body of knowledge, a venture to extract the strategic factors that instigate the effects leading to competitiveness is attempted. The objective of this work is to provide a topology of strategic factors concerning the rudiments of competitiveness within maritime clusters, their critical linkages with factors concerning other industrial clusters, and their differentiation, if any. For this end, literature concerned with industrial clusters is reviewed in order to extract the underlying factors that compose the distinct manifestation of competitiveness within and these factors are categorized as per their nature. This work aspires to provide a relevant understanding of the factors dictating the competitiveness of clusters in the maritime sector; its results contribute to the body of knowledge concerning maritime clusters, for they provide a readily available critical review of the elements that formulate competitiveness within these industrial entities.

Introduction

Industrial clusters have been enduring objects of study, deriving from Alfred Marshall's (1890/1920) 'localized industry,' to the point that scholars are still analysing the framework and dynamics of agglomeration economies and their underlying factors. Industrial clusters are considered as pillars of competitiveness, innovation, and sustainability for today's economies, for they may hold viable competitive advantages for industries and nations. The principles of the analysis of industrial clusters lie within the dawn of economics themselves and traces of the instigation of the theory can be drawn within the foundations of modern economic theory. Adam Smith's (1776) 'domestic industry' can be accurately regarded as a geographically clustered industry; even from these origins, we are able to observe a basic constituent of industrial clusters that is of a rather fuzzy and not explicit stock. For Smith it may be referenced as an 'invisible hand' that will guide the benefit of a society within a given geographical location "to promote an end which was no part of his intention" (though the 'invisible hand' is not generally coined as an industrial cluster constituent, we cannot overlook its subsequent relevance with industrial cluster theory), whereas for Marshall and whence illustrating the near-permanence of localization, it is the "mysteries that are no mysteries, but as it were in the air, the children learn many of them subconsciously." Though economic theory is all about identifying, analysing, and interpreting the dynamics of economies, we observe two predominant and pioneering fathers of economics entering the explicitly stochastic whence referencing the externalities of proximity. The thought that maybe clusters include an abundance of paradoxical elements is granted and as we will observe herein, defensibly sustained.

On the other hand, the attempt at the explicit is fruitful as well. Utilizing a formal and somewhat sterile perspective, agglomeration economies are all about concentration of entities due to cost reductions (McDonald and McMillen 2007). These cost reductions are said to originate from the three basic Marshallian dimensions that are better access to skilled labour (labour market pooling in proximity-locality), specialized suppliers (shared inputs and local supplier linkages), and knowledge spillovers (within the locality) from competing firms, as extracted from Marshall's work (1890/1920). The initiation of the 'localized industry' requires the pertinent conditions, albeit physical potential (e.g. from concentration of resources) and/or a centralized trigger effect; we would add these fundamentals to the dimensions of agglomeration economies mentioned above, for they are pertinent factors that readily affect cluster formation and health. The pillars upon which the industrial cluster is generated are ideas, people, goods, and natural advantages (Ellison et al. 2007) and these specifics may be the diverse facets of a unilateral cause: of the physical conditions that are required, or as literature suggests, the volatility of a centralization aspect that clusters need in order for these industrial entities to perform instigation (De Langen 2002).

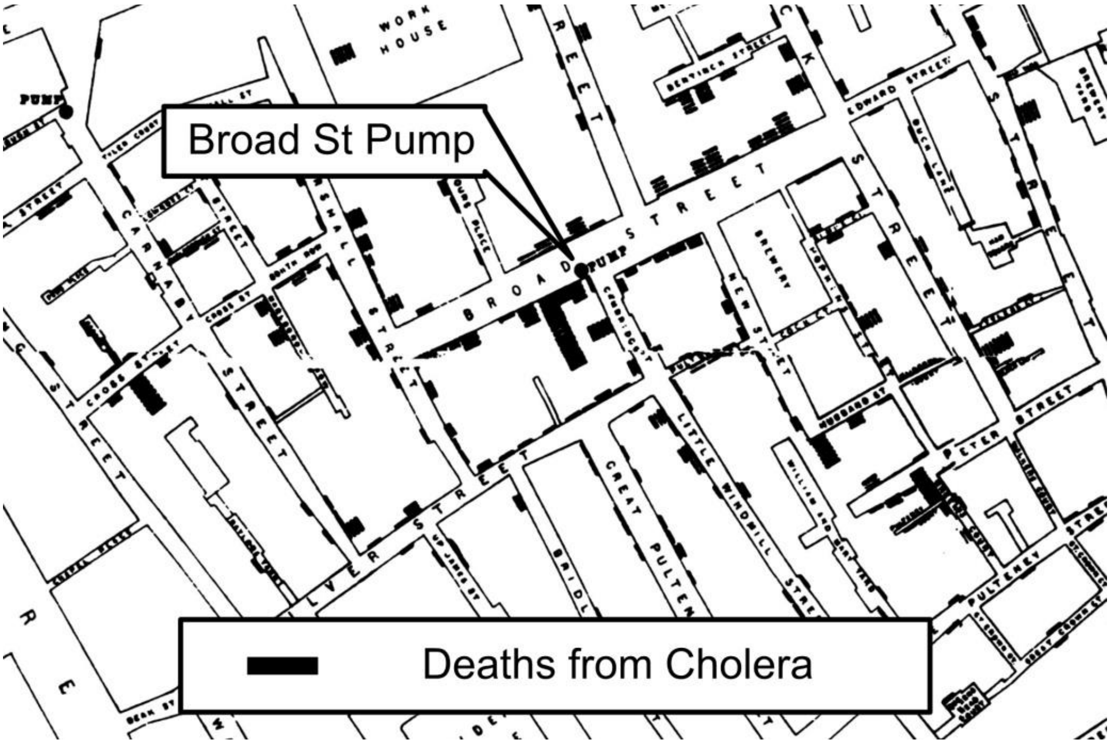


Figure 8: John Snow's 1954 drawing of cholera clusters (the original image belongs to the public domain).

Every time and in every aspect regarding agglomeration, whether we call it clustering or localization, the latent construct for the analyst is not that different: we seek out patterns and study them, in order to extract the cluster's structure, linkages, and components, and (by extension) better understand if not recreate this dynamic and fascinating phenomenon. The natural attribute within human beings that is to observe patterns within raw data and assign them to natural forming clusters has been manifested as the cornerstone of novel scientific domains as well as their formal initiation; John Snow (a father of epidemiology) mapped clusters of cholera cases in the 1854 London epidemic (Bonita et al. 2006) and thus paved the way for the origin of public health as a discipline. The original map by Snow portrays the clusters of cholera fatalities (Figure 8) and the water pump responsible for the epidemic, as located at the intersection of Broad Street and Cambridge Street. This ground-breaking work was utilized in order to (for the first time) associate a factor to an attribute, for until then, the miasmic decree was prevalent. Snow's work on clusters was the basis for the association of the disease to the single pump responsible for the outbreak.

The same underlying mentality and drive is utilized to study clusters of any kind, for within them lies the mesmerizing instance of patterns that can be investigated within an empirical or theoretical basis. Clusters hold parameters that whence observed within practice, are utterly daunting. Maybe it's the fact that nature herself utilizes them as the manifestations of abundance and opulence, that human beings are so keen to explore, understand, and imitate them. Whether referencing clusters of insects such as ants and bees or clusters of industries, the astonishment we may hold is identical, for we can observe a marvellous instance of systems on 'the edge of chaos' (Macintosh et al. 2007), self-sustained and always versatile, not only adapting, but always thriving within a complex, hostile, and ever-changing environment. The paradigm is along the lines that within this edge of chaos there is order, that within a given geographic location and following the ever-dictating scarcity principle, all members of the cluster may be able not only to survive, but prosper. It is maybe because of these paradoxes that we find clusters so interesting, because they hold so many characteristics that cannot be explained with any agreeable superficial account; they require severe scrutiny, pristine analysis, and recruitment of mighty mathematical instruments and even thence, they do not surrender their mysteries completely. Clusters as it seems are a prominent part not only of strategy and business, but society, nature, and life.

An inclusive and consolidated depiction of the strategic factors that are responsible for the formulation of competitiveness within maritime clusters is attempted, through the critical analysis of literature regarding industrial cluster derived competitiveness. As will hopefully become apparent, the industrial entities within the maritime sector that formulate clusters, hold much in common with generic industrial clusters, as there is no clear differentiation of cluster typology whence referencing competitiveness; rather, we could state that clusters are entities with veins of shared culture and characteristics, regardless of a particular cluster's distinct form and function.

Industrial clusters

Proximity, centralization, and agglomeration

Industrial cluster research finds a plethora of potential and exhibits herself in a wide range of applications. The three Marshallian factors can be analysed in order to extract location strategies (Alcacer and Chung 2010) and we are able to observe the centralization parameter being considered as a discrete analytical category, within centralized trading activities (Shi 2002). The centralized aspect can be embedded within a localization externality, such as the skilled labour pool (Searle and De Valence 2005), though whence investigating regional clusters by localized clustering and networking ties, centralization may prove to be a hurdle (Roolaht 2007); Hendry et al. (2000) argue that the centralization parameter is governed by a higher education institution. A first collective deliverable from the literature is that centralization may provide a stepping-stone for an industrial cluster's health. The aspect of knowledge creation is investigated thoroughly by Bathelt et al. (2004), whereas Feldman and Audretsch (1999) present the notion that it is directly correlated with ‘sticky knowledge’ (Von Hippel 1994) and with discrete geographical boundaries and components. The researchers move to conclude that specialization is not responsible to produce innovative output and favour Jacobian diversification; this both for industry and firm levels. Thus, proximity surfaces as a governing attribute for innovation, centralized dynamics and for the creation of knowledge, which as it turns out, are components of outmost importance for industrial clusters.

Jacobs (1969) argues that the knowledge spillover source and its underlying causes lie in diversification and that its benefits are situated outside of the industry, so following the diversification principle will lead to agglomeration; this is why there seems to be a persisting debate as to the externalities of agglomeration. For knowledge spillovers that generate innovation, the dichotomy is whether the cause is Marshallian specialization or Jacobian diversification. Van Der Panne (2004) shows that innovation is favoured by Marshallian factors; the inverse correlation of innovation and fierce competition is referenced as well. For innovation to flourish, cooperation is required. Beaudry and Schiffauerova (2009) investigate this divide from a meta-analysis perspective to conclude that both models are viable, and that specialization may hinder the more generous broadening of the economic cycle. The synergistic theory is supported by Helsley and Strange (2014) as well, for they demonstrate pertinent results whence the focus of analysis is a city. Galliano et al. (2015) highlight the benefits from utilizing a (dual) model of the fusion of externalities, for “an area can be both diversified (with a large number of activities) and specialized in the activity in which the firm in question is engaged.”

This synergy of typologies may hint to a novel response as to the analysis of agglomeration economies, for the two concepts may yet not be regarded as mutually exclusive with respect to innovation. Potter and Watts (2014) whence conducting a case study under the format of Marshallian factors indicate that these factors are still prevalent. Apart from the underlying causes of agglomeration and the debate therein, there is no question that knowledge creation and innovation are crucial factors of an intrinsic nature whence regarding geographical concentration of economic activity. The causes that sustain the former may be an object of empirical analysis, but literature converges whence the topic of knowledge creation is referenced with respect to industrial clusters: there can be no enviable industrial cluster without the inherent creation of new knowledge.

Innovation and culture

There is documentation arguing that (through the concepts and models generated for industrial clusters) validity is an aspect that remains to be exhibited and this should be formulated with the focus of a knowledge-based theory (Malmberg and Maskell 2002). Gibson and Kong (2005) provide a pertinent critical review of the cluster concept referencing the term 'cultural economy' as implicative of agglomeration and clustering. A healthy and synergistic culture could explain the effects that generate new knowledge within proximity and may provide the catalyst for the factors that result in cooperation that accommodates innovation. The aspect of knowledge surfaces from Maskell and Lorenzen (2004) as well, as does the notion that clusters lie between hierarchies and markets and exhibit many aspects of both. Industrial clusters are topologically diverse. De Langen (2002) provides a cluster construct and an in-depth analysis of the maritime sector in the Netherlands utilizing the three agglomeration economies (proximity of suppliers, knowledge spillovers, and the joint labour pool) as benchmarks; he also argues that competition fosters the clusters' performance.

We can extract that while there are instances wherein competition hinders innovation-driven competitiveness, there are others whence it may lead to a competitive advantage. This notion may present itself as a contradiction, but it actually designates a distinct cluster characteristic, for competition and cooperation are not mutually exclusive; rather they may share synergistic and complementary effects. Hassink (1997) offers a very interesting qualitative dichotomy for the characterization of agglomeration with respect to innovation, whereas Colgan and Baker (2003) provide a framework with eight dimensions for the assessment of clusters. The issue of the difficulty of clusters' explicit quantitative analysis and instrument reliability is referenced as well, and this is a finding that resonates with the fact that we can extract a plethora of instruments with pertaining interest to industrial cluster analysis.

Stavropoulos and Skuras (2015) demonstrate an inverse correlation of agglomeration and financial output whereas Delgado et al. (2010) indicate a direct correlation of clusters with entrepreneurship (that is coined as a medium of innovation). Schiele (2008) investigates the implications of clusters within strategic management and their importance in managerial decisions. Ghani et al. (2013) illustrate the externalities for female entrepreneurship and this within a cluster framework; the localization patterns of female entrepreneurs are analysed as well. Schuetz and Green (2014) investigate the agglomeration economies of art galleries and the clustering phenomenon within the art market, whereas Helmsing (2001) offers a three-dimensional effect framework of externalities, learning, and governance that affects the localization principle.

From a selected yet inclusive literature review with respect to industrial clusters that focuses primarily on their manifestation dynamics, underlying factors, and strategic constituents, we may extract that this divide of analysis pertains to a fertile ground for the potential of knowledge generation and analytical studies. The depth and breadth of potential analyses may be of a tantalizing extent; though the diversity of studies whence referring to industrial clusters may seem peculiarly abundant, their common threads seem to be harmonious and serenely uncontested.

Competitiveness

Within industrial cluster literature, there is a near mutual agreement that clusters foster competitiveness. From Porter's (2000) work we can extract a working definition for collective competitiveness and its close interrelation with clustering as well as the three ways that clusters affect competition: "increasing the current (static) productivity of constituent firms or industries, the increasing of capacity of cluster participants for innovation and productivity growth, and stimulating new business formation that supports innovation and expands the cluster" as well as his suggestion that "competitive advantage within the global economy seems to be local." This mesmerizing statement is as precise and self-explanatory as it is poetic and yet, with conflict inherent. Just to reference yet another paradox intertwined with cluster manifestation, the location paradox is analysed, as well.

Porter (2003) utilizes a database to extract factors driving competitiveness and divides regional economies in three sets: local industries, resource dependent industries, and traded industries. Liu et al. (2014) provide a competitiveness index with respect to industrial clusters, whereas Simmie (2004) shows that innovation (as a global dynamic system) drives competitiveness and discusses the linked processes that are productivity, innovation, and competitiveness; empirical evidence points to the direction that cluster dynamics may not be so intimately connected with innovation. Pinch and Henry (1999) explore an industrial cluster's competitiveness utilizing Krugman's theory and Simmie and Sennett (1999) examine the intricacies of the patterns that formulate cluster growth. Carbonara (2004) directly links clusters' competitiveness to innovation potential and their 'cognitive system' and provides a cluster typology with respect to distinct learning processes. Martin and Sunley (2003) yield a deconstruction of the cluster concept and point out the fact that caution is required whence utilizing the concept, for it is not free of caveats. Zhou and Ming (2014) conduct a competitiveness analysis for a magnesium industry cluster whereas Wang (2007) provides an analysis of competitiveness for a coal industry cluster wherein the relationship of the cluster with technical innovation is referenced. It seems that competitive dynamics are inherent in industrial cluster manifestation.

The focal length of studies with respect to clusters and their competencies can be very wide and diverse: city competitiveness can be examined within a cluster approach framework (Lyamzin 2005) and other factors such as eco-innovation (Daddi et al. 2012) can be investigated as per their relationship with competitiveness. Zhang et al. (2010) utilize the analytic hierarchy process and fuzzy comprehensive evaluation to assess competitiveness with respect to clusters of financial services. Spencer et al. (2010) extract the basic parameters of clusters from the literature to find a correlation of clustering with financial output and conclude that the cluster setting may be responsible for many firms' elevated performance. As can be extracted in near-mutual agreement, industrial clusters do foster innovation and competitiveness, yet provide a diverse and volatile setting for the evolution of industrial entities. At the same time, industrial cluster theory may be garnished with an arsenal of novel analytical instruments, which are directed towards its continuous exploratory enrichment and expansion.

Competitiveness within maritime clusters

Lee et al. (2014) investigate the shipping industry from a competitiveness point of view, extracting a shipping competitiveness index within a model that utilizes a dichotomy of competitiveness: present and potential, including the factors that formulate competitiveness for maritime clusters. Laaksonen and Mäkinen (2013) utilize Porter’s diamond to analyse the competitiveness of the Baltic Sea maritime cluster and point to elements that may hinder said competitiveness. Benito et al. (2003) utilize the diamond model to analyse Norway’s maritime sector, whereas Isaksen (2009) analyses various Norwegian industrial clusters in terms of innovation dynamics. Jenssen (2003) explores the linkages of innovation and competitiveness for Norway’s maritime industries to return the notion that skills and competences should be in the forefront of priorities. These elements may provide the building blocks for the innovation dynamics that a maritime cluster is so dependent upon.

Doloreux and Shearmur (2009) analyse the factors driving the fruition of three maritime clusters in Canada, as well as their competitiveness with respect to policy drafting; innovation and networking seem to be the factors pertaining to maritime cluster competitiveness. In their discussion with respect to the definition of a maritime cluster, they stress the importance of support organizations that diffuse knowledge and enable networking: “the term cluster is used to designate a geographic location (region) which has a higher than average concentration of firms in a particular domain (maritime sectors), research and education organizations which are active in a related field, and the presence of public support mechanisms operated by the government and regional stakeholders, through which actors share a common vision of growth and innovation strategies." This common vision can be correlated with the culture that is referenced in generic industrial cluster literature. We can gradually include in our parameters the importance of policy, cooperation, and of supporting industries (and/or entities, institutions etc.). In addition, the crystallization of a shared vision and the latent culture that will act as the supporting framework for this construct may hold the key that unlocks the elusive and paradoxical aspects of clusters, as mentioned above. Only if a common vision of mutual prosperity is sustained, then competition and cooperation surface not as conflicting parameters, but interdependent. This way, innovation becomes the medium of mutualism and eusocial dynamics, where competition stands to benefit the system, instead of polluting its dynamics.

Shinohara (2010) analyses the Japanese maritime cluster to introduce the concept of 'sustainable competitiveness' with respect to the cluster. The pillars upon which the pulse of competitiveness is dependent upon are "…at the initial stage of cluster formation, a strong government support for incubating each industry is necessary; business networking, especially long-term relationship between firms and support from financial institutions, is essential and human resource management based on the long-term co-working spirit is vital …" Again, we can observe the importance of a shared culture and of policy; within this work, the dimensions of culture can be considered as the education and research system, the style of corporate management, the mechanism of communication, knowledge creation and its transmission, as well as the value system of work. Inoue (2011) analyses the Japanese maritime sector with respect to the threats for the maritime community and Monteiro et al. (2013) formulate a differentiation framework for maritime cluster analysis from Porter's diamond with seven driving parameters of maritime clusters' performance extracted from Andersson et al. (2004): geographical concentration, specialization, cluster actors, cluster dynamics and linkages, critical mass, cluster lifecycle, and innovation.

It is evident that the maritime sector provides a very viable territory for the research and analysis of industrial clusters, as maritime industries are as diverse as they are competitive. It may be of substance to conjecture that though maritime clusters provide a very interesting benchmark whence analysing competitiveness within industrial clusters, their shared traits, characteristics, and similarities with a generic industrial cluster (if for the sake of the argument we would concede of such a device) are far more numerous and influential than their differences (which are not referenced in the literature, as far as an inclusive literature review is concerned). Whilst executing exemption and distance from any kind of bias in this theoretically derived conclusion, one could readily state that maritime clusters are merely another example of the abundant and collective manifestation that geographical proximity is able to encompass.

The strategic factors that formulate maritime cluster competitiveness

As Lee et al. (2014) utilize a framework of present and potential competitiveness that formulates a region's shipping competitiveness, it could be proposed that any competitiveness factor derives initially from cluster formulation that is based on conceptual and physical parameters. To illustrate the concepts, we utilize Ishikawa cause-and-effect diagrams. These diagrams were selected for they exhibit not only relations between factors, but the flow and synergy within them. Exactly as industrial clusters are dependent on shared values, culture, and communication, so do these graphical representations portray the simplicity on the one hand of the parametric constellation, but its breadth and interconnections, on the other. A dichotomy of representation and focus is instituted. The first level is general, for it portrays the basic succession of conceptual benchmarks; the second tier includes a detailed representation of the elements that guide the dynamics of the first. In order to be led to competitiveness within a cluster setting, the first and most important eventuality would be that of cluster formulation; this is manifested through 'invisible hands' that guide and nourish the cluster's birth, 'ideas that are as in the air' and the not so few paradoxes that we find inherent in the theory of industrial clusters. Directly across from these paradoxes we find one of the latent reasons behind industrial cluster research: the fact that cluster manifestation will lead to competitiveness if the entity is left to grow systemically.

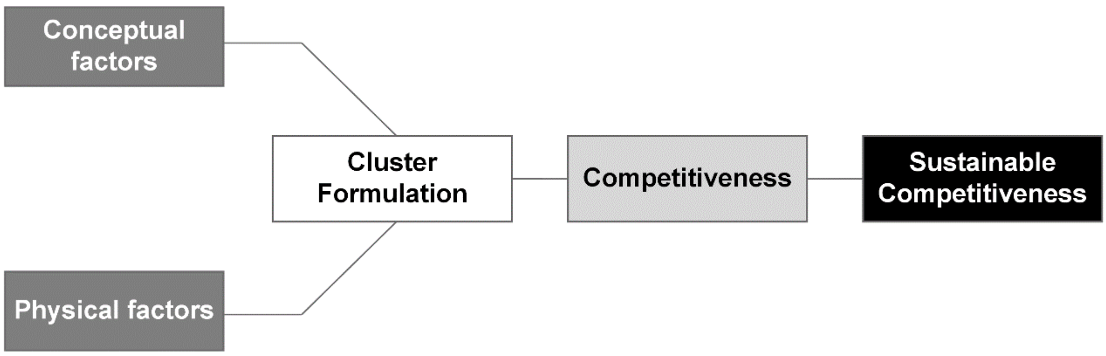


Figure 9: The process towards sustainable competitiveness (Source: author).

Based on the above, the natural progression proposed is illustrated in Figure 9. The term of 'sustainable competitiveness' (Shinohara 2010) has been included as the final chapter of the cluster formulation story, for if competitiveness is the objective, thence its sustainability should be intrinsic within the cluster's mission. For the first phase of the conceptual model that includes the strategic factors that formulate competitiveness, we depict the formation of the cluster that initiates from an unassociated and fragmented state. Conceptual aspects as well as physical ones are combined in order to instigate this construct (Figure 10).

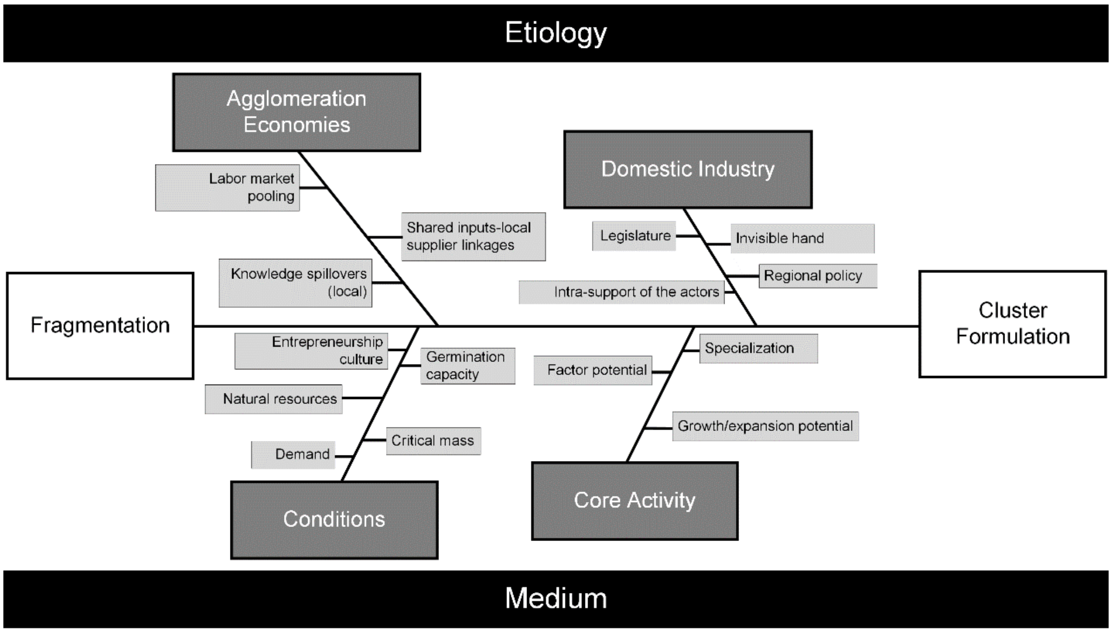


Figure 10: The process of maritime cluster formulation (Source: author).

The factors of aetiology hint to the reasons behind the formulation, whereas their mirrored elements provide more of the bricks and mortar for this consolidation (they are considered as the medium). Within the etiological factors we may include the presence of the Marshallian agglomeration economies (Marshall 1890/1920) that have been found to remain prevalent within an industrial cluster setting (Potter and Watts 2014), as to conjecture applicability within maritime sectors as well. Smith's (1776) domestic industry is included, wherein the 'invisible hand' will guide to the added value of the region; the support of the actors (Doloreux and Shearmur 2009) within it will play a crucial role as well. The 'invisible hand' at this phase represents all intangible constructs that will guide cluster formulation, albeit culture (Shinohara 2010), sticky knowledge (Von Hippel 1994), or indeed any notion that will facilitate the geographically based industry towards its sustainable progression.

Simultaneously, regional policy and governance (Doloreux and Shearmur 2009) will play their part in the formulation of this particular domestic industry (policy does play a prevalent role, as is included in the next phase of the overview as well, though here it designates solely the regional policy that affects the domestic industry).

At this point of cluster formulation, we sustain the conclusion from literature that antagonism may be catastrophic, for we hazard the conjecture that for cluster formulation, support is required from the members in proximity, rather than antagonism (cf. with Van Der Panne 2004). On the other hand and laterally guiding cluster formulation, we relinquish the aspects that mirror the etiological constructs and provide the medium for cluster formulation; these include the core activity and the conditions (this core activity, as may be accurately associated, has been tailored as such in order to include the 'centralized aspect' of the cluster). Within the latter we have included demand factors (Porter 2000) that can be formulated from factor and demand conditions, critical mass (Andersson et al. 2004), natural/regional resources (Marshall 1890/1920), the culture of entrepreneurship (Colgan and Baker 2003), and germination capacity (Delgado et al. 2010), whereas factor potential (Porter 2000), expansion potential (Simmie and Sennett 1999), and specialization (Spencer et al. 2010) have been included in the core activity aspect (Figure 10).

Within the formulating maritime cluster, demand will guide productivity, whereas critical mass and germination capacity will fortify the much-needed growth dynamic for a cluster's emergence. Natural resources (although the term usually refers to all resources with the exception of human association, herein 'resources' are not limited to conceptual and/or physical or even indeed potential resources, as the resources utilized from a cluster are not readily traceable, cf. with Isaksen 2009) need to be present, along with the culture of entrepreneurship. Culture cannot be left out of the cluster formulation constituents, as she is a parameter that is distinctly present within the totality of a clusters' life cycle. Models with which to address the cluster manifestation topic are numerous and from these, the strategic factors that impose constraints and guide competitiveness can be extracted and analysed. The factors within De Langen's (2002) work are utilized and distributed on the basis that agglomeration economies are an etiological factor that will facilitate cluster definition, whereas entry and exit barriers are included in the infrastructure constituent.

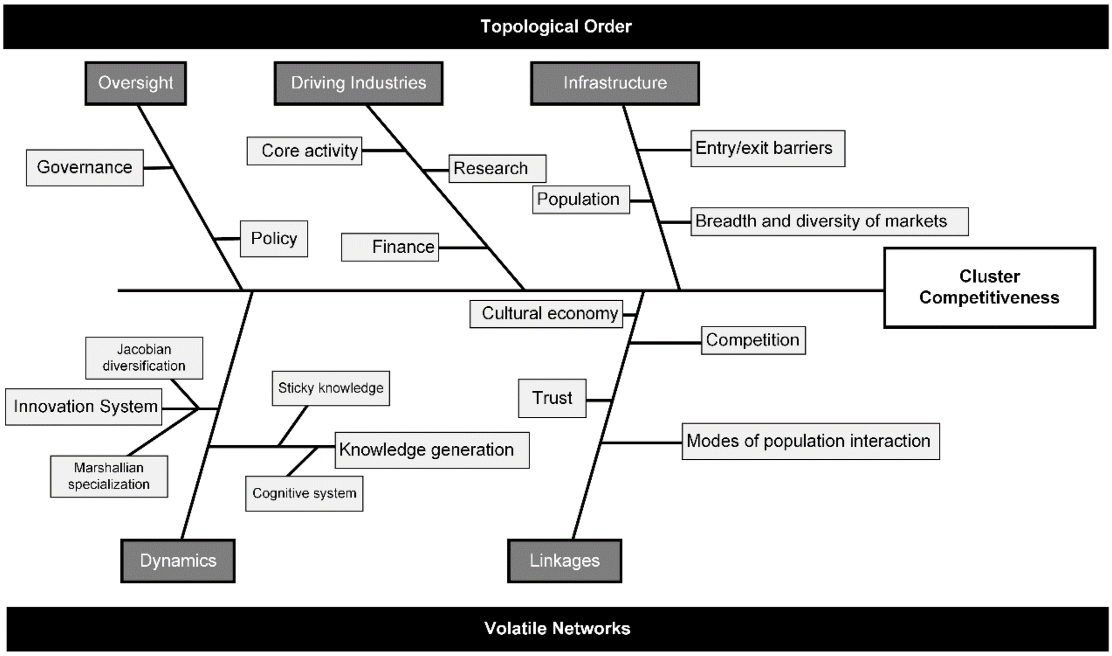


Figure 11: The process towards maritime cluster competitiveness (Source: author).

The factors linking cluster manifestation with cluster competitiveness are distributed within five categories that are oversight, driving industries, infrastructure, dynamics, and linkages (Figure 11). We consider the dynamics and linkages categories pertaining to the volatility of networks, whereas oversight, driving industries, and infrastructure constitute the topological order. Within the dynamics that guide competitiveness, we include knowledge generation (Bathelt et al. 2004; Maskell and Lorenzen 2004) that is composed of 'sticky knowledge' (Von Hippel 1994) and the entities' cognitive system (Carbonara 2004), along with the innovation system

(Simmie 2004; Isaksen 2009), and move to favour the Marshallian - Jacobian synergistic approach (Galliano et al. 2015) rather than the divide, so both are included as parameters of systemic innovation (Van Der Panne 2004). The strategic factors that constitute linkages within a maritime cluster are a fusion of the modes of population interaction (Jenssen 2003; Shinohara 2010), cultural economy (Gibson and Kong 2005), trust (Isaksen 2009), and competition (De Langen 2002) between the cluster participants.

Linkages are a very crucial element of a cluster's viability, for competitiveness is largely dependent on the way that cluster members interact with one another (Simmie and Sennett 1999). Competition has been removed from the modes of population interaction, for it has been deemed as an especially important (and distinct) parameter for the understanding of the formulation of the threads of competitiveness within a maritime cluster (De Langen 2002) and is thus worth defection. Akin to competition there is trust, for in clusters we can witness the harmonious coexistence of trust and competition (Porter 2000). Again, we observe culture as a distinct parameter, but this time within the setting of an explicit economy.

Though a cluster may not be created as successfully from directives, or at least not with the success it may have if left to evolve systemically, the element of cluster oversight is very important and crucial for a cluster's members to remain competitive (Andersson et al. 2004). For this reason, we include policy (Isaksen 2009) and governance (De Langen 2002) as two distinct parameters within oversight (in the 'oversight authority' sense). Lateral to policy and governance, the centrality parameter is present whence moving towards the competitiveness aspect of the cluster, but now its role is supporting and joined by other driving (and simultaneously supporting) industries, such as financial institutions, markets (that provide facilitation and streamlining in many aspects and for many stakes within the cluster lifecycle) and research (and/or educational) institutions (Colgan and Baker 2003).

These industries play a central role towards the cluster's competitiveness, for they are the catalysts that will drive the cluster's members towards mutualistic prosperity and at the same time will protect and reinforce the cluster from stagnation; for this exact reason they are coined as driving industries, as at first glance they may just seem to have a supporting role, but their latent importance is nearer to that of a competitiveness driver's. Next to the driving industries we find the cluster's infrastructure that is imperative for its competitiveness (De Langen 2002). The cluster infrastructure factors that will lead to competitiveness are the breadth and diversity of markets (Colgan and Baker 2003), entry and exit barriers, and the cluster population per se (De Langen 2002). The population of the cluster, though a dynamic entity, will pose as the cornerstone of the cluster's viability, as the cluster's competitiveness is its direct derivative. This population's entry and exit barriers will dictate the rhythm of the cluster's growth and along with the breadth and diversity of the markets (that are yet another parameter of cluster health) within the cluster, the topology of the infrastructure dynamics is complete, as included in Figure 11.

Each factor as extracted from literature and referenced herein plays a part towards the end-process of sustainability. If the objective is competitiveness, thence all these factors are pertinent strategic factors, for they must be considered each with its own distinct effect upon a strategic decision. Within the attempt to provide an initial topology of the factors that shape competitiveness within maritime clusters, we have included strategic factors that derive from the literature directly concerned with maritime sectors, joined with strategic factors that could not be left out of the conceptual model; for (even if their original scope within the literature was not the maritime sector) they are deemed as gravely influential strategic factors for industrial clusters in general. It could be of interest to investigate if the opposite notion stands and to analyse generic clusters' competitiveness utilizing maritime clusters as the benchmark. This concept, if verified, would move to strengthen the thesis that all industrial clusters share a common array of characteristics and exhibit these freely, regardless of the sector they belong to, or the central industry they support.

Another suggestion that crystallizes only after recollection of the abundance of instruments with respect to industrial cluster analysis is that though many instruments could be selected in order to portray the dynamism of strategic factors and their synergistic characteristics, Ishikawa diagrams seem to have a compounding effect upon the representation of strategic factors; this because the cause-and-effect diagram is able to actively portray an inclusive topology of rudiments relevant to the entity under analysis. Through its structure, it leads to an apparent synergy that can result from the consolidation of strategic factors and the simultaneous portrayal of their interrelations.

Conclusions

An inclusive approach as to the factors that harbour the resilience of maritime clusters has been attempted. Through this work, an inventory of strategic factors has been consolidated and pertinent conclusions regarding the competitiveness of maritime clusters may be generated. A taxonomy derived from literature and depicted through cause-and-effect diagrams has been proposed as to the causes of competitiveness within said industrial cluster divide. The inventory of strategic factors can facilitate the review and analysis of strategic management of maritime clusters, for it includes the pertinent indicators that must be taken under consideration from a plethora of perspectives and for an equal number of stakes.

The effort to shed a bit more light as to the intricacies and paradoxes of maritime clusters may have been productive, for within its inclusive approach, this work has gathered pertinent strategic factors that have been found to formulate competitiveness; at the same time, this inventory is not static and can be further analysed. The strategic overview included herein cannot be considered as a panacea, but rather as a dynamic inventory that must be challenged and enriched over time. It would maybe be of interest to institute a quantitative methodological instrument to provide a hierarchical analysis of the factors included herein, both from the standpoint of a present construct evaluation as well as from a strategic planning constituent.

Within this work, a comprehensive mapping of the factors that can be utilized extensively by strategic management practitioners with respect to industrial clustering is pursued; at the same time an extraction of factors in order to compile a preliminary benchmarking analysis with respect to the competitive advantage of maritime clusters is ventured. Though this inventory was compiled through the prism and focus of maritime clusters, the results may be utilized for the benefit of a practitioner in any industrial cluster setting. As is demonstrated, maritime cluster formulation is strongly dependent on policy, so by extension, many, if not all, of the strategic factors discussed herein have an implicative aspect with respect to policy drafting. The topology herein may well find applicability within a range of managerial applications, especially whence concerned with strategy formulation, for it may assist towards the understanding of the diverse array of strategic factors that enable the manifestation of competitiveness. At the same time, it can pose as a facilitator for managers venturing towards the extraction of clear strategic directions that are based on internal environmental scanning and the hierarchical positioning of strategic factors.

Hopefully, this work may serve as a stepping-stone towards the competitiveness of a maritime cluster's member, whether it is an active firm, a supporting institution, or an oversight agency.

This work can facilitate towards further intrinsic analysis with respect to maritime clusters and at the same time provide a methodological instrument to be utilized with respect to generic industrial clusters. In addition, the strategic factors affecting and influencing competitiveness as extracted from pertinent literature are consolidated within a structured inventory that may aid further scholarly research in addressing the issues rooted in effectiveness of industrial and maritime clusters. As intrinsic characteristics of knowledge dynamics in academia, continuity and evolution can find a distinct ally within the present work, as it fosters the potential for a lateral continuum that may germinate from herein. Based on this work, quantitative instruments able to prioritize strategic factors may be utilized in succession to the qualitative inventory and through their quantitative representation, pertain to accurate situation analysis of any internal strategic environment; this instance could as well lead to novel typologies' formulation. Simultaneously, the qualitative topology relinquishes itself for analysis, criticism, and enrichment. Furthermore, the attempt to map the strategic factors that shape competitiveness of maritime clusters utilizing Ishikawa diagrams may be performed with other methodological instruments and thence compared in order to investigate synergies and/or convergence.

II(2) – 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 has been 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 within clusters. The objective of the present work is to address this gap in the research, through exploratory data mining among the factors that affect competitiveness in maritime clusters. Within a structured review of the body of knowledge concerning maritime clusters, an inventory of strategic factors is extracted. These factors are sorted per Likert-type importance and exploratory cluster analysis is conducted. Through this methodology, items with strong correlations are grouped and an importance-based narrative for the competitiveness of maritime clusters is developed. The results of this research can be further utilized for benchmarking purposes within the realm of managerial practice, inclusive of the fields of policy and strategy. In addition, this work can provide a stepping-stone for future research, as many qualitative and quantitative instruments may be utilized to validate or challenge the results generated herein.

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, or investment firms; instead, they 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, 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, 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 (relative) 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 (academics and/or practitioners 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 (and their use as variables) per Likert-type importance. The results were then analysed to extract descriptive statistics of the assessment; these, in turn, provided the classification (per relative importance) of the variables. Furthermore, a cluster analysis of the results provided 'importance clusters' that can be extremely useful in analysing maritime clusters, as well as an 'importance narrative' for their manifestation.

This work is organised as follows. The present 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 work closes with the conclusion section that provides an overview of the research and discusses its relevance and impact.

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, stretching 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 for 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.

Methodology

As the literature review has produced the first analytical part of interest, the collection of the strategic factors, one must move to select a pertinent instrument to assess their importance. A simple, yet effective, process is administering a Likert-based questionnaire. Thereby, to quantitatively analyse the factors that instigate and sustain competitiveness within maritime clusters, a twenty-one-item questionnaire was developed, whilst adhering to proper questionnaire development guidelines, as addressed in the literature (Dolnicar 2013; Khari and Siavashan 2012; Tarighi et al. 2017). The whole project was planned, executed, monitored, and controlled based on 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). 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 included in Table 4.

Table 4: The competitiveness factors for maritime clusters (Source: literature review extracts).

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 4, 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). Then, for quality assurance purposes, the survey was pilot tested on a small sample of respondents, to ensure validity and reliability. In order to evaluate the factors presented, a pool of experts was drawn from the body of knowledge of industry clusters. This pool included scientists, researchers, academics, and practitioners 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 pilot testing of the questionnaire was concluded by November 2017 and the survey started accepting responses during the months of December 2017 up until May 2018. The questionnaire can be accessed through the link found in

Appendix A.

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 a final 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 5. 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 work, since if the factors' list changed temporally, the results' validity would suffer. For the sake of completeness, the factors complementing those in Table 4 that were proposed by the respondents themselves can be accessed in Appendix B.

Table 5: The Likert-type scale (Source: author).

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. The respondent could then 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.

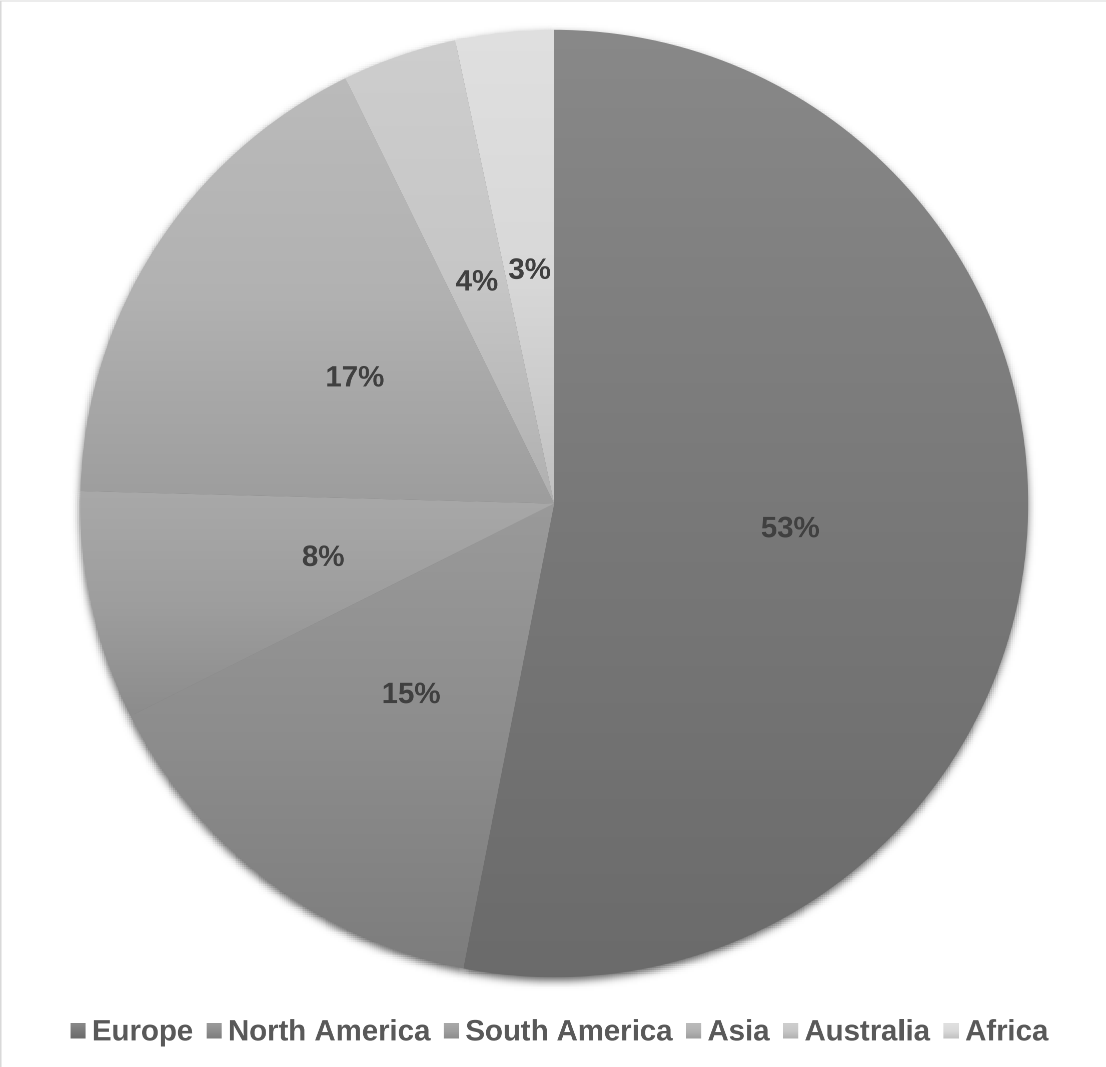


Figure 12: The continental distribution of the sample (Source: author, Excel™ output).

The choice of conducting the survey via a questionnaire facilitates the process of compiling a sample without geographical constraints. A preliminary analysis of the sample of respondents demonstrates that the former is quite diverse with respect to the variable of country of origin. As location is a prime factor of importance with reference to clusters, one may expect each respondent to classify the competitive factors according to personal (and regional) experience, albeit academic or managerial. Through utilizing aggregate data, any inherent regional peculiarities get cancelled out and the research produces a global average. The geographical span of the sample is forty-three countries within six continents. The spatial distribution of the respondents can be found in Figure 12.

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 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 and 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 0.00, 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 4 corresponds to a weight of 0.75, and Likert-scale point 5 corresponds to a weight of 1.00); these weights are presented as 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 12, where 'x_i' is the value of the variable for each case and 'w_i' the weight for each case.

Equation 12: The weighted mean.

$$\bar{x} = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i} \tag{12}$$

Subsequently, a cluster analysis for the Likert-type scale items was conducted, to extract the relevant clusters within the pool of factors. The methodology used was hierarchical clustering measuring squared Euclidian distance (between-groups linkage). The Euclidian distance between the items is presented in Equation 13.

Equation 13: The Euclidian distance calculation.

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

The process begins with all cases thought of as distinct clusters, whilst finding the most similar pair of clusters (by calculating their distance) and joining them. The method 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. This analysis can offer a first step for exploratory analytical procedures with respect to the dynamics of factors that affect competitiveness within maritime clusters.

The reliability of the data was assessed through the reliability coefficient alpha (Cronbach 1951). The measure (Equation 14) 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 factually assesses this notion.

Equation 14: Cronbach's alpha.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} S_i^2}{S_p^2}\right) \qquad (14)$$

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

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 14) 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 6.

Table 6: The case processing summary and Cronbach's alpha (Source: author, 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		

	Total	184	100.0	a. Listwise deletion based on all variables in the procedure.

Table 7: Response frequency and weighted means (Source: author, 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 7. 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 8. For comparison purposes, the initial numbering of the factors has been retained.

Table 8: The factors sorted per significance (Source: author, MS Excel™ output).

Order	Factor	W1	W2
1	**Labour market pooling (no. 2)**	4.48	87.09%
2	**Local supplier synergies (no. 3)**	4.34	83.56%
3	**Trust (no. 16)**	4.33	83.20%
4	**Cooperation (no. 21)**	4.29	82.32%

5	**Knowledge management (no. 17)**	4.22	80.46%
6	**Education sector (no. 1)**	4.19	79.78%
7	**Innovation system (no. 10)**	4.13	78.16%
8	**Knowledge spillovers (no. 12)**	4.13	78.16%
9	**Entrepreneurial culture (no. 4)**	4.10	77.60%
10	**Strategic management (no. 18)**	4.07	76.66%
11	**Specialization and diversification (no. 15)**	4.01	75.14%
12	**Specialization (no. 13)**	3.97	74.31%
13	**Factors/maritime industry (no. 19)**	3.95	73.75%
14	**Financial institutions (no. 7)**	3.92	72.94%
15	**Governance structure and policy (no. 6)**	3.85	71.17%
16	**Corporate culture (no. 5)**	3.83	70.63%
17	**Breadth and diversity of markets (no. 9)**	3.70	67.58%
18	**Competition (no. 20)**	3.62	65.47%
19	**Diversification (no. 14)**	3.59	64.70%
20	**Market entry and exit barriers (no. 8)**	3.52	62.92%
21	**Natural resources (no. 11)**	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 finding, 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 9. 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 9: The agglomeration schedule of the cluster analysis (Source: author, 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 and 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).

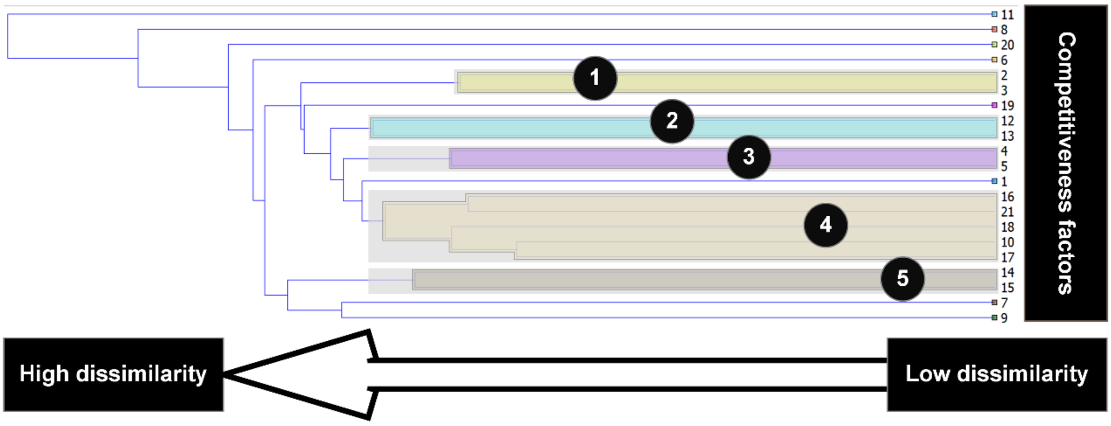


Figure 13: The dendrogram with thirteen clusters (Source: author, Orange™ output).

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 13). These thirteen clusters pertain to five clusters that contain at least two factors (numbered in Figure 13), whereas the remaining eight clusters are distinct items.

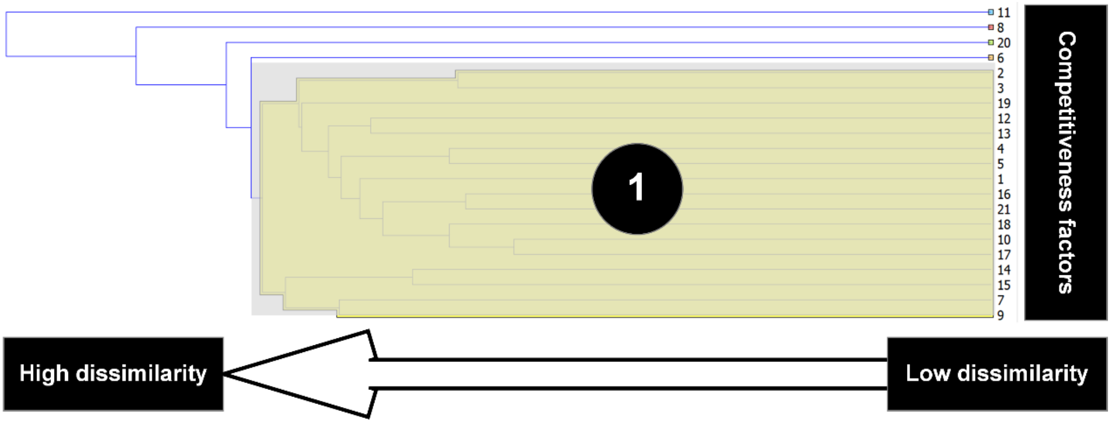


Figure 14: The dendrogram with five clusters (Source: author, Orange™ output).

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 14). 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.

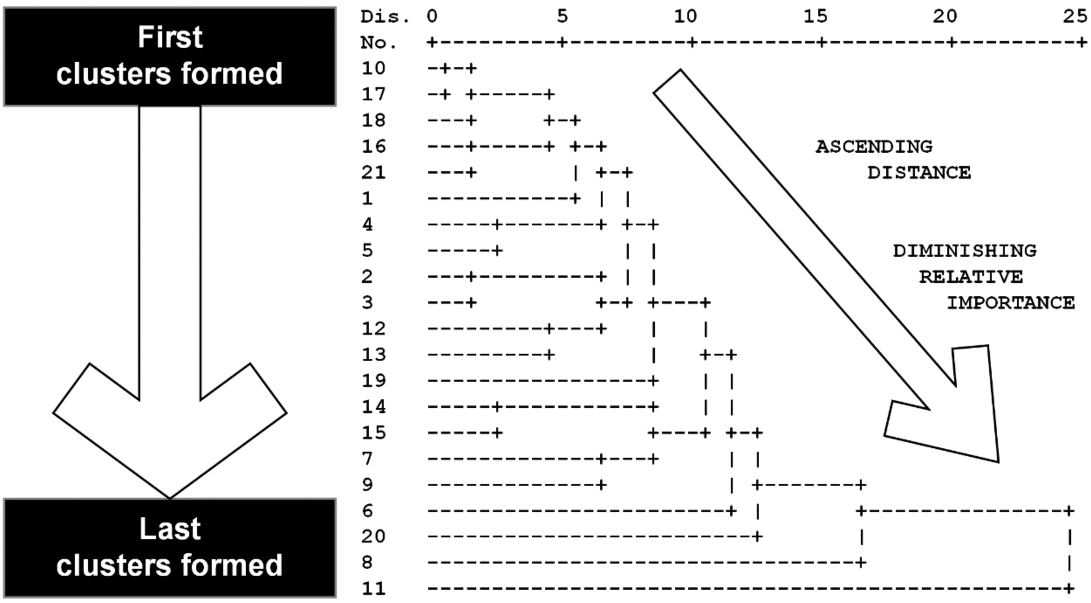


Figure 15: The dendrogram using average linkage between groups (Source: author, SPSS™ output).

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 findings, 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 15. Therefore, through outlier analysis and the relevant sequencing of the emerging clusters, strategies and policies for cluster formulation can surface.

Conclusions

Clusters are considered 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 market adversity. 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 clusters of all industries. The concentration of shipowners, port agents, suppliers of marine equipment, port authorities, shipbrokers, and logistics providers (among many others) in the same region can potentially enhance their competitiveness, so long as they operate in a coordinated manner; as one, and in full harmonization with the culture of the cluster. 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 industrial entities.

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, via the calculation of two different weighted averages. The results 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, exploratory cluster analysis of the strategic factors is conducted that secures grouping of distinct clusters. Cluster analysis can be a beneficial instrument for strategic analysis, as it not only indicates which factors are grouped first, but it can also be used to extract outliers. The calculation of reliability returned a high value for Cronbach's alpha, hinting to strong internal consistency of the raw data.

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. The sample of the survey may be stratified, as per any number of different variables, in order to investigate divergence within the strategic factors. One variable that has the potential to address regional importance disparities is that of spatial distribution. If this variable is selected, then a novel research question may surface, pertinent to the importance narratives not for maritime clusters in general, but the strategic factors of importance for maritime clusters as per their spatial configuration. With this approach, relevant mapping may be extracted, through which one can benchmark clusters of excellence as per their geographical distinction. Another variable that could produce interesting results is that of the respondent's professional background. It would indeed be interesting to investigate if the results converge when the sample is stratified among managerial and academic cluster experts.

Notwithstanding, this research can be beneficial for managerial practice as well, as a practical categorization and ranking of strategic factors is procured that can facilitate strategic management and policy formulation simultaneously. Maritime clusters can utilize the results herein to reach new levels of competitiveness, by analysing their strategic position with respect to the importance narratives produced within this research. Maritime clusters are provided with a benchmarking inventory that at any time can point to sustainable competitiveness. At the same time, clusters of other industries could formulate novel tactical approaches by benchmarking the clusters of strategic factors that are of interest to their specific industry. These results can also be very helpful in the initiation of clusters, as the cluster analysis of the strategic factors may provide a definitive prioritization of the groups of strategic factors that must be taken under consideration, so that the cluster is able to thrive.

Essentially, this work complements the existing literature by extrapolating the key drivers of strategic competitiveness in maritime clusters and ranking them based on their perceived importance. As mentioned, the sequence of factor groupings 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, synergy among local suppliers, trust, cooperation, knowledge management, and an 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 strategic 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 varied cluster types. 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 other quantitative instruments to analyse and compare the results herein.

II(3) – 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 the firms situated within, the region, and in many cases, the nation harbouring the cluster, altogether. For this reason, the attention exhibited towards these constructs of industry can be understood, as a bounded region has the potential to provide the foundation for a sustainable regional, and even national, competitive advantage. Pair these dynamics with the drive of the maritime industry and the results can be explosive, bearing the capacity to transform otherwise unembellished regions into beacons of global excellence. 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 important strategic elements of clusters, is absent. This work attempts to introduce a topology of the pivotal factors within maritime clusters and provide 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. Through the methodology utilized, the excellent and world-renowned clusters can provide benchmarking milestones that will assist regions in attaining a competitive position in an ever-changing global marketplace.

Introduction

Maritime clusters are excellent cases of the cluster concept. This is because the maritime industry is eccentric and extreme. Not many industries balance on a tightrope among the romantic and the analytical. There are not many industries where “camaraderie, storytelling, and commercial espionage” (Hershman 1988) go hand in hand with cluster culture. Maritime business is people. As such, it contains all the romanticism of venturing to overcome the treachery of the Sea, with naval engineering, business, strategy, and economics. Shipping and maritime business pertain to an amalgam of many interesting facets that can provide a plethora of domains with a fertile ground to develop and assess theories and quantitative constructs, as well as abstract and factual concepts. One of the latter that has gathered much attention from academia and practice alike, is the spatial agglomeration of industrial activity, coined as an industry cluster.

Cluster research is very interesting, as clusters can provide the drive towards a competitive advantage that can benefit localities, regions, and even nations towards the much-pursued end of sustainability. It does not come as a shock that policy has garnished attention towards these constructs of industry. Within a cluster a plethora of competitors can push through the scarcity principle and thrive simultaneously, through the vessel that is innovation. At the same time, many elementary concepts for clusters remain elusive (Doloreux 2017). This paradox provides a volatile opportunity for research, to develop and utilize theories that will explain the phenomenon effectively. A phenomenon that remains, geographical. The body of knowledge can pertain to diversity thus harbouring 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.

Thereby, maritime clusters are so successful; the maritime industry sine qua non is inherent with culture, folklore, traditions, and values: a maritime community. 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. As such, 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. Maritime clusters can then be considered as benchmarks of the cluster concept. This not to draw any attention from other types of clusters, where indeed excellent cases are afar from maritime (Silicon Valley, Hollywood, etc.), but at the very least, maritime clusters are indeed distinct and do provide an indicative case study of the cluster concept.

Within the body of knowledge concerning maritime clusters, there is much attention pertaining to spatial concentration and its dynamics (as is evident in the research body of generic industry clusters as well, cf. with Klepper 2010), although studies that aim to extract structures and constructs that govern the diversity, culture, and disposition of maritime clusters are sparse. This research tends to this gap in the body of knowledge. A questionnaire with factors deemed important for maritime clusters was compiled and forwarded to a sample of expert representatives from academia and practice. 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 and exploratory factor analysis was conducted on the sample. 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.

These results assist in the understanding of the governing parameters of clusters and can assist in benchmarking. The analytical instruments utilized are validated and further research can spawn from the work herein that can substantiate and/or challenge these results. This work 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, and the research concludes with a discussion.

Literature review

The theory of cluster research is collectively acknowledged to have stemmed from the Marshallian agglomeration economies (Marshall 1920). A step deeper in the analysis would be to include von Thünen's (1826) centralized construct as the first model of a cluster; and a step even further would be to regard Smith's (1776) 'invisible hand' as a core cluster element. Smith analyses the regional stakes that will be aligned implicitly through the manifestation of a local industry (i.e. a regional cluster), whereas Marshall notes 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." 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 are 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) 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.

On the antipode, contemporary research has bloomed through the works of M. Porter (1998; 1990). Porter has provided a popular 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 scientific foundation of industry clusters is economic geography, though this is expanded and embellished to include strategic management (Koliousis 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 multidisciplinary attention and interest in the field (Hassink 1997).

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), and synergies of the two (Othman et al. 2011), in addition to pertinent case studies (Fløysand et al. 2012; Pagano et al. 2016; Pardali et al. 2016; Salvador 2015). Maritime clusters can be researched with reference to sustainability (Rupo et al. 2018; Shinohara 2010), lifecycles (Shin and Hassink 2011), innovation potential (Pinto et al. 2018), and thus extract 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, 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. A very interesting aspect within the body of research is the potential exhibited for spatial analysis (Monasterio 2006), from many perspectives (Sharma 1993). The instruments employed 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), spatial scan statistic (López and Páez 2017), and combinations (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).

Spatial analysis is prevalent with reference to industry clusters, yet there are not many studies analysing maritime clusters from a geospatial perspective (cf. with Djoumessi et al. 2019). Therefore, with reference to spatial studies of maritime clusters, there seems to be present a research gap, as the body of knowledge is still germinating. As such, it would be pertinent to extract locational agglomerations with reference to maritime clusters. This work bridges this specific research gap. The research question pertains to the validity of exploratory data analysis in maritime clusters and the possibility of the extraction of a spatial narrative. Geospatial analysis of maritime clusters to uncover any governing parameters and underlying paradigms is a field of distinct importance and research is required towards this direction. This work employs exploratory data analysis techniques and validates their use through quantitative indicators, thus providing a contribution toward the subsection of the body of research. The methodological instruments employed to tackle the research question are analysed in the section that follows.

Methodology

The instrument and sample

To address the research question, a compilation of twenty-eight items was produced. These items pertain to the strategic factors deemed important for industry clusters, as addressed in the literature (cf. with Stavroulakis and Papadimitriou 2016); they assemble Table 10. The elements include 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 10: The factors of the instrument (Source: author).

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 sample of respondents and refined, for quality assurance purposes (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. 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 adequate. 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™). The questionnaire was then forwarded electronically with a brief explanation of the scope and objectives of the research project. If a response was not received within ten working days, a reminder was sent; if again there was no response, the process was repeated once more. Each respondent was asked to rate the factors of Table 10, based on the five-point Likert-type scale (Table 11), as per their importance for a competitive maritime cluster.

Table 11: The five-point rating scale (Source: author).

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 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 perceptions of importance of the 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 cluster analysis is conducted. In addition, various metrics that express the validity and reliability of the dataset are calculated. All the instruments utilized are introduced in the following subsections and consist of the remainder of the methodology section.

Reliability statistics

The internal consistency of the data was assessed through the reliability coefficient alpha (Cronbach 1951). Cronbach's alpha (as included in Equation 15) 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.

Equation 15: Cronbach's alpha calculation.

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} S_i^2}{S_p^2}\right) \tag{15}$$

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 16, with p(p-1)/2 degrees of freedom. The Kaiser-Mayer-Olkin measure of sample adequacy is included in Equation 17, where α_{ij}^* is the anti-image correlation coefficient.

Equation 16: Chi-square value for Bartlett's test of sphericity.

$$\chi^2 = -\left(W - 1 - \frac{2p+5}{6}\right)\log|R| \tag{16}$$

Equation 17: The Kaiser-Mayer-Olkin measure of sample adequacy.

$$KMO_j = \frac{\sum_{i\neq j} r_{ij}^2}{\sum_{i\neq j} r_{ij}^2 + \sum_{i\neq j} a_{ij}^{2*}} \; KMO = \frac{\sum\sum_{i\neq j} r_{ij}^2}{\sum\sum_{i\neq j} r_{ij}^2 + \sum\sum_{i\neq j} a_{ij}^{2*}} \quad (17)$$

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, for the analysis to be validated. 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 for factor model appropriateness.

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 for pattern recognition of a dataset not following a normal distribution (Gorsuch 1997). In this method, the matrix of factor loadings based on factor *m* is calculated as in Equation 18.

Equation 18: The matrix of factor loadings.

$$\Lambda_m = \Omega_m \Gamma_m^{1/2} \quad (18)$$

Where

Equation 19: The value of Ωm.

$$\Omega_m = (\omega_1, \omega_2, \dots, \omega_m) \quad (19)$$

And

Equation 20: The value of Γm.

$$\Gamma_m = diag(|\gamma_1|, |\gamma_2|, \ldots, |\gamma_m|) \tag{20}$$

The communality of variable i is given by Equation 21.

Equation 21: The communality of variable i.

$$h_i = \sum_{j=1}^{m} |\gamma_j| \, \omega_{ij}^2 \tag{21}$$

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 22.

Equation 22: The communality of variable j.

$$h_{j(i)} = \sum_{j=1}^{m} |\gamma_{k(i)}| \, \omega_{jk(i)}^2 \tag{22}$$

Then, the factor loadings are obtained by Equation 23.

Equation 23: The factor loadings.

$$\Lambda_{m(i)} = \Omega_{m(i)} \, \Gamma_{m(i)}^{1/2} \tag{23}$$

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

Promax oblique rotation

To assist with the interpretation of the principal axis factoring results, rotation is conducted. There are two basic categories of rotations, 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, 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 24.

Equation 24: The orthogonal rotated matrix.

$$\Lambda_R = \{\lambda_{ij}\} \tag{24}$$

The matrix P = $(p_{ij})_{p\times m}$ is calculated, as in Equation 25.

Equation 25: The matrix P = (pij) p×m.

$$p_{ij} = \left|\frac{\lambda_{ij}}{\left(\sum_{j=1}^{m}\lambda_{ij}^{2}\right)^{1/2}}\right|^{k+1}\left(\sum_{j=1}^{m}\lambda_{ij}^{2}\right)^{1/2}\Big/\lambda_{ij} \tag{25}$$

Here, k (k > 1) is the power of promax rotation. The matrix L is calculated in Equation 26.

Equation 26: The matrix L.

$$\boldsymbol{L} = (\Lambda_R'\Lambda_R)^{-1}\Lambda_R'\boldsymbol{P} \tag{26}$$

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 $f_{promax\_temp} = \mathbf{Q}^{-1} f_{\mathrm{var\,imax}}$. Because 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 $\Lambda_{promax} = \Lambda_{\mathrm{var\,imax}}\mathbf{QC}^{-1}$. 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.

Cluster analysis

To provide a greater depth in the interpretation of the exploratory factor analysis, cluster analysis for the items included in the factors is conducted. This is executed through hierarchical clustering measuring squared Euclidian distance (between-groups linkage, as in Equation 27). 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 investigate which items have the smallest distances and were the first to be merged to a cluster, along with the rest of the sequence.

Equation 27: The Euclidian distance equation.

$$\text{Euclidian distance}\ (\mathrm{x}, \mathrm{y}) = \sqrt{\sum_{i} (x_i - y_i)^2} \qquad (27)$$

Through cluster analysis of the grouping of factors produced through the factor analysis, one can attain insight as to the specifics that govern the distinct factors extracted. The results section that includes all the computations conducted through the utilization of the instruments analysed above, is as follows.

Results

Reliability

The answers of the respondents are categorized per origin (geographical and/or political groupings, as included in Table 12). The country groupings will assist the factor extraction process and point towards clusters of commonalities. The groupings provide a Cronbach alpha as in Table 12. This marker 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. As a next step, one can proceed with the exploratory factor analysis component.

Table 12: Reliability statistics and country groupings (Source: author, 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 and the United Kingdom
3.	DOS	Germany, Austria, and 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, and the 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, and South Korea
13.	ASEAN	Indonesia, Malaysia, the Philippines, Singapore, and Thailand
14.	North America	As per geographical grouping
15.	Four Asian Tigers	Hong Kong, Singapore, South Korea, and Taiwan
16.	G7	Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States
17.	FRITES	France, Italy, and Spain (España)

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 13. 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. 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.

Table 13: KMO, Bartlett's Test, and Communalities (Source: author, SPSS™ output).

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.798
Bartlett's Test of Sphericity	Approx. Chi-Square	374.698
	df	136
	Sig.	.000
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.		

As one can observe in Table 14, while utilizing the Kaiser criterion (selected eigenvalues larger than unity), 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 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. 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.

Table 14: The Kaiser criterion (Source: author, SPSS™ output).

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.

The Scree test (Figure 16) graphs the eigenvalues of the factors and involves a visual inspection for the breaking point where the data flattens out. It is clear that after the second factor the data flattens out excessively. Therefore, the Scree test validates the selection of two factors. Through the pattern matrix (Table 15) 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.

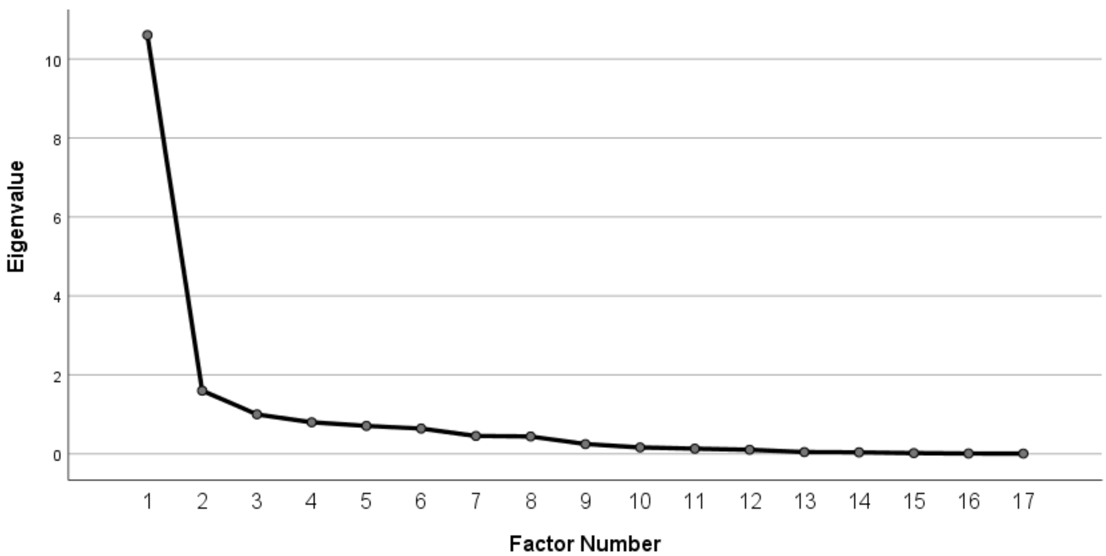


Figure 16: The Scree test (Source: author, SPSS™ output).

Table 15: The pattern matrix (Source: author, 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 17), where the clusters of countries composing the two factors can be portrayed in two-dimensional space.

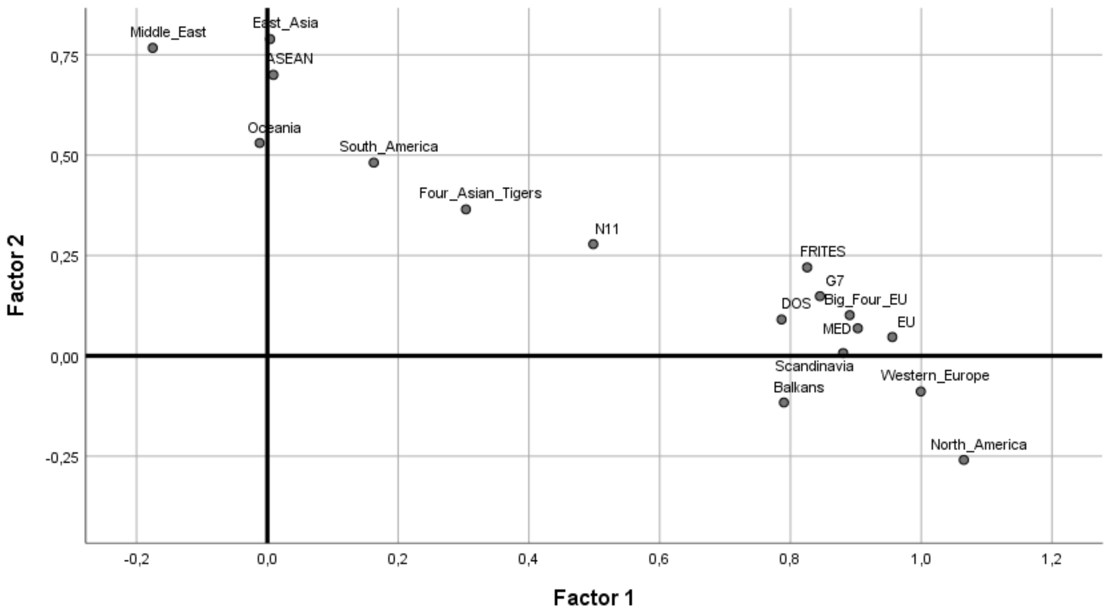


Figure 17: The factor plot in rotated factor space (Source: author, SPSS™ output).

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, in the plane seem to adjourn to complementarities among the factors. This could mean that the rapidly growing economies of the world are still crystallizing their cluster culture.

Cluster analysis

Cluster analysis is conducted for the country groupings governed by the first factor (Balkans, Big Four EU, DOS, EU, FRITES, G7, MED, N11, North America, Scandinavia, and Western Europe) and the second factor (ASEAN, East Asia, Four Asian Tigers, Middle East, Oceania, and South America). The extracts of this process will assist the interpretation of the results of the exploratory factor analysis, by pointing to the clusters of items that each factor deems more important. The cluster analysis portrays very different clusters of importance for the two factors. For factor one, the agglomeration schedule (Table 16) and dendrogram (Figure 18) 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 paired with strategic management and technological interconnectivity. At the same time, natural resources and the proximity to other clusters seem to act as outliers.

For the second factor (Table 17 and Figure 19), the results are quite different, as here knowledge spillovers between firms (a Marshallian factor) pair up with trust, where strategic management pairs up 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 find 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. 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 simpler cluster narrative.

Table 16: The agglomeration schedule for the first factor (Source: author, 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

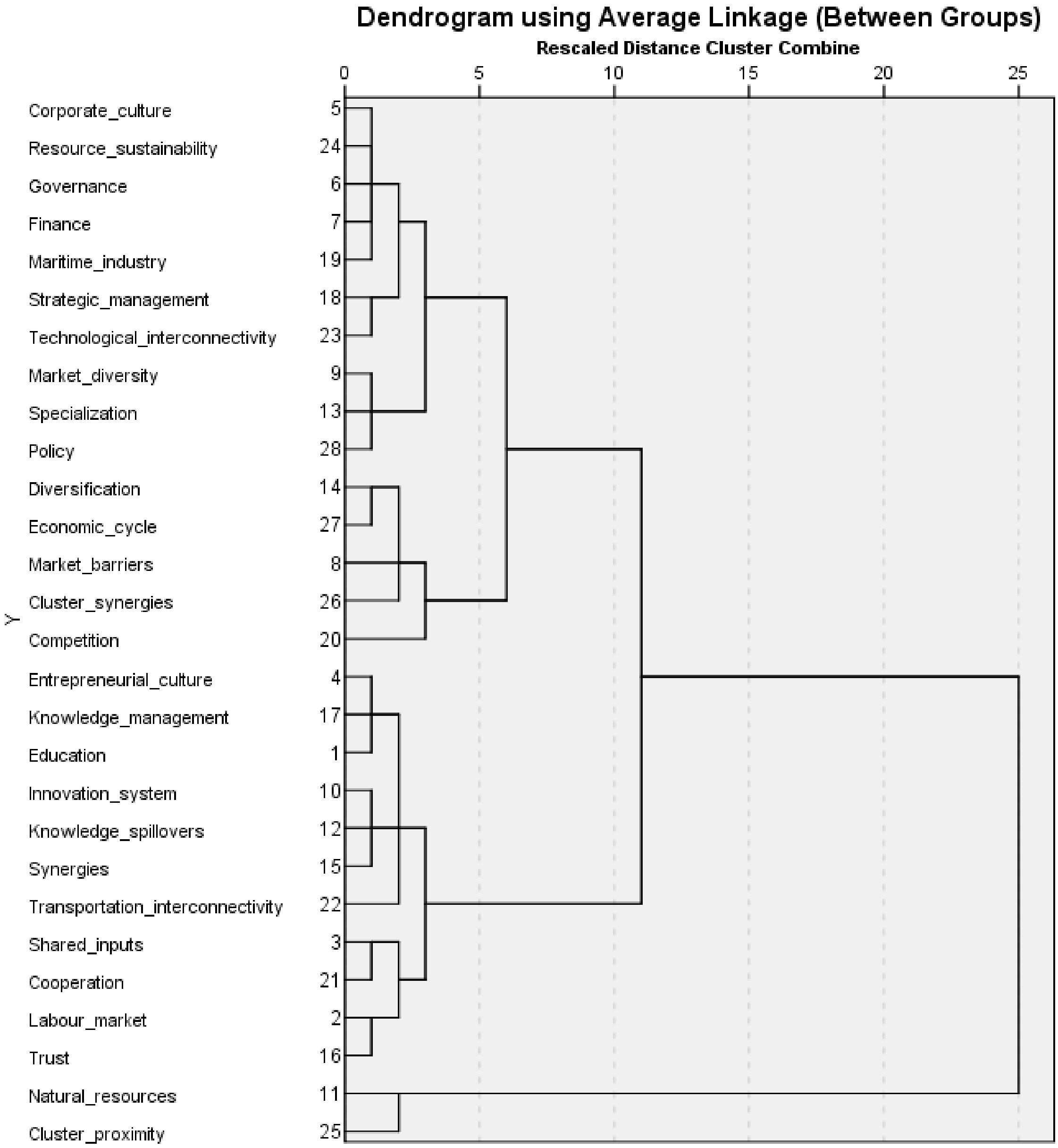


Figure 18: The dendrogram for the first factor (Source: author, SPSS™ output).

Table 17: The agglomeration schedule for the second factor (Source: author, 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

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 distribution 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 factors as per their relative importance. The results are then categorized according to their geographical origin and country groupings are produced.

Within this dataset, an array of quantitative methodologies is employed, with two basic objectives. One pertaining to the validation of the dataset and instruments utilized and the other to uncover any latent structure within the data.

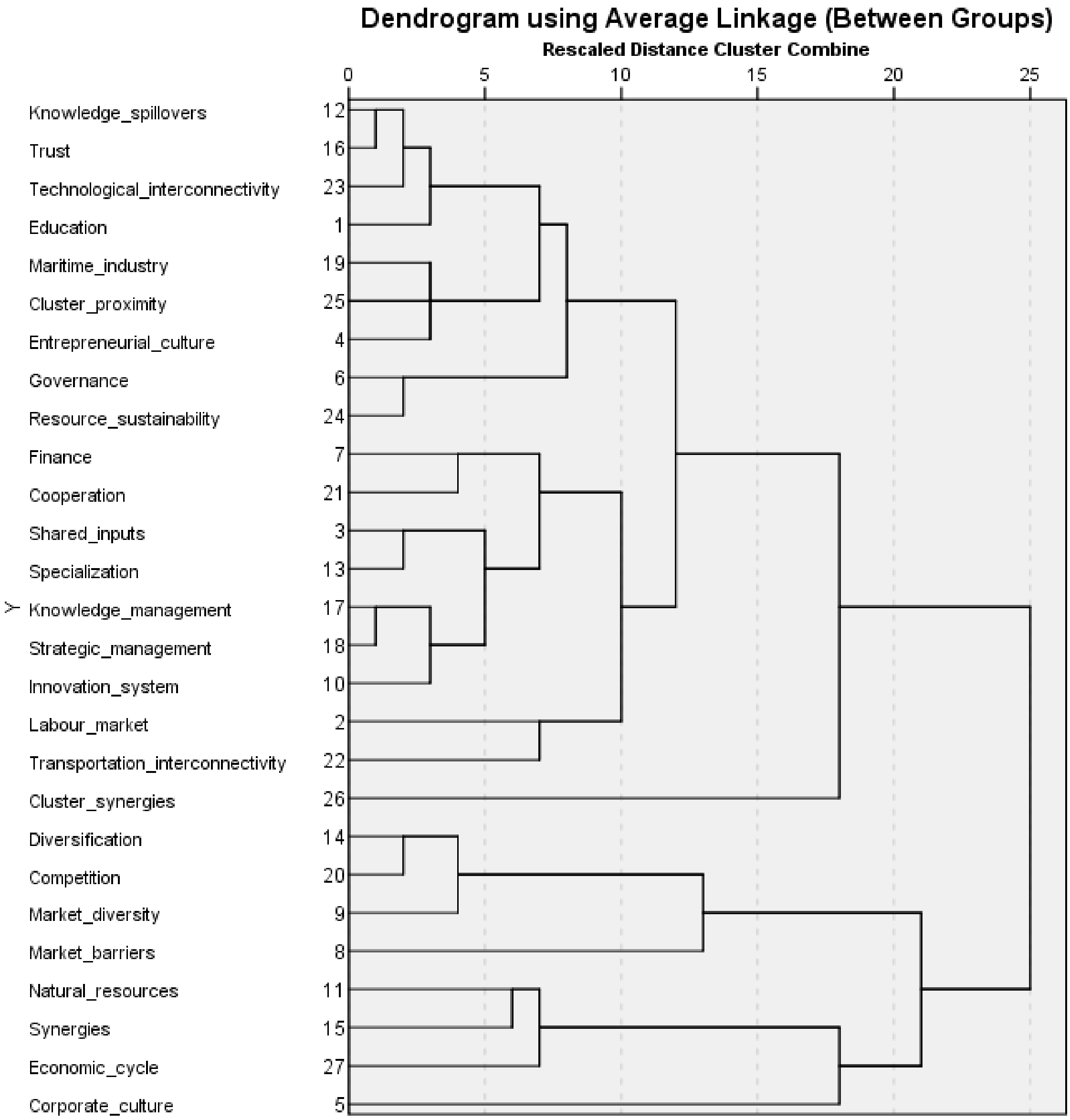


Figure 19: The dendrogram for the second factor (Source: author, SPSS™ output).

Cronbach’s alpha is used as a marker of the internal consistency of the data and produces 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 are 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 any hypothesis as to their distinct disposition. Nevertheless, through cluster analysis of the results, some preliminary directions may be inferred, as to the latent structures of these factors. 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 through benchmarking. Further analysis on 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 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 replicate 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 clear 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, more 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.

Publication list of Section II

(1) Stavroulakis, P. J. and S. Papadimitriou. (2016). "The strategic factors shaping competitiveness for maritime clusters." *Research in Transportation Business and Management* 19: 34-41. DOI: https://doi.org/10.1016/j.rtbm.2016.03.004

(2) Stavroulakis, P. J., S. Papadimitriou, V. Tsioumas, I. G. Koliousis, E. Riza, and E. Kontolatou. (2019). "Strategic competitiveness in maritime clusters." *Case Studies on Transport Policy, Article in press.* DOI: https://doi.org/10.1016/j.cstp.2019.10.008

(3) Stavroulakis, P. J., S. Papadimitriou, V. Tsioumas, I. G. Koliousis, and E. Riza. (2020). "Exploratory spatial analysis of maritime clusters." *Under review*.

Section III

Instruments for strategic management of maritime clusters

Strategic management has been proven to be important for maritime clusters and the analysis of strategic factors therein provides many interesting opportunities for research and practice. Nonetheless, if instruments for strategic management cannot be developed, the importance of strategy within maritime clusters is rendered as moot. The final section of this Thesis addresses the research question of the feasibility of development of qualitative and quantitative instruments for the management of strategy within maritime clusters. It includes the following contributions to the body of research.

(1) **Strategy, policy, and the formulation of maritime cluster typologies**

Provides an introductory framework for the development of strategic management instruments through contingency table formulation.

(2) **A strategic innovation framework for maritime clusters**

Provides a strategic analysis instrument based on the crosstabulation of innovation and strategy.

(3) **The management of change within maritime clusters**

Provides a strategic analysis instrument based on the change quadrants framework.

(4) **Strategic analysis and instrument formulation**

Introduces a conceptual parallel for the correlation of SWOT with strategic management practice for maritime clusters and the development of quantitative instruments for situation analysis of maritime clusters.

(5) **A hybrid SWOT analysis methodology for maritime clusters**

Presents an application of a quantitative SWOT instrument.

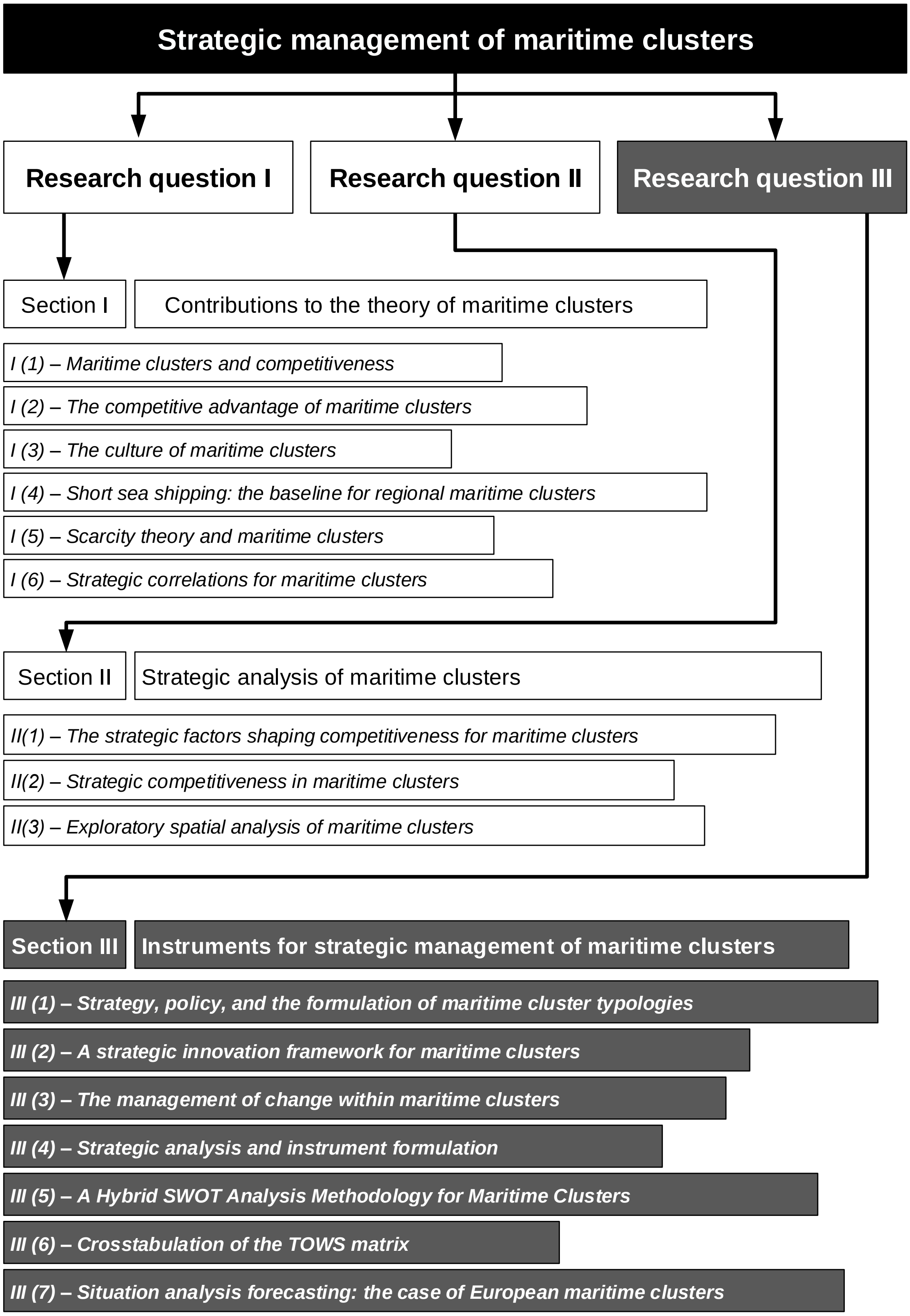
(6) **Crosstabulation of the TOWS matrix**

Extends the applicability of contingency tables and maritime clusters to the TOWS matrix.

(7) **Situation analysis forecasting**

Introduces a situation analysis forecasting model for maritime clusters.

Thesis framework (Section III)



III (1) – Strategy, policy, and the formulation of maritime cluster typologies

In recent years, clusters of industry have attracted multilateral attention, from academia and practice, alike. Clusters of industry relate to harbouring regional competitiveness; as such, they have come to be considered as important constructs for strategy and policy that can be deemed as complementary domains. At the same time, maritime clusters are regarded as dynamic cases from a multitude of viewpoints. The concepts of strategic policy, particularly as they pertain to maritime clusters, require deeper understanding and more thorough analysis. In this context, cluster typologies surface as a useful instrument that can offer valuable insight. While this field instils the eventuality of facilitating policy and strategy within clusters, it remains relatively barren. This instance may present the opportunity to better elaborate on the formulation of models and frameworks that address the intricacies within maritime clusters. The research conducted introduces a three-tier framework for the generation of maritime cluster typologies that bears the potential to enrich strategic management and its eventual policy implications, towards a more streamlined and informed manifestation.

Introduction

Industrial clusters have been on the spotlight due to their capacity to improve regional competitiveness, especially in an inefficient economy. Cluster theory is being currently revisited to attract business, improve competitiveness, and increase the gross regional product. Even more so, maritime clusters are regarded not only as dynamic groups, but are witnessed to attract a broad range of entities and undertakings, not exclusively active in the maritime domain. Maritime clusters are distinctly important, since wherever the maritime industry homes, the locality therein seems to prosper, as the Sea provides a wealth of lateral implications for the industry and region. These types of clusters stand out, both as cases of industrial cluster theory, and as cornerstones of regional competitiveness. All the interesting, romantic, and eccentric dynamics of the maritime industry seem to transcend to these clusters, as well. At the same time, from a purely fiscal sense, the industry, though relatively low in financial returns and not that attractive for inexperienced investors, has provided the context for some of the most legendary success stories in business.

The peculiarities and distinctions of maritime clusters have been acknowledged from academia, managerial practice, and policymaking entities, in a converging attempt to foster their healthy materialization, and better develop, organize, and understand them. For these reasons, maritime clusters have been selected as the analytical base for this work. Maritime clusters pertain to dynamic cases that may function as the base for many interesting topics of strategy and policy, for decades to come. One of the reasons enabling this manifestation is that the formulation of instruments for the facilitation of strategic management and policy formulation within industrial clusters is a significant field that remains relatively barren, nonetheless. As the domain has portrayed significant momentum from a variety of viewpoints, it would not be unfounded to expect that industry and academia will tap into this noteworthy sector and relinquish frameworks and models that will assist towards an increasingly stepwise appreciation of these clusters of industry.

The present work aims to contribute within the above domain, through the development of a novel application for strategic policy of maritime clusters. The instrument is founded with the selection of two categorical variables that pertain to a dichotomy of states. Through this dichotomy, a ranking of each categorical variable is performed, to extract a basic contingency table. The subsequent manipulation of the categorical variables will give way towards quantitative methodologies, including statistical treatment, and the calculation of measures of association. By extracting the relative positions of the variables through specific measures of association, clear definitions as to the case at hand can be drafted. In a succeeding step, each measure of association may be assigned to different classes, and depending on the class wherein the calculation resides, relevant typologies will be extracted. These typologies may provide insight as to the intricacies of maritime clusters, and enhance strategic management, policy, and governance.

This paper contributes to the understanding of the cluster classification typologies that facilitate policy and strategy initiatives and frameworks. It does so through developing a three-tier framework for the formulation of maritime cluster typologies that streamlines the classification of cluster attributes. More precisely, the methodological framework based on this classification of categorical dichotomous variables will initiate statistical hypothesis testing, for the investigation of causality between the variables, and the subsequent formulation of typologies, through the calculation of measures of association. Compared to other studies, this research innovates in terms of introducing a robust framework for the extraction of cluster typologies that improves the effectiveness of strategic management and cluster policies; this, for variables selected ad hoc, insofar conquering a profound level of versatility for the instrument. Therefore, the framework developed not so much challenges previous research, as it rather complements its formulated body of knowledge.

Literature review

Overview

The agglomeration of economic activity within a region, prevalently coined as an industrial cluster, can be described as an intricate network of firms, within a discretely defined industry. What may set an industrial cluster apart from any other industrial composition, is that the network of firms within the cluster shares a culture of trust

(Dayasindhu 2002) and a common vision (Shinohara 2010); these traits facilitate efficient cooperation and mutually benefiting competition. In addition, the outcome of a cluster's manifestation translates into knowledge creation and constructive innovation (Bell 2005). Through this process, entities with conflicting stakes are seen to co-exist within a locality, wherein, in other terms, their dynamics would mainly exhibit themselves through zero-sum tactics.

Clusters can establish themselves around a core-activity of a variety of industries; though, there are some cluster types that stand out, such as technology, entertainment, and cultural clusters, among others. Due to the extended and dynamic nature of the maritime industry and the fact that maritime industries exhibit many cluster traits, they can be considered as the cornerstones of regional (and/or national) competitiveness, for the localities wherein they reside. In addition, maritime clusters provide a fertile spawning ground for many scientific domains, wherein theories may be tested and models along with frameworks may be formulated and assessed. Outstanding examples of these domains are strategic management and policy, as they seem to share many fraternal characteristics (Cohen and Ernesto Amorós 2014; Jasper and Crossan 2012; Munian and Subramaniam 2009; Ramia 2003). Policy-making entities have provided distinct effort and support in the crystallization of both generic and specific maritime clusters (De Langen 2006; Directorate-General for Maritime Affairs and Fisheries 2009; Pardali et al. 2016; Zagkas and Lyridis 2011).

From the widely accepted instigation of industrial cluster theory, with Alfred Marshall's (1920/1890) economies of agglomeration, to its modern germination, that many times revolves around Michael Porter's (2000) contributions, a situation in twain can be observed. On the one hand, the theory has firmly grasped that clusters of industry can be deemed as very important locational constructs, for they may hold the key of a definitive competitive advantage (Doronina et al. 2016). On the other hand, clusters of industry are riddled with paradox; this cluster characteristic renders their eventual deconstruction, at times, elusive. This situation arrives to the point that any generalization with respect to clusters may hold its own caveats and be, ultimately, erroneous. Cluster paradox can be witnessed within Porter's 'location paradox,' all the way back to Marshall's work and his cryptic notion, regarding the beneficial attributes that are passed on within clusters among generations, as if they are "in the air."

Within this context, the disciplines of strategic management and policy find very resonating applications. With respect to the management of strategy within clusters, a unifying extract would be that corporate growth strategies shoot for the stars; and get there; since growth is a predominant feature within clusters of industry. Within a business strategy context, differentiation strategy seems to guide operations. The cluster steers firms towards competitive dynamics that blossom into innovation, which in turn creates new needs, ideas, and markets. At the same time, a cluster cannot move to present these advantages, without the facilitation of policy and governance (De Langen 2004; Stavroulakis and Papadimitriou 2016). As one could conclude that the importance of strategic management and policy within a cluster cannot be overstated, at the same time, strategy and policy seem to morph into a complementary concept. The latter could be coined as strategic policy (herein, strategic policy refers to the complementary nature of strategic management, policy, and governance; thus, it pertains to a unifying construct).

If the objective was to contribute to the field of strategic policy for industry clusters through model and framework development, a cluster type could be selected, as a baseline. This selection would facilitate the process of needs' assessment through a narrower and more streamlined scope, thereby assisting the specialization and targeting of the instruments formulated. At the same time, lest extremely differentiated cases, nothing would restrict the constructs from being applicable to generic clusters, as well. Herein, the maritime domain provided the instigation for the extraction of the framework introduced, though the latter could find pertinent applications within other clusters.

As already hinted to, the domain of analytical models and frameworks for generic industrial clusters, and maritime clusters specifically, remains to be harvested. The framework developed within provides a contribution to the domain of strategic policy for maritime clusters, as it provides a floor-to-ceiling integrated and versatile construct. Its integration can manifest from a multilateral potential of applicability, as its impact on scholarly knowledge, as well as managerial practice, can prove significant. The framework can pertain to a stepping-stone for theoretical and empirical practice, as it can provide a reference point to test and assess theories. The latter may benefit from its array of straightforward, yet evidence-based methodologies. At the same time, the framework is structured upon the ad hoc selection of the variables within. Therefore, the case requirements will formulate the instrument, not the other way around; this fact provides indicative versatility to the construct that may be the reason for its eventual effectiveness. Strategy and policy are both domains that are structurally fluent; they require high levels of adaptability and responsiveness, as their reason of existence is the perpetual change that is embedded in nearly all of nature’s systems. For this reason, versatile instruments can provide definitive contributions to topics of strategic policy, from an academic and a managerial perspective. The work relinquished aspires to contribute in this direction, and as such, its importance, impact, and potential may be assessed.

Strategic policy and industrial cluster typologies' review

Industrial clusters hold a distinct effect upon the firms within and provide dynamic cases that can facilitate the extraction and documentation of strategic decisions (Gu 2008). These decisions can surface from the domain of strategic management, for an industrial cluster, with diverse and novel instruments (Kim et al. 2014). Strategic management has found an important ally with respect to clustering within an industry (Magay 2014), though its effects spillover many other disciplines and aspects, such as knowledge management (Lai et al. 2014) and policy (Chen et al. 2013). As innovation is a direct corollary of a healthy industrial cluster, specific strategies that instigate different types of innovation may be investigated (Kachba et al. 2012). Through these methodologies, a synergy may be achieved between strategic management applications and the cluster case, to explore many other instances of the cluster's innovative aspects, as well.

The spatial configuration of industries can be reviewed effectively with the extraction of typologies (Lachininskii et al. 2016), since the latter facilitate the assessment of strategic decisions within the context of industries (Park and Ahn 2012). Typologies themselves may be the object of examination, as they are found to be dynamic implements that may coexist in harmony within the particularities of an industrial cluster (He and Fallah 2011). Many proposed typologies can be retrieved, for a diverse array of industrial cluster formations (Nosova 2013). These typologies may relate not only to the cluster itself, but to its origins and resources (Evaldo et al. 2013), in addition to the latter's renewal process (Samaganova 2009). The typology formulated can aid the health of the cluster, or the discrete strategic decision of firms within (Zelbst et al. 2010).

A variety of methods to address typologies of industrial clusters can be accessed within the literature. These range from qualitative constructs (Markusen 1996), to quantitative (Tristão et al. 2016) and combined, hybrid approaches (Naghizadeh et al. 2015). These typologies can facilitate a wide range of functions, from strategic-decision applications for emerging economies (Baron-Gutty et al. 2009), local value creation and upgrading (Edgington and Hayter 2013), to corporate social responsibility (CSR) and human rights within industrial clusters (Giuliani 2016). The study of industrial clusters within a typology perspective can extend to the formulation of typologies for distinct cluster parameters, such as innovation (Becerra Rodríguez and Naranjo Valencia 2008; Gong et al. 2012), regional competitiveness (Cappellin 2012), intrinsic cluster dynamics (Caniëls and Romijn 2005), and cluster life-cycle analysis (Handayani et al. 2012). In addition, cluster typologies can be rooted within the generic agglomeration economies themselves (Zelbst et al. 2010) and can be utilized for the comparison of different industrial clusters (Pedersen 1994). The literature referring to industrial cluster typologies that resonates with the research conducted herein, has been included within Table 18. As can be extracted, the field of typology formulation for industrial clusters is diverse, utilizing many different methodologies to address as many different topics.

Table 18: Selected literature on industrial cluster typologies (Source: author).

Contributor(s)	Premise	Methodology / Specifics
Baron-Gutty et al. 2009	Typology for clusters in emerging economies	Industry cluster case study in Thailand
Becerra Rodríguez and Naranjo Valencia 2008	Typology for innovation	Graphic models – system of innovation both for the production system and individual firms
Caniëls and Romijn 2005	Typology for learning and innovation	Local knowledge spillovers and regional innovative activity

Cappellin 2012	Typology for regional competitiveness	Different policy fields
Edgington and Hayter 2013	Typology of direct foreign investment clusters	Portray commitment to local value creation and upgrading
Evaldo Fensterseifer and Rastoin 2013	Typology formulation for cluster resources	Mapping of a cluster's resources' profile
Giuliani 2016	Typology with extended applicability	CSR and human rights in developing countries
Gong et al. 2012	Typology for innovation platforms	Comparative case study in China
Handayani et al. 2012	Typology for cluster life-cycle analysis	Delphi method employed to extract and assess typologies
He and Fallah 2011	Typology assessment	Mixed typologies prevalent in clusters / shaped by the industry
Kachba et al. 2012	Innovation types in clusters	Consolidation strategies and innovation management
Lachininskii et al. 2016	Typology formulation	Geoeconomic elements (transport hubs, complexes, and areas) are determined
Markusen 1996	Typology assessment	Typology of industrial districts
Naghizadeh et al. 2015	Regional typology assessment	Combination of quantitative (co-word analysis) and qualitative (meta-synthesis) methods
Nosova 2013	Typology formulation	Cluster formation mechanisms
Park and Ahn 2012	Typology for strategic decision assessment	Typology model for the analysis of strategic environmental management types
Pedersen 1994	Typology of enterprise clusters	Cluster comparison
Samaganova 2009	Typology of resources	Renewal process of territorial resources to analyse cultural resources in a software industry cluster
Tristão et al. 2016	Typology of industry clusters	Descriptive statistics and multivariate exploratory methods
Zelbst et al. 2010	Typology of cluster concentrations	Agglomeration economies, location, and strategic decision assessment

As typologies provide effective instruments for strategic policy within clusters of industry, one could pursue the formulation of typology-generating methodologies, that stem from the study and needs of a specific domain. This process would venture to apply the benefits of generic typologies' formulation to a designated type of industry cluster. For example, if one was to formulate instruments to be applied to maritime clusters, attention should be directed to the fact that the sector is highly cyclical, and therefore, instruments for strategic policy should be versatile. The maritime industry provides instances of near-perfect competition, and at its heart, holds a tremendous effect and impact upon the economy that encapsulates its activities (Lee at al. 2014). For these two industry-specific reasons, it is not surprising that maritime clusters pertain to special-interest cases, within the domain of clusters of industry. Of course, this goes not to assume that clusters of other industries do not hold lateral interest. In fact, clusters of many activities and origins, extremely differentiated from the maritime sector, have exhibited astounding merit. But, simultaneously, one could accept, that maritime clusters provide a coherent base for the analysis of strategic policy topics (Wu et al. 2016), even from the most definitive perspective (Doloreux 2017). Literature has already extracted that policy is an important aspect of the maritime domain (Roe 2007), as well as, maritime clusters (Doloreux and Melançon 2006; Doloreux and Shearmur 2009; Pinto et al. 2015).

A subsequent factor that may render the selection of maritime clusters as a desirable case is that the concentration of maritime activities assists cluster visibility and formulation (De Langen 2002). Another relevant factor is the fact that the maritime sector, most of the time, provides outstanding differentiation within a regional economy, towards its sustainable competitive advantage (Doloreux et al. 2016). This fact draws resonance to the point that a maritime cluster's present or potential manifestation may be the reason behind a region's not only regional and national (Chang 2011), but international competitiveness (Jenssen 2003). At the same time, competitiveness within clusters can reach novel lengths, to render notions of sustainable competitiveness (Shinohara 2010). Correlations with many other implicative factors, such as policy and governance (Doloreux and Shearmur 2009), play an important part as well, within a maritime cluster's contextual setting.

Within these types of clusters, classifications, taxonomies, and typologies can pertain to facilitating the analysis of a diverse array of facets, in addition to providing the baseline for the formulation of models, for the implementation of policy and strategy, as well as their eventual forecasting (Stavroulakis and Papadimitriou 2017). These may include typologies of innovation within maritime clusters (Makkonen et al. 2013), benchmarking and differentiation frameworks among different clusters (Monteiro et al. 2013), as well as types of materialization paths (Fløysand et al. 2012). Typologies can be useful when classifying maritime clusters, to analyse their evolutionary potential, and extract models that govern their rudiments and evolution (Zhang and Lam 2013); these may extend to pertinent empirical investigations (Zhang and Lam 2017). Consequently, a typology-generation methodology can be further utilized to formulate novel strategic directions (Salvador 2014). Thus, strategic and policy directions within maritime clusters can be well fortified through the utilization of typologies. Simultaneously, the field may benefit from the formulation of new frameworks and models to create and assess maritime cluster typologies.

Since the theory of industrial clusters is inherent with paradox, the elaboration on typologies can facilitate the disengagement of obscurity within scholarly research, and managerial practice. By doing so, both strategy and policy will be warranted with an effective ally, that may provide a complementary level of analytical clarity for the case at hand. From a structured literature review in the matter of generic cluster typologies and maritime cluster typologies, one may conclude that on the one hand, the topic is rich and filled with potential and on the other, that maritime cluster research may be considered as situated at its germination phase. Therefore, the domain of maritime studies may benefit substantially from the formulation of constructs that facilitate the extraction of typologies, for effective strategic management and business / cluster policy. Towards this aim, the present work relinquishes a novel instrument for the extraction of maritime cluster typologies that may prove effective in generic strategic policy applications as well. The literature with reference to maritime cluster typologies compiles Table 19. As with generic industrial clusters, differentiation and versatility is prevalent, within this subdomain of industrial cluster research.

Table 19: Selected literature on maritime cluster typologies (Source: author).

Contributor(s)	Premise	Methodology / Specifics
De Langen 2002	Conceptual framework	Instrument for maritime cluster analysis
De Langen 2006	Typology of stakes	Conflicts of interest in port clusters
Fløysand, Jakobsen, and Bjarnar 2012	Typology for maritime cluster manifestation	Types of development paths for maritime clusters
Makkonen, Inkinen, and Saarni 2013	Typology for innovation	Statistical survey methods to investigate types of innovation in the Finnish maritime cluster
Monteiro, De Noronha, and Neto 2013	Typology – differentiation framework	Differentiation framework for maritime clusters – cluster comparison
Salvador 2014	Typology for strategic decision assessment	Maritime cluster types comparison
Stavroulakis and Papadimitriou 2016	Strategic factor topology	Grouping of strategic factors for maritime cluster formulation and competitiveness
Zagkas and Lyridis	Benchmarking framework	Framework for model development and benchmarking
Zhang and Lam 2013	Typology for cluster evolution	Maritime cluster classification and evolution

Zhang and Lam 2017	Typology for cluster evolution	Empirical investigation of maritime cluster evolution

The extended versatility required for effective application within the maritime domain is acquired through the ad hoc selection of the categorical variables that will compile the construct. Through this process, this work pertains to a pure framework, as the analysis at its planning phase is completely free to select and scrutinize any matter of relative impact, without any methodological constraint imposed by the framework itself. At a subsequent step, the variables selected will be statistically treated to investigate correlation and causality of the latter, with the application of measures of association and statistical decision tests, respectively. With this formulation, the unhindered selection of the variables is then processed with robust techniques, in a way that the analytical results may be compared, assessed, and employed. Therefore, it would not be unwarranted to assess that the resonating impact of the methodology may spillover to and (even) interlock with maritime cluster requirements.

Formulation of maritime cluster typologies

Devising the framework

The methodological construct presented herein will initiate with the selection of two categorical dichotomous variables, pertinent to the strategic policy case of the maritime cluster. These variables can be selected on a case-by-case basis and/or can be accessed within the pool of strategic factors that accentuate competitiveness, per maritime cluster literature (Stavroulakis and Papadimitriou 2016). The objective is to compile a simple two-by-two contingency table. If the first categorical variable was to be designated as ‘Y’ and the second as ‘X,’ then the crosstabulation of these variables would render the contingency table of Figure 20.

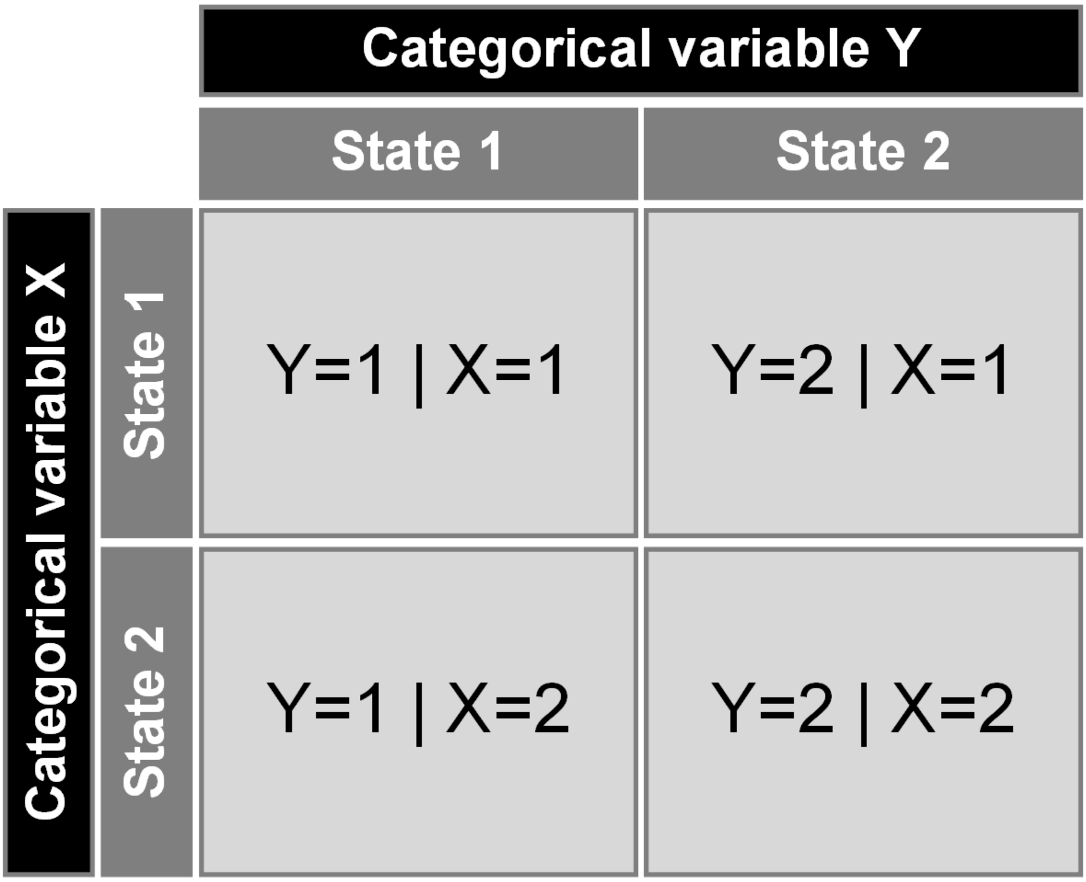


Figure 20: The formulation of the contingency table (Source: author, Visio™ output).

The four states of the contingency table will include all possible combinations of the variables, in states 'one' and 'two,' respectively. The first state will find categorical variable 'Y' in state 'one' and categorical variable 'X' in state 'one' (Y=1 | X=1); the second state will have categorical variable 'Y' in state 'two' and categorical variable 'X' in state 'one' (Y=2 | X=1); the third state will include categorical variable 'Y' in state 'one' and categorical variable 'X' in state 'two' (Y=1 | X=2); whereas the fourth will access categorical variable 'Y' in state 'two' and categorical variable 'X' in state 'two' (Y=2 | X=2).

Through this simple contingency table and the cases of each possible state within, statistical hypothesis tests and measures of association may be extracted. A designation as to the relationship of the samples can be accorded, as paired (dependent samples) or unpaired (independent samples), to proceed with statistical hypothesis testing. This will investigate correlation between the two categorical variables and therefore widen the analytical scope, as the former is an important aspect with many lateral implications to both policy and strategy. For a given significance level, with McNemar's test (for paired samples), the null hypothesis will pertain to the equality of the marginal probabilities, per H_0: P (Y=2 | X=1) = P (Y=1 | X=2). If the samples were considered unpaired, Pearson's chi-squared test would render the null hypothesis of H_0: P (X=i, Y=j) = P (X=i) P (Y=j). Let (Ω, F, P) pertain to the probability space, wherein results are designated with 'Ω,' events with 'F,' and the probability function with P: F → [0 1]. Per Kolmogorov's definition, the conditional probability of the 'i' event, given that the 'j' event has occurred, is P (i | j) = P (i ∩ j)/P (j), if P (j) > 0. Per Bayes theorem, P (X | Y) = P(X) P (Y | X) / P(Y); thus, the initial null hypothesis of Pearson's chi-squared test is rendered to H_0: P (j = 1 | i = 1) = P (j = 2 | i = 2), essentially supposing the equality of the two conditional probabilities.

These statistical decision tests will facilitate the investigation of the independence of the variables and by extension, can provide relevant insight. Since binary correlation has been investigated, the analysis may proceed to the calculation of measures of association. For example, one may consider the risk ratio that begins with an attack rate calculation, for each state of the categorical variable. For variable 'X,' two attack rates are calculated. For state 'one,' the attack rate would be calculated as 'Y=1 | X=1' / ('Y=1 | X=1' + 'Y=2 | X=1'), whereas for state 'two,' the attack rate would be extracted as 'Y=1 | X=2' / ('Y=1 | X=2' + 'Y=2 | X=2'). The division of these two attack rates, results in the risk ratio (a metric of not only association, but causality as well). The attack rate for state 'one' would pertain to the cases in state 'one' for variable 'Y' given that they are in state 'one' for variable 'X' as well, to the total ‘population’ in state ‘one’ of variable ‘X.’ This would signify the *tenacity* of the ‘Y’ cases that are included in the state of variable ‘X.’

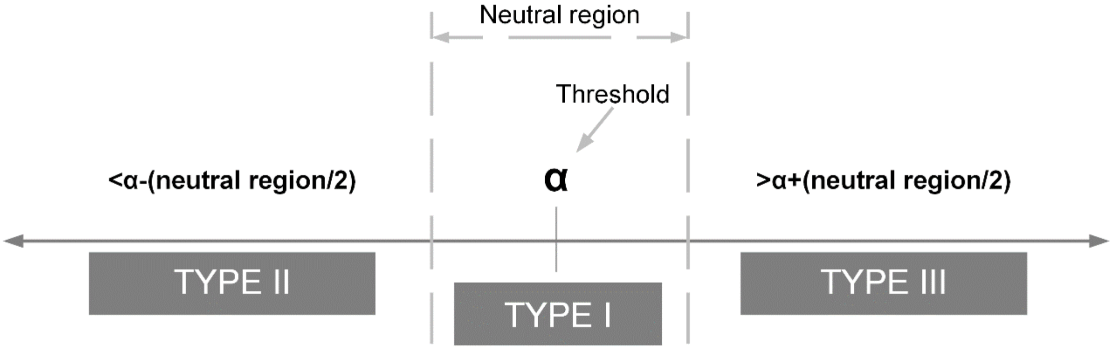


Figure 21: A typology with tree regions (Source: author, Visio™ output).

Accordingly, the remaining attack rate will portray the same concept, but for the cases contained within state ‘two’ of the categorical variable ‘X.’ It would be calculated as the cases of state ‘one’ of categorical variable ‘Y,’ given that they are within state ‘two’ of variable ‘X,’ to the total number of cases of state ‘two,’ within variable ‘X.’ As mentioned, the division of these two attack rates will render the risk ratio, that as a measure of association, will present itself as the risk of state ‘one’ to the risk of state ‘two’ within variable ‘X.’ By selecting a threshold, and depending upon where the measure of association will fall within the latter, typologies can be created. A simple typology of three categories is portrayed in Figure 21. The symmetrical region around the threshold (α) is designated as neutral and pertains to Type I; this region’s extent may be selected depending on the analytical requirements of the case. A value greater than the threshold (plus half the neutral region) will produce Type III, whereas a result less than the threshold (minus half the neutral region) will refer to Type II.

Adjacent to the attack rate and risk ratio calculations, the odds ratio (‘Y=1 | X=1’ / ‘Y=1 | X=2’) / (‘Y=2 | X=1’ / ‘Y=2 | X=2’) can be extracted as well. This will calculate the odds of state ‘one’ of ‘X’ and ‘Y,’ to state ‘one’ of ‘Y’ and state ‘two’ of ‘X,’ to the odds of state ‘two’ of ‘Y’ and state ‘one’ of ‘X,’ to state ‘two’ of ‘Y’ and state ‘two’ of ‘X.’ The odds ratio will designate the likelihood that one variable’s state has been affected by the other variable. Therefore, the analytical aspect is granted with two measures that can effectively portray the extent of association between the two categorical variables. Attention should be directed to the confidence intervals of each measure; the approximation of risk for each variable must be treated accordingly, so as not to deliver the analysis to unfounded conclusions.

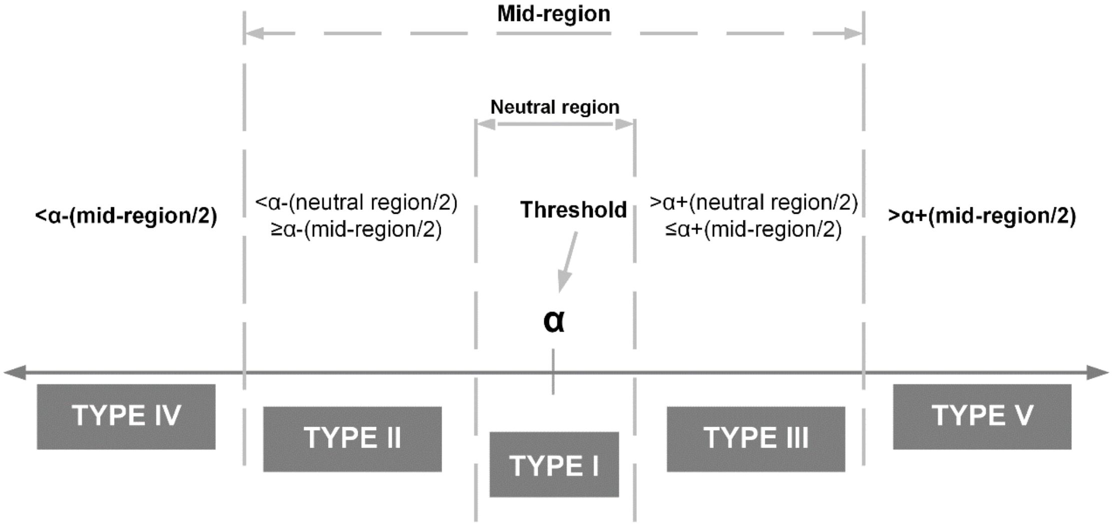


Figure 22: A typology with five regions (Source: author, Visio™ output).

The framework generated within pertains to three tiers. The first is relinquished with the selection of the variables and the compilation of the contingency table, including its marginal, joint, and conditional probabilities. The second tier includes statistical hypothesis testing that ensues with the calculation of measures of association - the third tier. By way of a discrete calculation, a marker may be assigned to the degree of the effect and this outcome may be included within a classification of a typology that has been extracted through the selection of a pertinent threshold and suitable regions; these will signify the different categories within the typology. The framework presented herein does not restrict the selection of any number of regions, as they can extend symmetrically from the threshold, to any value required. A three-region typology has already been presented in Figure 21, whereas a five-category typology is included in Figure 22. A mid-region has been included, that introduces two more categories in the typology. In this manner, the regions may be selected and tailored according to the analytical depth and diversity required.

Through the inclusion of the result within a typology, effective and educated strategic and policy directions may be drafted; in addition, the case may be monitored over time and assessed within a longitudinal perspective. At the same time, different cases may be considered and compared. Since the categorical variables are not fixed but selected for each case, ranges of typologies may be generated, each with a specified portrayal that may assist the management of strategy and the formulation of policy, within a maritime cluster. The instrument aims at including scientific robustness within a simple and functional construct and in this respect, it may have succeeded.

Demonstration of the framework

A demonstration of the framework's functionality is as follows. To initiate the analysis, two categorical variables are selected. For an indicative example, the first ('Y') could be the variable of 'sustainable innovation.' This variable may hold specific metrics to extract its presence or absence, based on (including but not limited to) a firm's track record, the internal processes that lead to knowledge creation, the output with respect to innovative products and services, etc. The question to be answered then, is how much the dichotomous variable of proximity with the cluster's members ('cluster proximity' = 'X'), may stand to affect the variable of sustainable innovation (= 'Y'). Within the literature, there are many instances where innovation has been documented to play a crucial role within cluster dynamics. Innovation itself may relate to different manifestations and characteristics, but somehow, it seems to be always pertaining to a major cluster component. But within this cluster constant, one may wish to calculate exactly how much the variable of cluster proximity will affect the existence of innovation. The instrument formulated herein can model this process and (for a given significance level) provide conclusive answers with respect to the variables' independence and causality (through the risk ratio). In addition, the typology formulated may pertain to (indicatively) three possible states of the maritime cluster, per the extraction of the risk and odds ratios, and the selection of a relevant threshold (herein, the value of $\alpha = 1$).

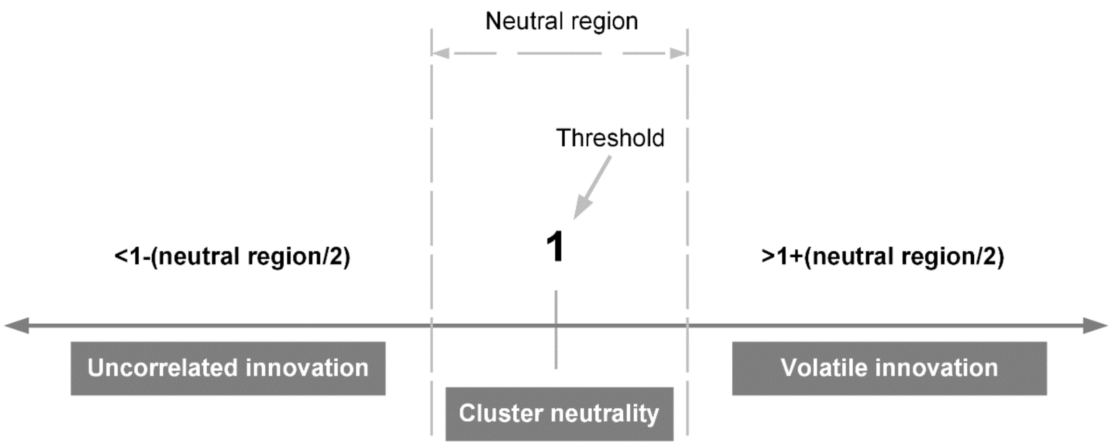


Figure 23: The maritime cluster typology (Source: author, Visio™ output).

A result close to the threshold may deem the cluster as neutral, whereas a result higher than the threshold will portray the cluster as relating to 'volatile innovation;' a result lower than 'one' will signify 'uncorrelated innovation.' The latter will represent the (interesting, but regrettable) state of a cluster, that is hampering the innovation of its members; an instance that would deem an unhealthy, or inefficient, maritime cluster; an occurrence not impossible, as cluster pitfalls have already been documented (Held 1996; Hutton 2004; Martin and Sunley 2003). The typology may have a linear portrayal, as in Figure 23. A region within the proximity of the threshold must be selected to designate when the result will pertain to cluster neutrality; this can be left up to the analytical sensitivity required.

After the selection of the categorical variables, one must move to document the cases within each of the four categories of the contingency table. The methodology of documentation and extraction of the cases must be specific, following a predetermined protocol, so that the analysis can be valid and reliable. After the extraction of the categorical variables and the formulation of the framework for the rudimentary contingency table, the cases are collected and summed, per study protocol. For the example that is presented herein, the initial number of cases portrayed derive from a random number generator, solely for the purposes of demonstrating the methodology. Though the initial values are randomly generated, the methodological application remains factual.

Table 20: Tier one - 'Cluster proximity' and 'Volatile innovation' crosstabulation (Source: author, SPSS™ output).

Crosstabulation			**Volatile innovation**		**Total**
			yes	**no**	
Cluster proximity	**yes**	**Cases**	**189**	**23**	**212**
		% within Proximity	89.2%	10.8%	100.0%
		% within Innovation	74.4%	19.0%	56.5%
		% of Total	50.4%	6.1%	56.5%
	no	**Cases**	**65**	**98**	**163**
		% within Proximity	39.9%	60.1%	100.0%
		% within Innovation	25.6%	81.0%	43.5%
		% of Total	17.3%	26.1%	43.5%
Total		**Count**	**254**	**121**	**375**
		% within Proximity	67.7%	32.3%	100.0%
		% within Innovation	100.0%	100.0%	100.0%
		% of Total	67.7%	32.3%	100.0%

The cases of this example are presented in Table 20, along with the marginal, conditional, and joint probabilities of the contingency table. Per the framework, the four potential cases signify the possible states within the Table. The 'Y=1 | X=1' state shows sustainable innovation, given cluster proximity. State ‘Y=2 | X=1’ represents the absence of sustainable innovation, given cluster proximity. State ‘Y=1 | X=2’ signifies sustainable innovation without cluster proximity and state ‘Y=2 | X=2’ portrays the absence of sustainable innovation without cluster proximity. Since the crosstab has been compiled, the analysis can proceed to the tiers of statistical hypothesis testing and the calculation of measures of association.

Table 21: Tier two - Statistical hypothesis tests for the devised case (Source: author, SPSS™ output).

Statistical hypothesis tests	Value	Asymptotic significance	Exact significance
Pearson Chi-Square	102.368	0.000	
McNemar Test			0.000

Per statistical hypothesis tests, McNemar’s test (for paired samples) and Pearson’s chi-squared test (for unpaired samples), will provide the results presented in Table 21. This process pertains to the investigation of the variables’ dependence, the second tier of the framework. Both statistical hypothesis tests have revealed that, for a significance level of 5%, the null hypothesis of the variables’ independence, is rejected. Therefore, for the given case, cluster proximity is statistically correlated with innovation. From this preliminary, yet statistically significant outcome, the analysis can proceed to the formulation of typologies, through the calculation of measures of association. These will quantify said correlation and portray an exact numerical designation as to the degree of the variables’ causality (through the risk ratio). Through this methodology, the binary result of the statistical hypothesis testing is normalized within the elaborate setting of a typology. The process may be interestingly considered to resemble digital-to-analog conversion, as the binary result of ‘reject’ or ‘fail to reject,’ is enriched with specific metrics that range within a typology drafted for the specific case.

Notwithstanding, the third tier of the framework can be extracted, even if there is no statistical significance from the preceding statistical hypothesis testing. The rejection of the null hypothesis can lead to the conclusion of statistical significance that translates into variables' dependence. If the null hypothesis cannot be rejected, then it would be critical to provide more insight as to the variables' intrinsic dynamics; one that the measures of association are able to provide. With this rationale, the third tier of the instrument may act as a backup calculation for the cases wherein the analysis has failed to reject the null hypothesis. For the devised case, the odds ratio compares the odds of exposure to the cluster within the innovative cases, to the odds of exposure to the cluster within the non-innovative ones. It is calculated as equal to 12.39 (Table 22), thus portraying that the odds exhibiting the fact that the innovative firms will be proximate to the cluster, are more than twelve times the odds that the innovative firms will not be proximate to the maritime cluster.

Table 22: Measures of association for the devised case (Source: author, SPSS™ output).

Tier 3 Measures of association	Value	95% Confidence Interval	
		Lower	Upper
Odds ratio	12.39	7.26	21.14
Risk ratio	2.24	1.84	2.72

For the risk ratio calculation, the attack rate for variable 'X' and state 'Yes,' is extracted along with the attack rate for variable 'X' and state 'No.' The risk ratio (referring to a taxonomically similar, yet conceptually divergent interpretation to that of the odds ratio, as it can signify causality), with respect to 'cluster proximity' and 'sustainable innovation,' will be equal to 2.24 (Table 22). A risk ratio such as this, will signify that a firm exposed to cluster proximity, has 2.24 times higher chance (probability) to engage in sustainable innovation, exactly because of its proximity to the cluster. A risk ratio greater than two such as the one extracted within, hints to the fact that cluster proximity is responsible for firms' innovation (causality). Due to the results of the measures of association, the maritime cluster's classification within the typology is deemed as 'volatile innovation.' Both measures of association may be portrayed in the linear representation of the typology, as in Figure 24, where a neutral region of two tenths (1/10 bilaterally) around the threshold (α = 1) has been selected.

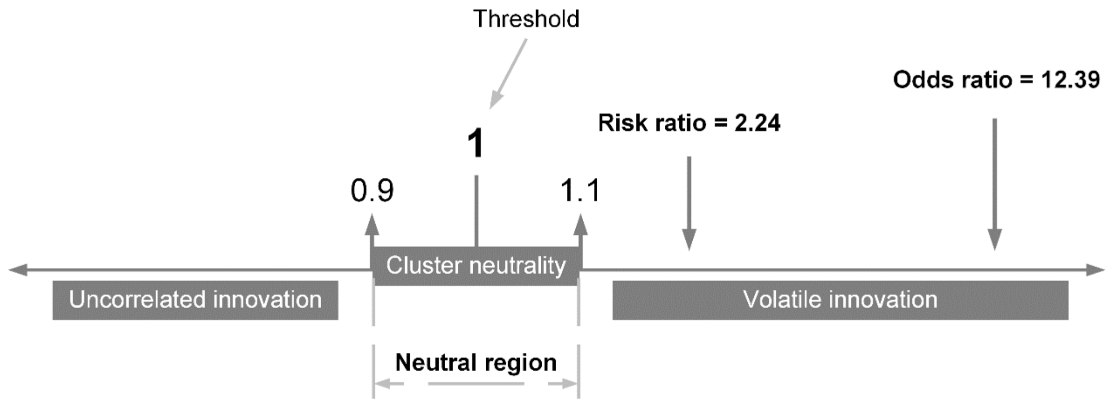


Figure 24: The risk and odds ratios within the maritime cluster typology (Source: author, Visio™ output).

Calculations such as the above may be conducted in fixed points in the future, to monitor their results within a temporal perspective and draft strategic policy directions accordingly. These sets of metrics portray cluster health, so they may pertain to the monitoring mechanism that can inform as per the implementation necessity of mitigative strategies and/or invasive policy. Other strategic groups of dichotomous categorical variables may be selected, to assemble a monitoring array of strategic indicators for the maritime cluster. This collection of indicators can be used to compare typologies between different maritime clusters, as well. The framework presented can provide analytical clarity and insight that may, extensively and cost-effectively, facilitate the process of strategic management and policy formulation for a maritime cluster.

Conclusions

Clusters of industry form cases of proximate agglomeration that are considered to pertain to sustainable competitive advantages for their respective regions. Within these constructs, strategic management and policy find a dynamic arena of applicability, with a definite potential for the generation and assessment of novel models and frameworks. Clusters that are formulated with a central aspect akin to the maritime industry demonstrate resilient instances of strategic might, since the maritime sector revolves around an economy of near-perfect competition, wherein networks of trust can lead to sustainable innovation and prosperity-designating competitiveness. From a maritime cluster's vantage point, the domains of strategic management, policy, and governance benefit from the formulation of typologies, for documenting, assessing, and monitoring an array of aspects. The work herein pertains to this field of interest.

A framework for the generation of typologies is presented, that provides the autonomy to select two categorical variables, in accordance to the strategic policy interest of the case at hand. Since the methodology is flexible and does not prerequire a determined set of variables, it can be applied within a wide array of cases. After the dichotomous categorical variables are selected, their case count is included within a two-by-two contingency table. Through this table, statistical hypothesis tests and measures of association may be calculated, that render the case within a given typology. From the extraction of typologies, the case may be observed in a longitudinal perspective, assisting the process of strategy and policy formulation; in addition, it may be compared to other maritime cluster cases. The methodology is limited from the validity and reliability of the protocol followed. Its effectiveness is based on the validation of the raw data acquired and respective caution is advised with reference to its robustness. Nevertheless, the framework is considered particularly relevant to the maritime sector due to the breadth of business entities participating in maritime clusters. The flexibility of the framework provides an inclusive methodology for the diversity, heterogeneity, spatial, and temporal focus of maritime clusters.

From an academic viewpoint, the domain of frameworks and models for the strategic policy of maritime clusters, may stand enriched. Subsequent research can focus on the collection of data from factual shipping and maritime firms' active within clusters and relinquish novel typologies based on predefined sets of categorical variables. Through this process, the value of the typology-generating methodology that is presented herein, may manifest itself in a practical perspective. From this standpoint, the analytical approach proposed enhances current literature by effectively documenting, assessing, and monitoring different strategic and policy attributes that maritime clusters entail. The focal point of the analysis enables greater variability compared to traditional models, as it pertains to an inclusive methodology to be utilized by either individual cluster members, or the entire cluster itself. This top-down perspective, in contrast to any bottom-up approaches, complements more effectively previous methodologies in analysing cluster governance, strategy development, and policy formulation.

A practical contribution of this research is that this framework effectively documents dependence and causality among two categorical variables that are not set a priori by the methodology, but are selected on an ad hoc, per case basis. The framework's applicability is mirrored within its capacity to measure and assess different sets of variables and to monitor these within a temporal perspective. Maritime clusters exhibit a high level of competitive and cooperative dynamics within; therefore, they may be able to utilize this framework to unlock further aspects of regional competitiveness that guide regional dynamics into collective prosperity. In addition, the framework is relatively simple and straightforward in its application, yet it is backed up by proven analytical methods, such as crosstabulation, statistical hypothesis testing, and measures of association; all considered benchmarks of best practice in their respective domains. To this extent, its robustness can ensure its applicability to heterogenous maritime clusters, such as port, shipbuilding, services, and tourism clusters, to name but a few.

The instrument is expected to facilitate strategy and policy for maritime clusters and help them enter new frontiers of competitiveness. The proposed framework is based on a conceptual outset and has been piloted within an academic context; however, it holds the likelihood to be of interest and practical feasibility for many cluster types. In addition, the framework should not be considered as a static construct, for it bears the potential to be further enriched and developed. From this viewpoint, the work presented herein aspires to be the first step towards the formulation of a subset of instruments for strategic policy of maritime clusters that have derived from this initial design.

III (2) – A strategic innovation framework for maritime clusters

Maritime clusters are very important constructs for the locations wherein they reside. Their importance derives from the fact that clusters formulate a melting pot of innovation and value creation that promotes competitiveness and sustainability for the region. Maritime clusters can be considered pillars for regional and even national competitive advantage. As such, they have drawn a large amount of attention, from research, policy, and practice. An established fact is that innovation is a distinct driver of a cluster's vigour and that strategic management within a cluster is important, as well. Though the correlation of these two elements has not been researched extensively. Within this work, a framework to correlate and measure the association of strategy and innovation is provided. This framework can be utilized to measure different factors as well, therefore, its applicability can be extended beyond the variables investigated herein.

Introduction

Maritime clusters have been gathering increased attention from academia and practice. For the latter, clusters combine the core competences of firms in a harmony of competition, cooperation, and innovation. These synergies give rise to sustainable competitive advantages for regions and nations. Many policies are then directed at cluster manifestation and facilitation, as the dynamics of clusters need to be safeguarded. On the antipode, clusters provide a viable breeding ground for the development of many instruments for research, both qualitative and quantitative. The framework developed herein provides a contribution in this domain. One major conclusion for all types of clusters is that innovation is a distinct characteristic of cluster function. At the same time, strategic management has been proven to be important for the research of maritime clusters.

Innovation provides a system of cooperation and competition that is imperative for clusters. Sustainable competitiveness derives from the harnessing of the system of innovation. One could go as far as stating that if a major component of the system is not innovation, then the construct cannot be considered as a cluster. Innovation is the facet that will provide sustainable competitiveness, as many firms will formulate a cooperative of spillover value-creation potential. The factor of innovation will create new markets and products and will carve regional, national, and even international competitiveness. Innovation will turn the focus of market dynamics from a finite number of customers and firms that compete for the same resources, to an infinite amount of market potential that renders competition irrelevant. This, because innovation itself will be the major element of competition, reducing all other tactics as moot. One can point out that innovation resides in all levels of analysis when concerning clusters. From the dwellings of a specific firm, to a regional constellation of industry, such as a cluster.

A fraternal element, holding an equal importance for the health of a cluster, is strategic management. If innovation is the fuel of sustainability and value creation, then strategic management is the engine that will allow this fuel to provide the efficient and effective manifestation of its might. It would seem, that exactly as an engine cannot function without fuel, and fuel by itself provides only the potential, the same symbiotic relationship can be supposed for strategy and innovation. One requires the other to harness it and direct it towards its beneficial provisions for the firms situated within the region and for the regional cluster itself. Strategic management will provide the direction that innovation requires and the cognizance within the industry so that knowledge creation can be directed towards a domain that pertains to value. Without strategy, innovation may provide marvellous ideas, but ideas that are not required or valued, nonetheless. It seems that strategy is the element that will direct innovation to materiality. Thus, strategic management surfaces as a very important aspect for business in general, and for industry clusters, as well.

An analytical aspect that is absent from the literature is that of the association of innovation and strategic management. The work herein provides a framework that can document said association. With the framework formulated, one can analyse these aspects and derive specific conclusions as per the correlation of the variables of strategy and innovation. This framework sets one variable of the two as a factor that may or may not pose an effect to the other (the condition). Therefore, by selecting one over the other, one can regard (and analyse) the correlation of innovation to strategic management, and the opposite, should the analysis call for such a distinction. The framework formulated is created for the analysis of association between innovation and strategic management, as these pertain to important elements of maritime clusters. Notwithstanding, the framework can be utilized for other categorical variables as well, and beyond the scope of maritime clusters. The paper is organized as follows. After the Introduction section a Literature Review rooting the necessity of the framework is provided. This is followed by the development of the framework and a case study demonstrating its use. The paper closes with a discussion in the Conclusions section.

Literature review

Strategic management has been proven to bear weight on the topic of maritime clusters (Koliousis et al. 2019). Strategy is very important when concerning a maritime cluster, as it will formulate the flight plan towards sustainable competitiveness. Strategy can be domain wherein typologies are formulated (Koliousis et al. 2017; Koliousis et al. 2018a) and models tested (Stavroulakis and

Papadimitriou 2017; Stavroulakis and Papadimitriou 2016; Koliousis et al. 2018b). At the same time, innovation formulates a distinct aspect of maritime cluster theory. There are many types of innovation present in a maritime cluster and many instruments that can be utilized for its manifestation (Bolmsten and Kitada 2018). Innovation can blend with cooperation and factors such as human and social capital, to produce healthy maritime clusters (Pinto et al. 2015). It has been substantiated that the factors that guide prosperity and competitiveness within a cluster are not discrete, but can be combined with one another, to provide the positive externalities that a maritime cluster requires. For instance, one can consider that competition and cooperation, two factors of importance for maritime clusters, are combined and synergize to trigger innovation (Monteiro 2016). Innovation is such a prevalent factor in the manifestation of competitive maritime clusters, that even its key drivers share commonalities in renowned international maritime clusters (Pinto and De Andrade 2013). The factor of innovation can be intertwined with sustainability and value (co)creation, as well (Rupo et al. 2018).

Maritime clusters provide a basis for researching many aspects of innovation, such as resilience (Pinto et al. 2018). The types of innovation that are prevalent within a maritime cluster can be investigated based on a specific case study, with many interesting results (Makkonen et al. 2013). The aspect of innovation can be considered of paramount importance for a cluster, as maritime clusters provide benchmarks of innovation and evolution (Salvador 2014). Research based on innovation can focus not only in the factors that sustain competitiveness within a cluster, but at ones that hinder it, as well (Laaksonen and Mäkinen 2013). Factors hindering innovation and competitiveness in specific maritime clusters can be analysed to produce relevant policy directives (Doloreux and Melançon 2006). Policy can pertain to a distinct factor of cluster formulation that will produce innovation and competitiveness (Pinto and Cruz 2012; Ortega et al. 2013). Along with the factor of innovation, strategy is prevalent, as well (Salvador et al. 2016). Strategic management should be included in all aspects of maritime cluster manifestation, from its development, all the way to its operations (Pardali et al. 2016). This aspect is intertwined distinctly with policy (Doloreux et al. 2016). Strategies for guiding maritime clusters towards competitiveness can be facilitated from frameworks and models found in the literature (Zagkas and Lyridis 2011). Strategies for the development of clusters are present as well, to the point of attaining importance for national economies (Doloreux and Shearmur 2018). Strategic aspects that must be included in policy and planning can be the outcome of research (Salvador et al. 2015). Policies and strategies can range from regions and nations, to economic unions, as well (Gailitis 2013).

Within the literature, the importance of innovation and strategy for maritime clusters can be substantiated. At the same time, the correlation and association of these two factors is not present, nor researched, in depth. The work herein provides a framework that can analyse said correlation and association with a robust computational methodology, thus providing an important contribution to the literature concerning maritime clusters.

Maritime cluster strategic innovation framework

The maritime cluster strategic innovation framework developed herein comprises of two categorical variables, the variable of 'Innovation' and the variable of 'Strategy.' One variable can pertain to the factor and the other to the condition. For the demonstration of the framework, the variable of strategy will be considered as the effect and the variable of innovation as the condition. Through this framework, measures of association can provide quantitative metrics as to the association and causality of these variables. The latter will take place through the crosstabulation of the variables, as in Table 23.

*Table 23: Strategy * Innovation crosstabulation (Source: author, SPSS™ output).*

Strategy * Innovation Crosstabulation					
			Innovation		Total
			YES	NO	
Strategy	**YES**	Count	**136**	**25**	**161**
		% within Strategy	84.5%	15.5%	100.0%
		% within Innovation	71.2%	25.0%	55.3%
		% of Total	46.7%	8.6%	55.3%
	NO	Count	**55**	**75**	**130**
		% within Strategy	42.3%	57.7%	100.0%
		% within Innovation	28.8%	75.0%	44.7%
		% of Total	18.9%	25.8%	44.7%
Total		Count	**191**	**100**	**291**
		% within Strategy	65.6%	34.4%	100.0%
		% within Innovation	100.0%	100.0%	100.0%
		% of Total	65.6%	34.4%	100.0%

Table 24: Chi-square tests (Source: author, SPSS™ output).

Chi-Square Tests					
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	56.692a	1	.000		
Continuity Correction[b]	54.838	1	.000		
Likelihood Ratio	58.316	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	56.497	1	.000		
McNemar Test				.001c	
N of Valid Cases	291				
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 23.87.					
b. Computed only for a 2x2 table					
c. Binomial distribution used.					

The rudimentary crosstabulation of strategy and innovation can produce preliminary indications as to the association of the variables. For the demonstration of the framework (Table 23) the number of cases is produced through a random number generator. The categories of the crosstab pertain to dichotomous variables and the crosstabulation can provide the row and column frequencies, as per the descriptive statistics of the extracted.

After the formulation of the crosstab, association of the variables and causality can be investigated through Chi-square tests, as in Table 24. The Chi-square tests demonstrate that the variables of strategy and innovation, in this example, are associated. If one considers the samples independent (unpaired), then the Pearson Chi-Square test will produce a p-value of 0.000, that for a given significance level (i.e. $\alpha = 5\%$) produces a result of the p-value $< \alpha$. If the samples are considered as paired, then McNemar's test produces a result of a p-value $= 0.001 < \alpha = 5\%$. Thus, both for the distinction of paired and unpaired samples, the variables are dependent.

Table 25: Risk Estimate (Source: author, SPSS™ output).

Risk Estimate			
	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Strategy (yes / no)	**7.418**	4.278	12.863
For cohort Innovation = yes	**1.997**	1.616	2.467
N of Valid Cases	**291**		

To further support the analysis and provide specific metrics with reference to the exact association of the variables, one can produce risk estimates (as in Table 25) that include the Odds Ratio and the Risk Ratio. As for the specific analysis, the Odds Ratio calculated is over seven. This demonstrates that the presence of strategy will increase the odds of innovation by more than seven times, as opposed to its absence. At the same time, a Risk Ratio of almost two signifies that innovation as a condition, is most probably derived from the exposure to strategy, or better yet, that exposure to strategy can lead to a higher ‘risk’ of innovation of almost two times. The framework developed herein, along with its case study based on random number generation, can demonstrate the relevance and impact of such a framework on the analysis of important factors that generate competitiveness and sustainability in maritime clusters. With frameworks such as this, the exact association of the categorical variables of interest can be calculated and specific strategic directions can be selected, stemming from the association (or its absence thereof) of the categorical variables selected.

Conclusion

Maritime clusters are important aspects of regional competitiveness, as within them a system of collective innovation carves global excellence. Maritime clusters have drawn a plethora of attention from policy and practice. Clusters require policy to remain competitive and at the same time they pertain to a fertile ground for the development of many frameworks and models. Many factors have been considered important for a healthy maritime cluster and these include innovation and strategy. Innovation seems to be the spark that sets the potential of the firms within a cluster in a motion of perpetual sustainability, whereas strategy directs this potential towards a beneficial context. Therefore, frameworks pertaining to the elements of strategy and innovation can be very beneficial for the sustainable competitiveness of clusters.

This work has developed a framework for the association of strategy and innovation in maritime clusters. It is formulated through the crosstabulation of the categorical variables of strategy and innovation, by selecting one variable as the effect and the other as the condition. For the demonstration herein, strategy is selected to be the effect, and innovation the condition. Thus, the association investigated is as to what extent strategy is correlated with innovation. Of course, the variables of the effect and condition can be reversed. The framework presented in this work can be beneficial for the assessment of the impact of strategy with reference to the manifestation of innovation in maritime clusters. Notwithstanding, it can be used for other cluster types as well, and more factors can be assessed, thereby extending the range of applicability of the instrument developed.

III (3) – The management of change within maritime clusters

Maritime clusters have come to be understood as important compositions for many regions, as they seem to exemplify the breeding ground of regional and even national competitiveness. As with other cluster types, the relational characteristics and dynamics of maritime clusters foster knowledge creation and innovation. As such, they have provided symptomatic interest, for many domains relevant to research and practice, alike. Strategy and policy are indicative within the former and both regard the management of change as bearing paramount importance. Therefore, it would be relevant to create instruments for the management of change within maritime clusters. Through this work, a framework for change management of maritime clusters is formulated, based on the change quadrants framework. It can provide a facilitator towards more effective strategic management and policy formulation for maritime clusters. The instrument can be used by practitioners and simultaneously, it may provide the kindling for further research.

Introduction

Clusters of industry consider a constellation of firms, agencies, and institutions that share relational capacity, to an indicative extent. This relational capacity drives societal dynamics of these cluster members towards collective excellence that can benefit regional and even national economies. A major driver of this effect is innovation, as it’s rooted within the rudiments of clusters (Furman et al. 2002). Other characteristics of clusters include knowledge creation and management that turn into sustainable competitiveness for the cluster members (Asheim and Coenen 2005). All these effects provide a viable base for the development of many research frameworks (Baptista and Swann 1998). An interesting instance within cluster research includes the investigation of causality between two factors, as can be exhibited within the body of literature. One factor that manifests prevalence within the research is spatial clustering. It can be correlated within organizational learning to inquire its bound effect towards innovation (Giuliani and Bell 2005), or its sole effect on entrepreneurship (Stuart and Sorenson 2003).

Many other pairs of factors are investigated within the literature. These may include the causal effect of networks on innovation (Giuliani 2006); the effect of support services and social (and venture) capital on the initiation of an entrepreneurship culture (Feldman 2001); and the causality of location patterns with reference to innovation (Iammarino and McCann 2006). As innovation stands as a major factor of interest for clusters, research has documented that it does indeed bear a causal relationship with the proximity of firms to a cluster (Bell 2005). Other factors researched can include clusters situated in developing countries, with reference to technology and systems of knowledge (Bell and Albu 1999); the matter of knowledge can be researched with respect to the causality of the flows of knowledge and the system of contacts (Dahl and Pedersen 2004). Research extracts point to the fact that entrepreneurship may be linked with the presence of a cluster, as well (Delgado et al. 2010). In addition, knowledge creation and management can have an indicative effect on the system of innovation within a cluster (Sammarra and Biggiero 2008).

The first to provide a model on centralization that provides semblance to a cluster, was the father of location theory, von Thünen (1826). One of the first of the neoclassical economists, Alfred Marshall (1920), has extended the theory by providing relevant agglomeration economies that bear the causal effect of a cluster's competitiveness. These factors are analysed in modern theory, as well. The latter includes a strong interest with reference to the contributions of M. Porter (2000) that contain research on the origin of competitiveness, along with the diamond model, that can be used to analyse the competitive position of a cluster. As can be extracted from the literature, clusters are important constructs for regional and national economies, as their networks fuel knowledge creation and innovation that can drive regional competitiveness. As such, policy and strategy are important elements for clusters, as they both can facilitate the management of change that is imperative in nearly all instances of knowledge creation, innovation, and competitiveness.

Strategic management is important for the research of clusters, as well (Lee 2006); to the extent that the effectiveness of the strategic decisions within the cluster will hold a direct and causal relationship with competitiveness (Akoorie and Ding 2009). In addition, strategic management can affect performance (Galdámez et al. 2009) and have an impact on trust between the cluster members; the former is also an important aspect, found inherent within the network of cluster actors (Niu 2010). Not only this, but future research can delve into the subject, as it holds indicative potential (Ploykitikoon and Daim 2009). It is important to mention that strategy and policy are not divergent, but correlated cluster aspects (Chen et al. 2013). The domain wherein cluster research is situated can portray diversity; it includes economic geography, location theory, strategic management, and organisational theory (Niu et al. 2012). The contributions of cluster research, paired with strategic management, can impact not only strategic decisions within firms, but concepts that affect other sectors, including the environment (Røyne et al. 2015).

Strategic management research can assist the documentation of many topics, such as cluster evolution (Lin 2012), wherein the relational dynamics of clusters and their impact on innovation can be investigated (Ilin and Anisiforov 2014). The organizational structures within the research referring to these factors and concerning change management, can be very important (Martínez et al. 2012); all the way to the regional management of change with respect to the industry clusters of the district (Fayyaz et al. 2009). As the development of strategic management frameworks that can assist the management of change is an emerging and dynamic domain, this work provides a novel framework that can facilitate the management of change within maritime clusters. The latter are a type of clusters that can be considered indicative, as their impact on regional economies is grave.

Strategic management within maritime clusters

The factors presented above, with reference to innovation and entrepreneurship, can be analysed very effectively within maritime clusters (Benito et al. 2003). The latter provide benchmarks for strategic management research (Doloreux and Melançon 2008). As expected, competitiveness within maritime clusters can be affected and carved by effective strategy and policy (Doloreux and Shearmur 2009). Research focuses on the potential and capacity of cluster formulation (Karlsen 2005), employment (Mitroussi 2008), and governance (Lam et al. 2013), as topics affected by the presence of a maritime cluster. Again, these clusters bear an exemplary effect upon innovation, social capital (Pinto et al. 2015), and competitiveness (Laaksonen and Mäkinen 20163). Researching maritime clusters can have a diverse scope, inspecting even the most preliminary facts within the theory (Doloreux 2017). In addition, maritime clusters provide the ground for the development of frameworks (Stavroulakis and Papadimitriou 2016) and models (Stavroulakis and Papadimitriou 2017).

As with many other types of clusters, the dynamics of cooperation and competition within maritime clusters will influence innovation, competitiveness, and performance (Monteiro 2016), in addition to the creation of value (Hammervoll et al. 2014). Many outcomes from the strategic domain, such as alliances within and among maritime clusters, will affect regional and even national competitiveness (Brandt et al.

2010). The intricacies of maritime cluster dynamics can be documented through the utilization of many theories (Jin and Zhen 2013). The use of models can explain many maritime cluster characteristics, such as their evolution (Zhang and Lam 2017). As it is accepted that strategy and policy may be intertwined, policy exhibits herself as an important factor of maritime clusters (Pinto and Cruz 2012) and, in addition, the evolution of the latter can be investigated with the utilization of typologies (Salvador 2014).

Research into topics concerning maritime clusters can utilize qualitative and quantitative methodologies and contribute within the domain of strategic management (Salvador et al. 2016). This can include the impact of regional strategies within maritime clusters (Pagano et al. 2016). Many factors of importance for all cluster types surface as same for maritime clusters, as well. These include innovation (Pinto et al. 2013), policy, and governance (Ortega et al. 2013). Research models can assist the selection of effective policy (Zhang and Lam 2013) and the sustainability of competitiveness can be impacted by culture (both the cluster's and its members'), within a maritime cluster (Shinohara 2010). Again, the dynamics of cooperation and competition are very important for the management of strategy (Chang 2011) and the research instruments formulated can have many and diverse applications (Zagkas and Lyridis 2011).

As maritime clusters hold distinct potential with reference to strategy and policy and simultaneously the development of frameworks for these constructs can be quite beneficial, one may wish to develop frameworks for the management of change within maritime clusters, as these may stand to benefit both domains of interest. Within this field, the extension of applicability of effective instruments can prove to be quite useful. A framework that is very important for change management, is the change quadrants framework. Within this work, the latter is induced through a quantification prism, insofar that succeeding crosstabulation and relevant statistical decision tests may be administered, so that it can be used effectively for the strategic management of maritime clusters.

The change quadrants framework and its impact on strategic management

Within the diverse domain wherein one may locate instruments for the management of change, the change quadrant framework stands out (ten Have et al. 2003). The basis of the framework consists of two categorical variables that are dichotomous. One variable refers to the internal environment, where the other to the external (Figure 25).

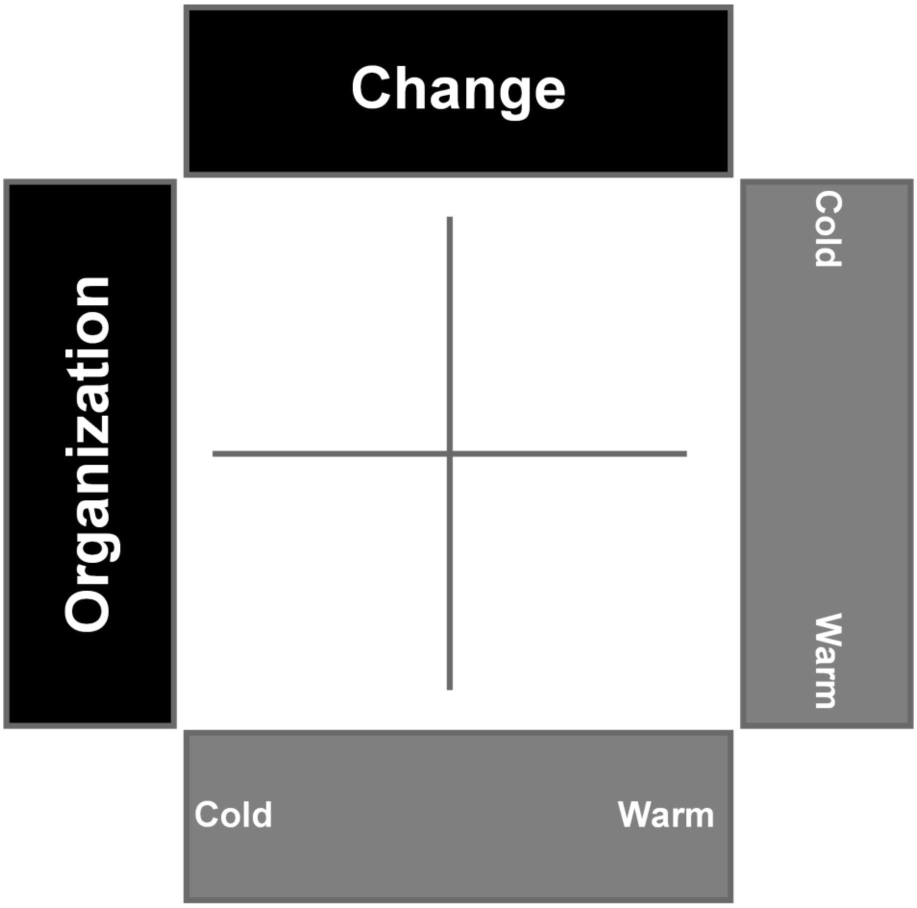


Figure 25: The framework of the change quadrants (Source: author).

These variables can belong in one of two states, either ‘hot’ or ‘cold.’ The four possible combinations of the two states of the variables can produce the four different strategies one may implement, with respect to the management of change. With reference to the variable of the internal environment, a ‘cold’ organization is described as one where procedure will dictate direction. A ‘warm’ organization will use its shared culture to determine its direction. With respect to the second variable, that of ‘change,’ a ‘cold’ motivation for change will have an external origin based usually on the firm’s fundamentals. A ‘warm’ change will include the materialization of corporate vision.

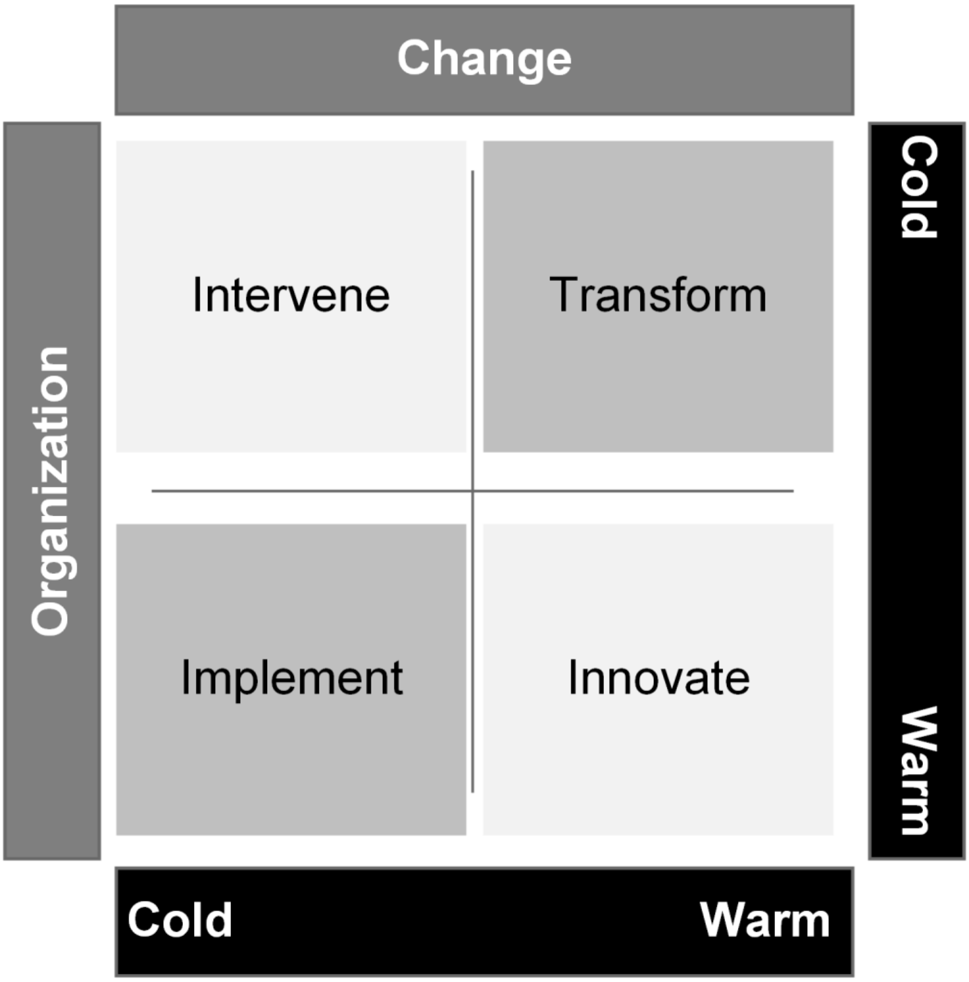


Figure 26: The types of change strategies (Source: author).

The four states of the framework will extract different strategies to be implemented. Within these four possible strategies, one must either intervene (cold motivation for change in a cold organization), transform (warm change in a cold organization), implement (cold change in a warm organization), or innovate (warm motivation for change within a warm organization, as in Figure 26).

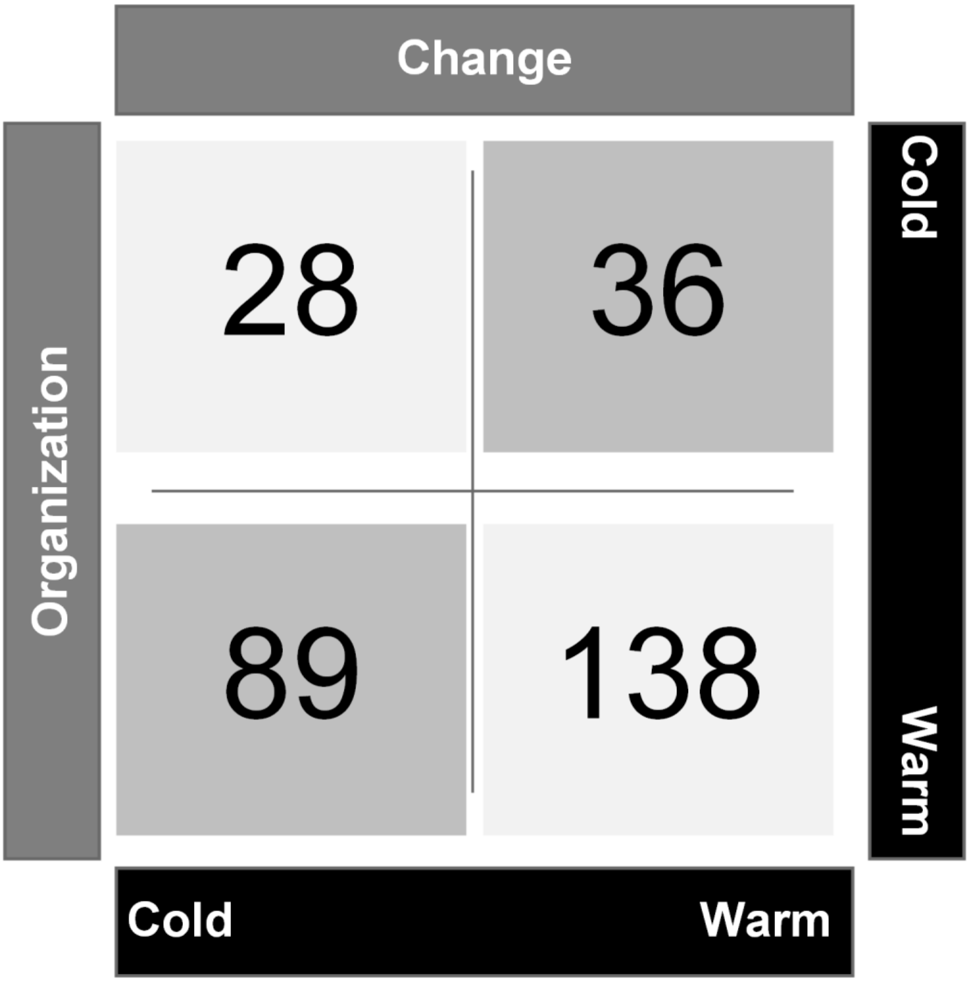


Figure 27: Compilation of the change quadrants crosstab (Source: author).

As mentioned, a quantification aspect within the instrument can be introduced. The latter will give way to the investigation of dependence and causality between the variables that is very important for maritime clusters. The first step toward developing this model would be to perform the preliminary analysis with respect to representing the cases that fall within each state of the change quadrants framework. Through the numeric representation of the cases within the maritime cluster that fall into these categories, a simple crosstab would be compiled, as in Figure 27. This includes a generation of random numbers, for the purposes of demonstrating the model.

As a subsequent step, one may calculate the joint, marginal, and conditional probabilities (Table 26). The collection of probabilities themselves can introduce a novel analytical aspect that can benefit the management of change within maritime clusters, as research and practice now hold a strong quantitative instrument that can document the proper change strategies to be implemented. Through this model, these strategies derive from a robust methodology. Within the crosstabulation of the change quadrants, a modelling approach is introduced and through this, an arsenal of analytical instruments may be administered.

Table 26: Joint, marginal, and conditional probabilities of the devised case (Source: author, SPSS™ output).

Organization * Change Crosstabulation					
			Change		**Total**
			yes	**no**	
Organization	**yes**	Count	**28**	**36**	**64**
		% within Organization	43.8%	56.3%	100.0%
		% within Change	23.9%	20.7%	22.0%
		% of Total	9.6%	12.4%	22.0%
	no	Count	**89**	**138**	**227**
		% within Organization	39.2%	60.8%	100.0%
		% within Change	76.1%	79.3%	78.0%
		% of Total	30.6%	47.4%	78.0%
Total		Count	**117**	**174**	**291**
		% within Organization	40.2%	59.8%	100.0%
		% within Change	100.0%	100.0%	100.0%
		% of Total	40.2%	59.8%	100.0%

The aspect of quantification introduced to the change quadrants framework through the crosstabulation of its variables can bear indicative effect to the analysis, as the structured and robust methodology introduced can usher a novel analytical domain for the instrument. By extension, the modelling approach can not only extend the analytical scope through the procurement of the typology of probabilities, but also introduce the investigation of causality among the categorical variables of the change quadrants; a potential element that can provide indicative results for the strategic management of maritime clusters.

For a given level of significance (for the analysis included herein it is selected as α=5%), one can select one of two interpretations with reference to the samples included in the change quadrants. The first concerns paired samples and will lead to the utilization of McNemar's test. Rejection of the null hypothesis of marginal homogeneity will reject the hypothesis of equality of the marginal probabilities of the crosstab and thus, point to variables' dependence. If the distinction of unpaired samples is selected, then Pearson's chi-squared test may be administered. Here, the null hypothesis of independence will provide statistical significance hinting to variables' correlation, if rejected. The results of the devised case are included in Table 27.

Table 27: Causality investigation for the change quadrants (Source: author, SPSS™ output).

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	0.429a	1	0.513		
Continuity Correction[b]	0.260	1	0.610		
Likelihood Ratio	0.426	1	0.514		
Fisher's Exact Test				0.564	0.304
Linear-by-Linear Association	0.427	1	0.513		
McNemar Test				0.000c	
N of Valid Cases	291				
a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.27.					
b. Computed only for a 2x2 table					
c. Binomial distribution used.					

For the consideration of paired samples, the statistical hypothesis test moves to reject the null hypothesis, given that the p-value is equal to zero (i.e. lower that α=5%). Therefore, for the case presented herein, McNemar's test hints to variables' correlation. This type of result can have major effects in the management of change within a maritime cluster and it was all extracted through the crosstabulation of the change quadrants framework. It is evident that, through this methodology, not only is the initial usability of the change quadrants not hindered, but its applicability extended and offered novel insight that can prove beneficial to any analysis concerned with variables' causality within maritime clusters.

Table 28: Estimates of risk (Source: author, SPSS™ output).

	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Organization (yes / no)	1.206	0.688	2.114
For cohort Change = yes	1.116	0.809	1.539
For cohort Change = no	0.925	0.728	1.176
N of Valid Cases	291		

Notwithstanding, another analytical aspect that can surface through crosstabulation, is the calculation of risk (Table 28). The statistical hypothesis tests can provide a dichotomous answer with respect to variables' correlation, whereby risk analysis can provide a level of representation for causality. For the case presented here, the odds ratio is over 1.2, hinting that there are over 1.2 times greater odds for a warm motivation for change to take place in a warm organization in the maritime cluster, to the odds of a warm motivation for change occurring in a cold organization. In the same manner, the risk ratio is calculated at over 1.1, indicating that a probability of a warm motivation for change is over 1.1 times likely to occur in a warm organization than a cold one – not very strong associations for this particular case, but notwithstanding, these results can be very important for both the change quadrants framework and the management of strategy within a maritime cluster and can be included within the broad range of research that is concerned with the topics of sustainability (Dragović et al. 2016) and optimization (Rajkovic et al. 2016).

Conclusions

Clusters of industry are very important for the regions wherein they are situated, as within them there seem to bloom indicative constellations of networks that promote knowledge creation and innovation towards regional and national competitiveness. Within all types of clusters, there are many that are considered indicative. Among the latter, one can include maritime clusters, as they have a grave impact on the economies wherein they are situated. At the same time, research into these types of clusters can include an array of topics that include strategy and policy.

The development of frameworks for the management of strategy and policy within maritime clusters is highly consequential and prevalent, as instruments can facilitate the effective management of these domains, both for research and practice. An element that affects both strategy and policy, is the management of change. A framework of importance within this domain is the change quadrants framework that can be indicatively effective for strategic management within maritime clusters. The former is cross-tabulated, and thus a model is introduced, that extends the applicability of the generic change quadrants framework. Through this, many novel analytical directions for the management of strategy and policy within maritime clusters can be pursued.

III (4) – Strategic analysis and instrument formulation

> To formulate instruments for analytical competitiveness within the scope of situation analysis for maritime clusters, the quest might originate in the analysis pertaining to strengths, weaknesses, opportunities and threats, typically referred to as SWOT analysis. The methodology of the instruments' formulation may provide a stepping-stone for successive research and analysis. Situation analysis has regarded SWOT as an asset within its arsenal because this analysis can provide a pertinent strategic snapshot and simultaneously cede the rudiments of necessary strategic manoeuvres. These facts derive from the inherent characteristics of SWOT, and mainly of the fact that SWOT analysis is an inventory of strategic factors that presupposes effective strategic scouting. Through scouting focused in the extraction of pertinent strategic factors the latter may be extracted, the SWOT inventory formulated, and the environmental analysis portrayed. This exactly may very well be the case of the tenacity that SWOT analysis has exhibited within its decades of activity, wherein its key relies in the accurate extrication of the factors that will affect the entity and/or case under analysis. If indeed the results of strategic scouting are realistic, thence we will arrive at the factors affecting our prosperity, so that we may implement and even affect beneficial change, for our sake. Stake-oriented change may pose as the mere beginning of a process that is profound and in case we are referring to maritime clusters, will lead to mutualistic stakes being complementarily compensated. This work provides the baseline for the development of such an approach.

Introduction

The move to associate industrial cluster strategic analysis with situation analysis and SWOT in particular, could not but come effortlessly, for just as clusters hint to collectiveness, so does SWOT imply environmental conscience, in its pure definition. Only if there is pure conscience and awareness of the external and internal environment can a SWOT analysis venture be successful, and this because the critical structural pillar of SWOT, is effective environmental assessment. The argument that the competitive advantage of SWOT analysis, apart from its simplicity, is the fortification of environmental importance, is evident, since SWOT requires efficient scrutiny to be demonstrated, for the analysis to be of any use. The distinct effect of this scrutiny, the sensitivity with respect to the environment and the candour about the internal environment, make all the difference. These two factors put together point to the raw grit of SWOT, for it requires two distinct circumstances to be true simultaneously. First, a true assessment of the self-included system must be conducted, a feat inordinately tussled with perpetual complexity, as truth concerning the individuality may lie under intertwined and impenetrable layers of pretention, perception, and veneer. As if a self-appraisal was not perilous enough, SWOT comes to state that this is only half of the enterprise, and an expedition to accurately assess the external environment must be orchestrated as well. But, despite the hardship, one can only gleam at the insurmountable potential that SWOT can grant. A meticulous, proper, and factual inventory of strategic factors, both beneficial and unfavourable, for the external as well as for the internal environment, may pose as the difference between growth and retrenchment, as the determinant between sustainable opportunity and continuous futility.

Within the equilibrium of the external and internal environment that SWOT requires, lies the nexus between SWOT and its unmistakable applicability in industrial cluster topics, for both though simple in nature, can be paradoxical in practice, as both reside within a cosmos of sustainable effectiveness for the entities that make up the internal and external environment. One could move as to imply that industrial clusters and SWOT analysis though divergent factual entities, one a manifestation of spatial agglomeration and the other a methodology situated within strategic management, share inborn culture, for both invariably manifest themselves as pinnacles of brilliance; therefore, they may complement one another, to achieve yet another mutualistic synergy rooted in paradox. In the same manner that clusters hold the deed to overcome inherent systemic limitations, so does SWOT analysis; it may redeem the diligent and culturally awakened strategic scout with a clear and definite strategically-oriented perspective. It is within cultural convergence that an industrial entity and an analytical methodology may find alignment paved with synergies of mutualistic alliance.

Offering competition to a duly compiled SWOT analysis inventory is the fact that its preceding process, the extraction of the strategic factors, may suffer in the arena of objectiveness and materiality. This goes to apprehend that most basic of the instrument's flaws, subjectivity, for the process of factor extraction is not analytical and may prove lethargic. Surely, if an entity is offered the pertinent strategic factors that affect its internal and external environment, thence strategic decisions are focused and directions overindulged with clarity, but the fact of the matter remains that this inventory is not relinquished upon a silver platter, but is the result of strenuous effort and uncontested skill. In addition, this process may include semblance to implicit, stochastic, discursive, and unsystematic activities. It would be unfeasible if not impossible to deconstruct the product of a process based on skill, or even worse, on instinct and empiricism. But alas, strategic scouting can be anything but deterministic, and so are the systemic threads of maritime clusters, as well.

Thus, we arrive at the first major caveat of SWOT, that it may render a compilation of factors that are not of an appropriate nature and/or that it may prove remiss of factors crucial to the strategic case. A reference though must be made to the stochastic nature of systems it analyses, for it is nearly always subjective if a strategic factor is pertinent, and thus, its inclusion in the inventory, is indeed a type of forecast. So, we grasp the elemental importance of SWOT; surely it is the inventory of the strategic factors that affect the entity, but at the same time the tacit statement is that the same factors are the ones that will affect change in the future. This fact leads to the same situation as if trying to predict financial performance utilizing the balance sheet, an important statement nonetheless, but surely not temporal in nature. Within the constant that the environment is in perpetual change, there are instruments that, if utilized with care and with the understanding of their inherent limitations and risks, may prove useful. The point to remain is that vigilance should be instated and all results filtered through the materiality principle.

Lateral to the above, a major risk that lurks undisturbed, dwells in the makings of the theory. Even if we assume that all factors within the inventory duly deserve their place and that no factor has been left out, the inventory within itself implies that the factors are of an equal significance; a potentially menacing assumption to be made. If there is no prioritized sorting of the factors, thence there is no way to be sure what direction to pursue and the distribution of resources to allocate for a strategic endeavour. Thus, as if it were not enough that SWOT analysis may be misleading regarding its items per se, it must be burdened with an absence of categorization. Conclusively, SWOT analysis not only is not rid of bias, but contains grave systematic error, that will manifest itself as selection and measurement bias. Not providing a proper selection of factors will mean that the inventory may be riddled with selection bias, and the fact that no categorization may exist between the items, will grant measurement bias.

Research fervour was gracious enough to provide a body of knowledge with the sole objective of tackling these flaws. At the same time, these drawbacks provide a fertile ground for analysis and experimentation of instruments and methodologies directed at mitigating said issues. This work provides an extension of applicability of the instruments instituted to tackle the deficiencies of SWOT, with the implicit utilization within maritime clusters, as their synergies may surface as interlocking and complementary. A primary analysis of competitiveness through the focal point of strategic management is conducted, followed by the formulation and presentation of methodologies pertaining to the contribution of upholding the mitigation of issues within situation analysis, and enriching the analytical methods for competitiveness within maritime clusters. An example of how the model formulated may be used is included as well. Hopefully this model will provide a pertinent contribution within the domain of strategic management of maritime clusters.

SWOT analysis

Strategic management may prove to hold the key for the materiality and sustainability of any venture, since the intricacies of adaptability lie within its domain. Strategic management will facilitate the transition from an environmental shock, and so will it formulate the plan towards any vision. In addition, strategic management provides the methodologies and instruments to define and quantify the progress of each strategic goal. In its generic setting, it will pave the road to fulfil a vision. If there was a sector for strategic management to be active within that would be vision attainment, for the former includes all processes and procedures that will guide an entity towards the fulfilment of its objectives. Strategic management includes a plethora of domains, and many depending on the model of strategic management utilized, but the most widely accepted formulations include the same overall threads, such as strategy formulation and strategy implementation, environmental scanning, and situation analysis. The latter pertain to the instigators of the strategic management process.

Situation analysis is a very (if not the most) important aspect of strategic management, because no goal may be attainable without a complete understanding of the environment (both internal and external), wherein any organization operates. It is within the interaction of the internal and external environment that sustainable competitive advantages reside. Especially for industry clusters and maritime clusters, the aspects of strategic management that involve environmental interactions, are of the outmost importance. The efficiency of proximity that is inherent within a maritime cluster especially, could be coined as an efficient tacit situation analysis case. Therefore, strategic management finds a marvellous playing field within maritime clusters, for the dynamism of the maritime industry, paired with industrial cluster specifics, germinates in an explosion of interest for the management of strategy.

A maritime cluster will define environmental boundaries based on the health and sustainability of the cluster and therefore generate mutual benefit between strategic management as a domain, and the cluster itself. On the one hand, a maritime cluster's culture may provide the much-needed latent instigators of mutualism and environmental respect, whereas strategic management will provide the instruments for this endeavour to materialize. The case-specific consideration of the environment within a maritime cluster is astonishing and this very fact finds attraction with respect to strategic management. If an agglomeration of economic activity, within a domain, depending on the case at hand, can consider a shift in environmental boundaries to formulate and implement the best strategy for itself whilst latently benefiting the whole cluster, there is no mistake in the importance that strategic management will hold within. The specifics of environmental boundaries are what gives situation analysis the advantage of the utilization within a maritime cluster, as competition and cooperation will shift what defines the external from the internal environment, accordingly.

One framework within the domain of situation analysis – that of SWOT analysis – stands out, albeit from its applicability, versatility, and popularity. For decades, SWOT analysis is the situation analysis' instrument of choice, and this, since SWOT provides a snapshot of the strategic environment, both internal and external, within a dichotomous perspective. The analysis provides an inventory of strategic factors that affect the case at hand, and categorizes them as per their origin, and qualitative impact. Through this representation, two categorical variables, the environment and the qualitative distinction, are found (each) within one of two states, rendering the four categories of SWOT analysis. The environmental origin may be internal or external, and the qualitative attribute may be beneficial or unfavourable. Thus, SWOT pertains to a basic framework that has been utilized extensively over many decades, that encapsulates the mandates of effective situation analysis.

SWOT analysis provides a snapshot of the results of a given situation analysis, in a way that can be further utilized, either qualitatively, or quantitatively. Many models have been formulated as an extension to basic SWOT analysis, and the inventory itself can provide the stepping-stone for succeeding frameworks. A mere sample of the framework's effectiveness is its utilization from academia and practice alike. Seldom is an instrument cherished by industry and academia at the same time. Usually, the accuracy demanded from academia is divorced from the usability requested from industry. But SWOT analysis does hold popularity in research and practice, since it's simple, practical, and cost-effective, thus fulfilling many if not all the prerequisites of an instrument for any practitioner that wishes to perform an efficient situation analysis. At the same time, SWOT analysis relishes an arsenal of quantitative potential, and can stand as the starting point of many pure-math models, that many researchers may find attractive.

At its base, the SWOT analysis framework consists of firstly a consolidation of strategic factors that pertain to the same categorical variable, and then, a presentation of the categorical variables. As referenced above, these variables are extracted from the rudiments of situation analysis and are dichotomous. The first division expresses itself as to the qualitative attribute of the strategic factor, albeit beneficial or unfavourable, and the second divide is that of environmental derivation. The dichotomy then is bifold, producing four categories, each including strategic factors of an environmental origin, and a qualitative attribute. By providing these four categories, the analysis can portray a rather comprehensive dissection of any given situation, by relinquishing a boundary as to the internal and external environment, and to the positive or negative aspect of each factor. In addition, the inventory of strategic factors can provide the basis for subsequent analyses, such as the TOWS matrix. By introducing a temporal perspective herein, a thorough strategic analysis with respect to the case at hand has been conducted, and the strategic factors extracted have been distributed per their environmental origin, and qualitative connotation. Through this portrayal, the next relevant step, as to strategy formulation, may be ascertained.

The process of analysing the internal and external environment to extract strategic factors and subsequently categorize the latter per their qualitative inclination, is not without pitfalls. These analytical perils come with respect to the inventory of the strategic factors that is compiled, in twain. That is, there can be two sources of bias within the inventory, as was mentioned above. First, there can be bias within items, as a strategic factor may be left out of the analysis, and/or a strategic factor may find proximity within it, when it does not belong there. Since the list is open to relative interpretation of the analytical steps that extracted the factors, then the final inventory may be riddled with 'observer bias.' In addition, the framework of SWOT has a basic flaw within itself, as the mere portrayal of strategic factors hints to a uniform distribution of importance within them, when, of course, this can seldom (if ever) be the case. SWOT presents a list of factors, that even if we assume has no observer bias (that is, all the pertinent factors are included in the inventory), still does not do us any good as to their relative ranking and importance.

Thus, if we were to perform a SWOT analysis for SWOT analysis, one major weakness of the instrument would be that of the uniform importance of the strategic factors, and a major threat, would be the relativity and subsequent bias of the entity compiling the inventory. To a point, both this weakness and threat are relative, within themselves. This because a successful situation analysis can only be proven if it materializes, so in effect, any situation analysis holds a distinct aspect of forecasting. The point would not be to include a weight or importance for each strategic factor as pertaining to a deterministic output, but a relative ranking of the strategic factors to assign a quantitative constituent within an aspect of stochastic output. This (or in fact, almost any) introduction of a qualitative partition within SWOT analysis, will potentially enforce and enrich its output. In addition, the introduction of quantitative constituents within the analysis, hints to the evolutionary potential of the instrument. Indeed, SWOT analysis pertains to a very fertile ground with respect to model formulation.

With a review of the literature that has been formulated and introduces novel applications of SWOT analysis, at first its breadth of applications is of interest, as it is indeed plethoric. Few instruments have burrowed their way to find such an intricate network of applicability. It is as though SWOT analysis plays both its strengths and weaknesses to its advantage, at the same time. The matter of its strengths facilitates a rich germination of utility, within an abundance of applications and domains, wherein its weaknesses are an opportunity to formulate new frameworks and models to overcome the former. The breadth of the applicability of SWOT can be witnessed in domains that range from the utility of the framework as an assessment instrument for stakeholder decision making within complex socio-ecological systems (Elsawah et al. 2015), or for the socioeconomic considerations of fisheries (Glass et al. 2015). In both cases, SWOT is utilized to point to strategic directions, after the assessment of a case. Wadhwaniya et al. (2015) utilize SWOT in tandem with systems' analysis for the assessment of a World Health Organization program with respect to global violence and injury prevention. Nicolopoulou-Stamati et al. (2015) provide an environmental health assessment with SWOT analysis that helps point to the importance of tacit knowledge within training processes.

Stewart et al. (2002) use SWOT to analyse the strategic implementation of Information Technology / Information Systems (IT/IS) projects in construction. Liu et al. (2015) instigate SWOT analysis to perform a path selection of the construction of a low-carbon city. Chong (2015) analyses the cruise tourism sector in Malaysia with SWOT analysis; Braun and Amorim (2015) provide a diagnosing method for conservation areas that is based on SWOT analysis. Öztürk (2015) extracts management strategies for a nature protection area from SWOT analysis; Prezelj (2015) portrays strategic directions to improve inter-organizational cooperation in counterterrorism, based on a quantitative SWOT assessment. Manzano-García and Ayala-Calvo (2014) provide an overview of nursing in Europe through SWOT analysis. Mphasha (2015) uses SWOT to facilitate the portrayal of the importance of folktales with respect to the cultural values within communities. Raslavičius et al.

(2015) develop a SWOT analysis assessment of the challenges and opportunities of electric vehicles in the Baltic. Sharma and Singh (2010) analyse the state of ICT in six universities in India, through comparative SWOT analysis.

From even an elementary review of literature that includes the instrument, one can confirm the broadness of topics wherein SWOT can be utilized, but also, the significant difference in systemic detail and complexity. SWOT is found useful both in a simple case study, wherein the system may pertain to a case of organizational proportion, and in a complex and global case. One extract that flows from a generic literature review is that not only the topics of SWOT applications can be endless, but their differentiation may be extreme as well.

To bypass the issues of *traditional* SWOT (i.e. the generic analysis with no quantitative constituent), numerous applications have been drafted and relinquished within the literature concerning SWOT. Many of these may be admitted as to a construed subsection, since they utilize the same analytical process. One example is the analytical hierarchy process (AHP) that has been paired extensively with SWOT. Kurttila et al. (2000) utilize AHP to extract a hybrid SWOT methodology and apply it to a forest certification case. In addition to AHP, some of the interesting qualitative methodologies employed in tandem with SWOT are multiple criteria group decision-making (Gao and Peng 2011), multiple phase clustering algorithms (Hadighi et al. 2013) and fuzzy quantified SWOT (Kuo-liang and Shu-chen 2008). From the applications that are formulated to tackle the inherent limitations of the traditional analysis, we can observe that the same limitations have helped towards the germination of many methodologies, and the vast exploratory potential that the instrument provides.

SWOT analysis and maritime clusters

Since SWOT analysis exhibits such a vast potential of applicability with respect to many topics, and at the same time, maritime clusters are such a dynamic case for strategic management, the synergy of the two is self-evident. What may not be so apparent is the mutual benefaction that can be extracted from exposing one to the other. The aspect of strategic management within a cluster has one more instrument within its arsenal, but at the same time, the case benefits the instrument, for it will provide the instigator of many analyses that are based on traditional SWOT. One of these instruments is developed and presented herein. As with its breadth of applicable topics, SWOT has been utilized extensively in the maritime sector as well.

The Directorate-General for Maritime Affairs and Fisheries (2009) utilizes SWOT in its official report with respect to the importance of maritime clusters in regional and national competitiveness. Andersson (2013) utilizes SWOT to analyse strategically several maritime clusters. Maritime clusters do benefit from the extensive utilization of the analysis within the maritime industry, in general. Arslan and Er make use of the instrument to analyse both successful bridge team organization for safer marine operations (2008a), and analysis for safer carriage of bulk liquid chemicals in tankers (2008b). Chou et al. employ the instrument to assess the operation strategies of the world's top twenty carriers (2012), and to analyse strategies for the operation management of port logistics in the global supply chain (2013).

Rapisarda et al. (2014) employ the instrument for the development of an applicative model for regional interventions for supporting the sustainability of the maritime department of Augusta. Keceli (2011) proposes an innovation strategy for Turkish port administration policy via information technology, through SWOT analysis. Rathman et al. (2014) provide a structural analysis of development capabilities of the port as a potential container port and include SWOT in their analysis. The vast array of applications that SWOT includes may be directly applicable within maritime topics.

Chang (2011) employs SWOT to analyse the maritime industry and maritime cluster potential, through the case study of South-West England. Runko Luttenberger et al. (2013) perform a viability analysis of the sector of short sea shipping through the instrument of SWOT. Genc and Guler (2006) assess marinas in the Mediterranean, to portray and strategically analyse the position of Turkey, through SWOT analysis. Thanopoulou (2012) analyses, with the assistance of the instrument, bulk reefer market economics within a product life-cycle perspective. Murphy and Landamore (2009) perform a cost-benefit analysis for autonomous underwater vehicles for marine search and rescue operations, wherein SWOT analysis is one of the selected analytical methodologies.

Many, if not all the quantitative instruments that have been formulated through, or for, SWOT analysis, can have direct applicability to the maritime sector, and maritime clusters. The maritime sector, as a fascinating case study for many disciplines, and maritime clusters as well, especially for strategic management, can provide the fertile ground for the experimentation of quantitative methodologies that are based on traditional SWOT, as has already been attempted. Quantitative methodologies are introduced within SWOT analysis, when the case of analysis pertains to the maritime industry. Such is the case in Celik and Kandakoglu (2012), wherein a fuzzy quantified SWOT analysis is extracted to facilitate maritime policy development against the ship flagging out dilemma. Quantitative methodologies can be used to generate output that can be subsequently used as input for a SWOT analysis, for proposing competitive strategies on container ports in maritime transportation networks (Celik et al. 2009). We can extract that the evolution of the formulation of quantitative instruments and models that can be used in succession to traditional SWOT, has a discernible potential. As referenced above, this potential may prove to benefit purely academic or practical applications, thought we should not disparage the opportunity of many instruments being able to contribute to both sectors.

Methodological formulation

Before framework development, the mentality and drive latent to formulation is introduced. Much of this is based upon disciplinarian synergies of two discrete scientific domains; strategic management and epidemiology. The former's aspect that is of interest herein, that of situation analysis, has already been analysed. The latter pertains to a holistic discipline that has benefited populations more than they can estimate, because its effort is preventive and not mitigative. The common domain of the two, is that of health. If referencing organizations (and/or clusters) as the basis of our focus, then we are referring to organizational health. But if we were to examine the concept of health within a strategic management outlook, we would see that health itself is contained within a basis that resembles that of a vision. Indeed, within its all-inclusive definition, that of "health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (World Health Organization definition), the threads of a vision are in plain sight.

The same way that a vision is to be acknowledged, in the fact that a venture may never reach it, but its utility is to set a landmark that is to be followed, like that of a higher calling, pertains to health. Complete physical, mental, and social well-being may be very hard, if not impossible to attain, but the importance of the definition lies within its conceptual basis. Health is not there to be conquered completely, but rather, to set an *impassable* benchmark that is clear and comprehensive nonetheless, so that all can be guided towards its manifestation. Health is a vision, in the strategic management understanding. The same way that if an individual is to conquer anything at all, she must include a latent vision statement that pertains to health – so must an organization capture health, even within a veiled perspective, even if the process remains conceptual, within the confines of a vision.

Within recent literature, there are many extracts that solidify the point made above. The foundation of sustainable competitiveness is found to be organizational health (Xenidis and Theocharous 2014). If a firm is to attain any form of permanence and sustainable operations, then its culture must include the vision of health, as these concepts are inherently linked (Lin and Lin 2014). Besides a purely conceptual status, organizational health theory includes the wellbeing of employees (Miller et al. 1999), as well as direct links to individual and organizational performance (Cotton and Hart 2003). Within an anthropocentric culture, the former cannot come as a shock. From the foundations of management theory, it had become clear that a happy employee will offer much more to an organization than an unhappy one. Organizational health comes to offer a novel interpretation and theoretical cradle for the concept, rather than pertain to a completely radical domain. It is as though ideas founded many decades before, can find their conceptual backbone within the theory of organizational health. This theory does not hold only qualitative concepts, but quantitative as well (Tofighi et al. 2011). These may pertain to constructs and development of analytical models (Nair et al. 2014), dedicated frameworks for diagnostics (Saeed et al. 2014), and models for organizational health assessment (Shoaf et al. 2004).

The manifestation of organizational health (or at least its pursuit), can be linked to a variety of attributes, such as organizational trust, knowledge sharing (Tuan 2013), and leader communication styles (Hicks 2011). Apart from separate traits, the concept does pertain to a more systemic and holistic understanding (Vinberg and Gelin 2005), that can be traced and directly correlated to customer satisfaction (Golzari 2012). Much in the same way that the human relations school linked employee well-being to performance, does contemporary research find spillovers of said well-being throughout the product flow. These spillovers include organizational commitment (Yüceler et al. 2013) and job satisfaction (Mako et al. 2012), and may extend to solid cultural frameworks for the organization, that will pertain to an 'organizational family,' wherein employee recognition will not be an alien occurrence (Thompson et al. 1985). The importance of a culture of prevention rather than one of mitigation is stressed as well (Wright 1969), alongside the impact of honesty and transparency (Perry and Barney 1981). Along with trust, recognition, and commitment, comes the ever-poised outcome of loyalty (Cheramie et al. 2007). From these specifics, we might be reminded of some cluster pillars.

Within the present context, the case of organizational health has the same exact manifestation when referring to a cluster, and especially, a maritime cluster. The concept can be extended in the same way it is extended from an individual to a firm, as from a firm, to a cluster of firms. As addressed in the beginning of the section, the discipline employed to aid this quest is that of epidemiology, since the burden of extending effectiveness from the individual to groups of individuals and populations, lies within. Epidemiology will study a specified population with respect to its health and draft qualitative and quantitative instruments for this end. As already mentioned, the concept of health needn't be restricted to its physical aspect (Bonita et al. 2006), but generalized, it can include dysfunction of any kind.

The basic function of epidemiology is according risk factors to aetiology; in the same exact manner that a strategic factor is given a positive and beneficial qualitative hue for situation analysis. If we were to direct the analysis within the domain of epidemiology, we would reference causality directly correlated with the health of the defined population. And in the latter concept lies the key in the generalization of the principle. The definition of a specified population is left to the perspective of the analysis. Therefore, the analytical focus may pertain to a specified population of firms, i.e. an industrial cluster, wherein the risk factors will include the strategic factors. Consequently, the aetiology of health and dysfunction will be like the qualitative attribute assigned to the risk factors, respectfully. Through this perspective, the analytical arsenal of epidemiology (that has already proven its effectiveness in human populations), can find applicability within the domain of situation analysis of maritime clusters.

These ideas are not new, as epidemiological instruments have found applicability in a variety of sectors that diverge from medicine (Huisingh et al. 2015). The concepts of strategy and epidemiology as it seems may be not that far apart, since epidemiological instruments are recruited to pertain to strategic directions (Verma 2014), as well as organizational specifics (Hung et al. 2014). Correlations and synergies of strategic management with epidemiology are indeed apparent in literature (Falconi et al. 2014), wherein ethics can have a prevalent effect as well (Prichard et al. 2014). Lateral to strategic management, quality management has its implications, with respect to epidemiological environmental and organizational determinants (Ennis and Harrington 1999; Wagner et al. 2001). Spillovers and the extension of applicability of general concepts of epidemiology, as well as its extension of applicability, have been relinquished by Nakayama (2006). When extending aetiology to generic dysfunction, epidemiology has already been selected as the domain of applicability with respect to accidents and disasters, albeit far apart from medical applications (Lechat 1993). The importance of epidemiology to overall health (Okoli 1990), economic impact (Henschke et al. 2015), and overall well-being (Song 2014), must be referenced as well.

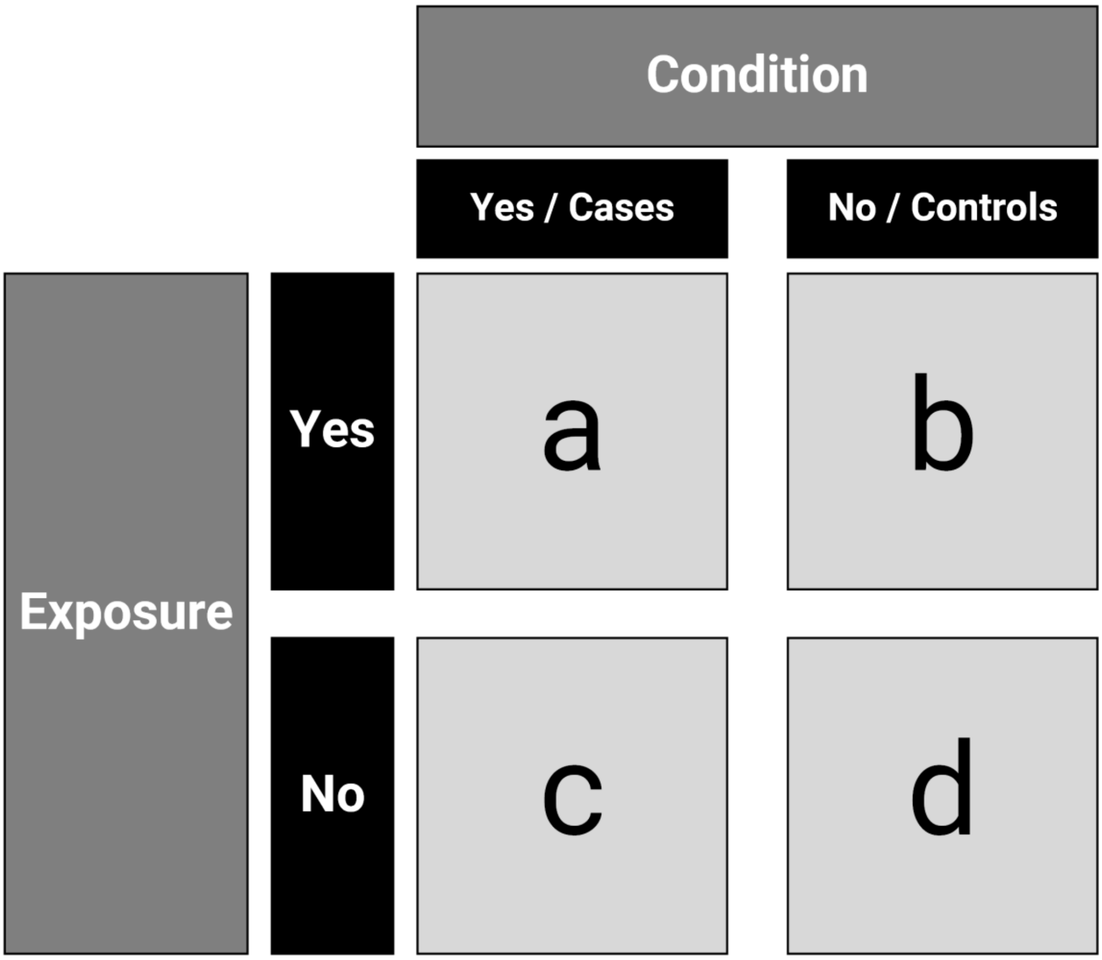


Figure 28: *The components of a generic case-control study (Source: author).*

Synergies and complementarities between scientific disciplines are not something ground-breaking, but rather an inherent attribute of science (Yarborough 2014). Since there is a distinct common ground between epidemiology and strategic management, one could ponder to investigate and extract specific instruments, frameworks, and models that may be applicable among the two disciplines as well. Herein, an applicable extraction as such, is conducted. It is to be demonstrated, that a conceptual sibling to the extracts of situation analysis, and SWOT, is that of the very popular and effective observational epidemiological study that is coined as the case-control study (Aggarwal 2015). A generic case-control study involves two basic categorical variables, the risk factor and the condition. These are variables contained in two dichotomous states, referring to exposure (or absence of exposure) to the risk factor, and presence (or absence) of the condition. If the condition is present, this is found in the 'cases,' whereas absence of the condition signifies the 'controls.' Through this conceptual framework, a simple two by two contingency table may be formulated (Figure 28).

These studies (along with many others included in the epidemiological sphere of authority) are utilized to prove that the risk factor is directly tied to the aetiology of the condition. A major proponent of their usefulness is their inherent robustness and simplicity, along with the statistical instruments that may be utilized, based on the basic contingency table. The simplicity goes to show that the analysis renders a straightforward portrayal of the categorical variables. There is the condition, and the exposure, and the total number of cases of the possible combinations. The basic question is if the risk factor has something to do with the condition. What would be apparent, is the fact that from the mere compilation of the contingency table, it is helpful to hint towards such a correlation. If the exposed consider more cases than the unexposed, then this would be a crude, but introductory, assessment of the involvement of the risk factor with respect to the condition. What would be more helpful in the analysis, would be to calculate proportions between the discrete states of the contingency table. These calculations are the 'measures of association.'

A rudimentary concept is that of risk, where its “synonyms will include attack rate, incidence proportion, probability of getting a disease (condition), and cumulative incidence” (U.S. Department of Health and Human Services 2006). This basic measure takes the two states of the ‘exposure variable’ and calculates a sum. So we would end up with the total number of exposed and unexposed, regardless of the presence or absence of the condition. This sum would then be used to divide the number of cases, to provide two possible combinations of risk, for the two by two contingency table; one risk for the exposed, and one for the unexposed. By attaining a high risk of the exposed and a low risk for the unexposed, one could gather that exposure might matter, regarding the condition. For solidifying this argument, two measures of association can be readily calculated from the risks of exposed and unexposed. The two risks may be subtracted and divided, rendering the attributable proportion (or attributable risk, AR) and the risk ratio (RR), respectfully.

The attributable proportion is calculated through the subtraction of the risk of exposed, and the risk of unexposed, then divided by the risk of exposed. Since it is a subtraction of proportions (as the risk is a proportion), itself is a proportion, sometimes called ‘attributable proportion.’ Based on the denotations given in Figure 28, we would gather that the two risks (calculated as new cases to ‘population’ size, i.e. cases to total exposed, and cases to total unexposed) would be equal to ‘a / (a+b)’ (for the exposed), and equal to ‘c / (c+d)’ (for the unexposed). The AR would then be equal to (risk of exposed – risk of unexposed) / risk of exposed. The risk ratio or relative risk (incidence proportion or attack rate, in exposed to that of not exposed), would be calculated as equal to ‘risk of exposed / risk of unexposed.’

The division of risk, as extracted through the risk ratio, would simply compare the two groups. A figure more than one would indicate that the exposed have a higher risk of condition occurrence, whereas less than one indicates that exposure lessens the occurrence of the condition. The attributable risk will portray the reduction in the cases, if the factor would not be present, as the number of cases that are attributable to the factor. The calculation of the opposite (1 - AR) would render the cases that are not attributable to the specific factor and would have happened regardless to exposure. The third measure of association that will interest the analysis herein, is that of the 'odds ratio,' also known as the cross-product ratio. The odds ratio is calculated as $(a / c) / (b / d) = (a / b) * (c / d) = a * d / b * c$. It should be noted that in pure case-control studies, that calculations of AR and RR are not relevant, since within these studies the population (total number of the group) is not known (and for the AR and RR calculations to be valid, the population size is a prerequisite). On the other hand, the odds ratio may be utilized, since it can adequately approximate the risk ratio. The odds ratio signifies the odds of exposure within the cases to that of the controls.

As with most studies, systematic error (bias) can be an inclusive deterrent as to the reliability and validity of the results. Within these epidemiological studies, bias usually manifests itself as measurement and/or selection bias. Bias of these studies can be tackled with other methodologies (de Glas et al. 2015), as well as with better planning (de Bruin et al. 2015). Through the above, the basic methodological formulation that will concern the analysis, is presented. It will provide the basis for the utilization of the contingency table within SWOT analysis that will be presented in the next section, along with the applicability of the measures of association and other pertinent metrics, within situation analysis.

Crosstabs, situation analysis, and SWOT

The issues of SWOT, as analysed in previous sections, have been tackled in many instances, through quantification, by introducing a numerical constituent, or methodology, within the framework of the instrument. This analysis may easily render a numeric interpretation of each SWOT category, exactly in the same manner as a contingency table (crosstab). The added gain of this formulation is that it can be complementary to any other numeric analysis, as well as completely standalone. Through this understanding, it could be used to solidify a preceding analysis, or as a discrete and independent formulation.

The only requisite would be that a number (either a derivation of approximation, or calculation) is put in place of a SWOT category. This means that each of the four items of the inventory are to be assigned a numerical designation, so that the contingency table may be formulated, and in the same manner as the epidemiological studies, render the succeeding calculations. Through this prism, SWOT analysis is granted a dual tactical advantage, as its calculatory range is broadened significantly, since a novel calculatory level is introduced. The added benefit is that through the SWOT – contingency table, a broad range of analytical instruments may be utilized, that would formerly not be at all considered. Then, the basic question would be as in all models and frameworks – if the construct would make any sense.

In the epidemiological studies, there was such practical resonance, since they can accurately measure causal relationships between a risk factor and a condition. But what about a cross-tabulated SWOT analysis, would it as well have any practical bearing? The answer is inescapable. Since the dichotomic nature in the categorical variables exists in SWOT, its items can be very easily cross-tabulated conceptually. The ‘condition’ can be the positive or negative aspect, the qualitative attribute that pertains to the analysis, whereas the exposure can signify the presence or absence of the external environment. Thus, absence of the exposure, will simply mean that there is absence of the external environment, and thus, it will signify the internal environment.

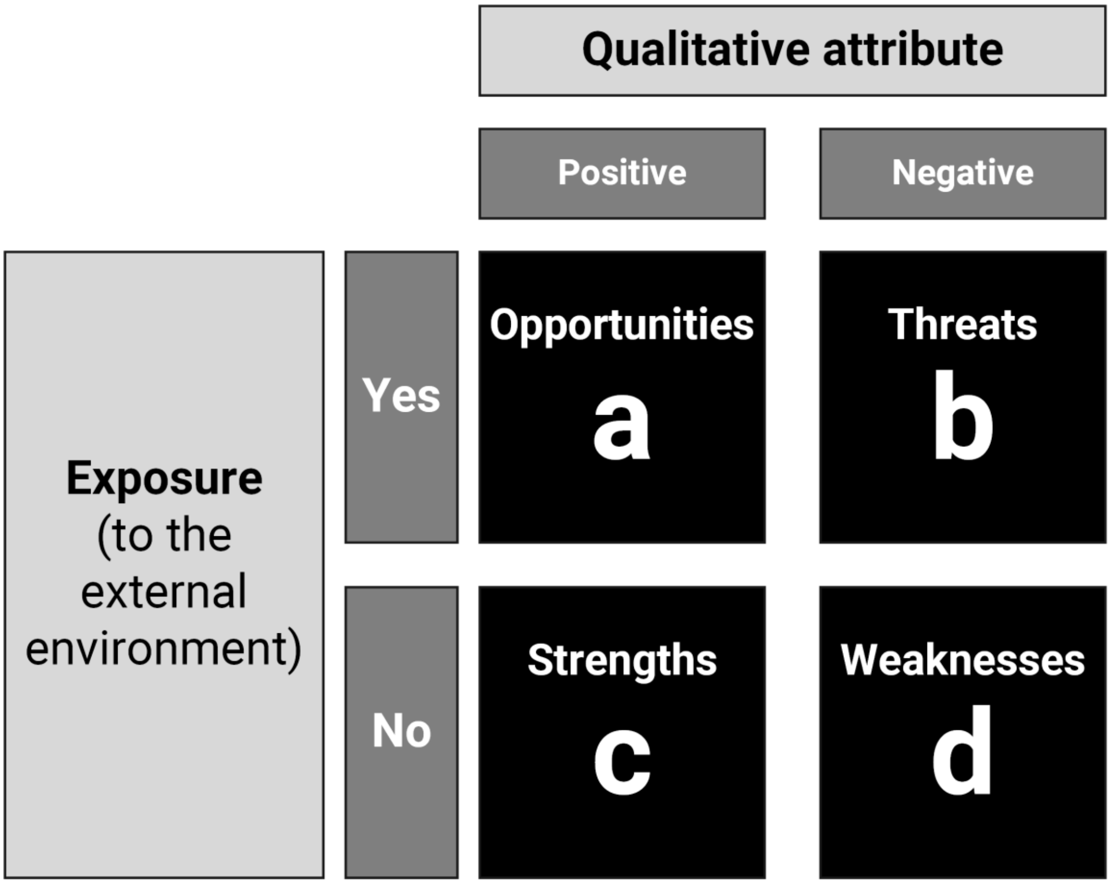


Figure 29: *The cross-tabulated SWOT analysis (Source: author).*

Within this perspective, the condition, or qualitative attribute, will mark the difference of a strength and a weakness as to their effect, and the exposure to the external environment, as to their derivation. Threats and opportunities will be the dichotomy of the qualitative attribute with exposure to the external environment, whereas the strengths and weaknesses will portray the same dichotomy, but for absence of exposure to the external environment, as they both are of internal origin. Accordingly, strengths and opportunities offer the same qualitative attribute (beneficial), but for a dichotomy of exposure (since the former signifies un-exposure and the latter exposure to the external environment), as do threats and weaknesses, but for the dichotomy of unfavourable qualitative attributes (Figure 29).

Through this understanding, SWOT analysis is granted an additional conceptual pillar that goes hand in hand with its founding principles, those deriving from situation analysis (Wheelen and Hunger 2011). Of course, the basis of the cross-tabulation is not any ground-breaking feat of analytical perspective, but the mere recognition of a pattern, that must dichotomize condition and exposure; insofar that situation analysis holds the same basic dichotomy and distinctions of environmental derivation and qualitative assignment, cross-tabulation is applicable. This convergence of founding principles moves into focus and approves the conceptual encapsulation of a contingency table within the SWOT framework.

As has been distinguished, the intricacies of the two share a mutual domain. Again, the importance for maritime clusters with respect to strategy is the same as the crosstab's, regarding the environment. This overlap may very well prove to be the determinant in the model's effectiveness. In addition, a relevant level of interpretation is provided for SWOT analysis that may prove useful in its contextual evolution. A strength is not merely a 'positive trait' from internal origin, but rather the presence of (a single interpretation, this goes to say that other interpretations may find themselves divergent) a favourable qualitative effect, that originates from the absence of exposure to the external environment. In the same manner, a weakness is the absence of a favourable qualitative effect that originates from the absence of exposure to the external environment, as well. An opportunity is interpreted as a favourable qualitative effect that originates from the exposure to the external environment and a threat is the absence of the favourable qualitative effect that finds its origin from the exposure to the external environment. The effective interchange of these concepts may hint to many more applications and the potential to formulate novel frameworks.

Within this prism, the question as to the relative tolerance with respect to the limitations of traditional SWOT emerges. The answer surfaces in twain, since at the one hand, the crosstab may be compiled independently, and in sequence of any other analytical instrument utilized within SWOT, like many of the methodologies that have been introduced herein. In both cases, the crosstab comes to offer a novel level of detail for the situation analysis case at hand. Since its foundations are adamantly linked to causal relationships, the resonance with situation analysis of maritime clusters is apparent. A maritime cluster case will be able to benefit greatly within a strategic interpretation, from the conceptual background that is offered by the crosstab, along with its full calculatory might. The added benefit of this model is that the depth of calculations can be left up to the analysis, for its simplicity or complexity can be a matter of selection. But the option will be there, and its benefits as well. Depending on how well-documented or cost-effective the analysis need be, the pertinent calculatory methodology can be pursued. Nonetheless, the analytical constituent will derive from the crosstab. SWOT's data just happens to be there, a mere visitor that gets along perfectly with the contingency table as its host.

To further illustrate this point, a correlation between the measures of association presented above and situation analysis will be disclosed. Besides, the items of SWOT may hold a rational argument for their utility in a factor – condition universe and thus cross-tabulation may prove to make lots of sense in its utilization within SWOT, but that may not be the case for measures of association, or indeed any other metric that is used for crosstabs' calculations. Therefore, the applicability of the measures within the aspect of situation analysis, must be investigated. This process should bear in mind that the applicability must hold for a wide range of applications, wherein each measure may not be universally appropriate. Thus, it would be preferable, and more effective, to determine if the measures of association, and other crosstab metrics, can hold their weight when used in a situation analysis perspective, but in a conceptual, generic and rudimentary manner, rather than not. If the measures agree with the founding principles of situation analysis, then they will find pertinent applications, in the same manner that the crosstab was introduced within SWOT in the first place.

An initial conjecture would be that since the measures calculate different aspects of the same groups to render a comparison between them, that they will perform the same operation within a cross-tabulated SWOT analysis, and therefore, will be applicable in most cases. It should be noted that the exclusion of some measures from different studies, as noted above, cannot be included, or relevant, in SWOT, since the analysis is inclusive, and stands to benefit from most comparisons between its items. This fact bears the necessity that has helped many instruments to be formulated, like to TOWS matrix, to name one.

The investigation must begin with that most basic of measures, and concepts, risk. What would the notion of factor-condition risk mean within a strategic management perspective? Let us return to the crosstab. The calculation of risk includes the division of the cases (within a group), divided by the total number of the group (for accuracy's sake, risk would require the total number of the population to be included in the analysis). It would portray the proportion of the population that exhibits the condition. For the exposed, it would be calculated as a / (a + b), and for the unexposed as, c / (c+d). Shifting to SWOT, the calculation of a / (a + b) would be equal to 'Opportunities / Total factors attributable to the external environment.' But even within this very basic and elementary calculation, a very important metric surfaces.

This proportion portrays the 'amount' of opportunities within the external environment that does include the notion of risk at its purest form. Speculative risk signifies the calculation that portrays the possibility of loss, or gain. In the same manner, this calculation will provide the metric of environmental risk. If a percentage is calculated, it will mark the favourability of the external environment, in such a form. The inverse calculation of 'Threats / Total factors attributable to the external environment' is pertinent as well. This calculation within itself may be enough to provide a hint as to the strategic environment that is to be pursued.

In the same manner, the risk for unexposed, or rather, the risk of the internal environment, is calculated as 'Strengths / Total factors attributable to the internal environment.' So, it's the same calculation as before, only this time, for the internal environment; it would represent esoteric risk. Again, the inverse calculation of 'Weaknesses / Total factors attributable to the internal environment,' may be of interest. The rudimentary calculation of risk, we find, manifests itself within a dynamic and resonating capacity for situation analysis, for, we now hold the calculatory discharge of environmental risk, for both the external and the internal environment. The quest could be fruitful, and a glimmer of hope may be formulated, since the basic construct of the crosstab has such an applicable potential within strategic management.

The mere comparison of the two measures of risk is capable to facilitate strategic clarity, since we will be able to share a quantitative comparison of the *risky* nature of the external and internal environment. We find, that even within this simple calculation, the major drawback of SWOT analysis' absence of quantitative comparison between the items is bypassed, and a forceful analytical metric is relinquished. This extract benefits both the analysis at hand, and the SWOT framework itself. Indeed, the very important and major concept of risk, within a strategic management perspective, now has an agent within SWOT analysis, an agent that can manifest through a numerical proportion and/or percentage, that is simple and cost-effective to calculate, but can hold much weight in the analysis, nonetheless.

Within the initial calculation, we are already relished with measures of environmental risk, both internal and external. Let us proceed to the risk ratio, to investigate if the quest will bear fruit. The risk ratio basically compares the risks between two groups, by division. It would be calculated as the 'risk for the exposed group / risk for the unexposed group.' In the SWOT model, the 'condition' is identical to the 'favourable attribute,' so by dividing the risks of 'Opportunities / Total factors attributable to the external environment' to 'Strengths / Total factors attributable to the internal environment,' we would expose the likelihood to obtain a favourable attribute from the external environment. Due to this fact, this risk ratio could be coined as external risk ratio, and subsequently, we could calculate the internal risk ratio, simply by inversing the division, to gather 'Strengths / Total factors attributable to the internal environment' to 'Opportunities / Total factors attributable to the external environment.'

Such a calculation would render how likely it is to develop a favourable attribute that resides within the internal environment. Of course, the inverse qualitative attribute can be calculated as well, to signify the negative qualitative aspect. This could be valid for the risk calculation as well; where within an epidemiological perspective, the risk ratio will denote an increased or decreased risk in a group of interest (the exposed group), within a strategic management perspective, the risk ratio will stand for the increased or decreased possibility of the external environment to pertain to a favourable attribute. In a relevant step, SWOT also has the flexibility to inverse both states of the two categorical variables, to obtain further analytical depth. We could extract that the risk ratio is more than applicable in a situation analysis domain.

Next come the attributable risk and the odds ratio. At this point, it would maybe not be surprising if they are found to be applicable in SWOT analysis, as their siblings did, above. The odds ratio compares (through division) the exposure within the cases, to that of the controls, and for a study wherein the population is not monitored, it is the metric of choice, since it approximates the risk ratio that alas, can be utilized only with a 'population' denominator. Although this distinction may not be applicable or worrisome within a SWOT case, it should be pondered, nonetheless. The ratio will be calculated through the division of 'external positive qualitative attributes' to 'internal positive qualitative attributes' and then again divided by 'external negative qualitative attributes' to 'internal negative qualitative attributes,' as $[(a / c) / (b / d)] = (a * d) / (c * b)$, to render the might of the external environment about positive and negative attributes. Thus, it will produce the likelihood of the attribute, with respect to the exposure, since it compares the odds of exposure to the external environment among the favourable attribute, to the odds of exposure to the external environment among the unfavourable attribute. A relatively high value of the odds ratio for a situation analysis, will mean that to reach a positive qualitative attribute, there is much to blame the external environment for creating it, at least in comparison to the internal environment. Of course, as before, tandem inverse calculations may be made, to fulfil the requirements and objectives of a distinct case.

We move to the attributable risk. This measure of association assesses the impact of the exposure to a factor within a population. It will portray the effect of the attribute within the exposed group that is directly attributable to the exposure, and further depicts the loss in attribute that can be estimated, if the exposure to the factor is to halt. The attributable risk would be calculated as [‘a / (a + b)’ – ‘c / (c+d)’] / [a / (a + b)] = 1 – [‘c / (c+d)’ / ‘a / (a + b)’], equal to ‘Opportunities / Total factors attributable to the external environment’ minus ‘Strengths / Total factors attributable to the internal environment,’ and the result divided by ‘Opportunities / Total factors attributable to the external environment.’ The result of the calculation of the attributable risk portrays the beneficial attributes that are derived exclusively from the external environment. By extension, it marks the percentage of favourable attributes that will be lost, if we were to isolate the system of study from its environment.

The opposite proportion (1- ‘attributable risk’) will give a bearing as to the favourable attributes that are generated without exposure to the external environment and would have been present within an ‘isolated’ system. As in all the previous measures of association, the inverse calculations may be conducted, if it is deemed fit. As the applicability of the measures of association presented herein has been investigated as to their application within the crosstabulation of SWOT, as well as the conceptual foundation of the notion of ‘risk,’ we can conclude that their usability seems more than welcome, in a situation analysis case. Since maritime clusters are so vulnerable and responsive to effective strategy, one can only imagine the benefits that may derive from the application of such metrics within these entities of industry.

Besides the applicability of measures of association, we could investigate if the cross-tabulation of SWOT can render any other analytical perspective within itself. A practical application of the measures of association of the cross-tabulated SWOT that could be found to bear much applicability and resourcefulness to situation analysis of maritime clusters, is that of the formulation of an environmental classification for the maritime cluster. Since strategic management and situation analysis are so important with respect to maritime clusters, any framework that may offer a designation regarding the tactical environment may be beneficial. Through the methodology formulated herein, a distinct instrument of situation analysis is offered a subsequent level of analysis that renders a quantitative aspect within its qualitative framework.

With this methodology as an origin, an environmental designation, both internal and external, may be drafted. For any of the measures of association presented, if a nexus point is created, then at least three environmental categorizations may surface. Each measure can be regarded as instrumental in each designation it facilitates. Through this classification of the internal and external environment, a very simple procedure can be granted, that nonetheless, can bear much weight within situation analysis, as one can select the level of detail required, and very simply extract within what categorization the internal and external environment is located. In addition to a very direct method to calculate this classification, the simplicity and cost-effectiveness of this analytical instrument can prove to be important for the analysis, as well.

The above notion can be applicable not only in measures of association, but in risk calculations as well, as the example that follows illustrates. To begin, a benchmark value must be selected; for simplicity, let us select 50%. Of course, per the case, the tailoring and selection of the threshold, is up to the analysis. In addition, it may be a moving, rather than a static threshold. If within the exposed, the risk is more than 50%, this would indicate that there are more opportunities rather than threats in the external environment. In the same risk nomenclature, this environment can be coded as inviting, whereas a percentage of risk lower than the threshold, may indicate a hostile external environment. If the exposure to the external environment is shifted to negative, then with the same threshold, an abundance of strengths may signify a *capable* internal environment. This opposed to a value under the threshold that will point to a weaker and maybe deficient state of the internal surroundings. If, on the other hand, the inverse calculations were selected to portray risk, in the event of positive exposure to the external environment, a basic environmental coding would be that of low (<50%), medium (around 50%) and high risk (>50%). The same values can be matched to the internal environment, accordingly.

It is of essence to note that the analytical cycle has performed a full circle, initiating from the qualitative, striving towards the quantitative, and back again. This kind of methodology does hold the potential to strengthen the results themselves, since lurking within only one aspect of analytical potential is cumbersome. The fact that this analysis can switch seamlessly from the qualitative to the quantitative and back, only hints to its practical potential. Again, its versatility may work to its advantage, as it may work toward the benefit of the analysis, whatever the latter may require. From this aspect, the model seems to be faithful to those most basic of SWOT analysis' traits, of versatility and redundancy. In addition, since the methodology tackles one of the framework's pitfalls, but in a simple and practical manner, the added benefit of qualitative shifts can guide towards the efficient factual use of the complete method, albeit cross-tabulation and environmental coding. So the steps can be considered as different aspects of the same instrument.

Moving on to the risk ratio, we are reminded that it pertains to the division of risk for the exposed group, to the risk for the unexposed group. As presented above, the (external) risk ratio portrays the likelihood to obtain a favourable attribute from the external environment. If the analysis selects the threshold of the equivalent of 50% for the ratio, that is the figure of one, then around this value, we would find systems in harmony, where opportunities are generated at almost the same frequency and multitude as strengths. If the ratio is more than one, then the external environment is more dynamic at generating opportunities, than the internal environment is, at creating strengths. Accordingly, if the ratio is less than one, then the internal environment is more dynamic than the external. If instead of the external risk ratio we had utilized the internal risk ratio (strengths / total factors attributable to the internal environment to opportunities / total factors attributable to the external environment), then the meaning of the ratio on both sides of the threshold, would be inversed. The same would hold if the ratio calculation was performed with 'threats' in the numerator of the external risk ratio and 'weaknesses' in the numerator of the internal risk ratio. Again, a diversity of variability within the framework can be implemented, and tuned to the analysis at hand, accordingly.

With respect to the odds ratio, we hold a portrayal of the likelihood that the attribute had been derived from exposure, or how more likely it is for a case of a quantitative attribute to have been derived from exposure to the factor. With respect to our initial construct, we would calculate the odds of the cases of the (positive) qualitative attribute (a / c), to the odds of the absence of the case, i.e. the negative qualitative attribute [(a / c) / (b / d)]. So, like the risk ratio, the odds ratio will manifest the dynamism of the external environment in producing positive circumstances.

Furthermore, in constructing the classification of tactical environments with a threshold, if the latter is again selected as one, then a figure around the threshold would signify that the odds of the external environment manufacturing positive attributes, (a / c) are nearly equal to the odds (b / d) of the external environment creating negative attributes, and these, regarding the internal environment, which, after all, is included within the denominator. So, a figure around one would mean that the equilibrium of the external to the internal environment is achieved, and to an extent, the internal and external environment share their dynamics. If a figure less than the threshold is generated for the odds ratio, then this would mean that ‘threats to weaknesses’ are overwhelming to ‘opportunities and strengths’. By extension, exposure to the external environment would not provide for the presence of a positive qualitative attribute, but probably would move towards contributing to a negative qualitative attribute. If the odds ratio is over the threshold, this would signify that the external environment is volatile in generating positive qualitative attributes; this, regarding the attribution of a negative attribute, from the external environment.

The remaining measure of association, the attributable risk, shows the potential of the external environment in creating favourable qualitative attributes, by comparison to the potential of the internal environment. With the same reasoning, it signifies the proportion of the qualitative attribute that will be lost, if the exposure to the external environment may somehow be achieved. The figure of [‘c / (c+d)’ / ‘a / (a + b)’] = 1 – ‘attributable proportion,’ is the percentage of positive qualitative attributes that would have occurred regardless of the exposure to the external environment. If the threshold of one is selected as before, and the attributable proportion is found to be near it, then this would mean that nearly all the positive qualitative traits are attributable to the exposure to the external environment.

Accordingly, the opposite of the ‘attributable risk’ will signify that the qualitative attributes occur without exposure to the external environment, thus, if this figure is close to zero (since the ‘attributable risk’ is near one), then the internal environment cannot be found to play a major role in generating positive qualitative attributes. If the attributable risk is calculated close to zero, then, absence of exposure to the external environment will not play a major role in differentiating the generation of qualitative attributes. This because a negligible figure of the attributable ratio will mean that most of the qualitative trait cannot be attributed to the exposure to the internal environment. Since the ‘attributable risk’ will be close to zero, the formula of [‘c / (c + d)’ / ‘a / (a + b)’] = 1 – ‘attributable proportion’ will generate a result close to one, thus signifying that most of the percentage of positive qualitative attributes would have occurred due to the internal environment, and regardless of the exposure to the external environment.

Through the introduction of relevant increments within the analytical perspective of SWOT, a diverse array of proportion may be introduced within the situation analysis case. These additions to the traditional framework may be used in sequence to other quantitative instruments, or completely independently. As an addition to tandem models, the methodology may facilitate and enrich the analysis that is carried out. As an independent construct, the model can provide its distinct strategic insight to the case. In all instances, it may be important that there exists the tactical option of both, for not many methodologies provide the flexibility to either enrich an already performed analysis or simultaneously suffice as a standalone construct.

Even within the formulation of the measures that may be calculated, the versatility is predominant, as there is no one unique form to address the metrics, as has been proposed; the inverse calculations may be performed, if it is seen to benefit the case. The plethora of diversity that SWOT has achieved, may stand to gain a great deal from methodologies that are as diverse within themselves. Furthermore, the richness of strategic management cases with a situation analysis perspective in maritime clusters, nearly dictates the necessity of versatility and choice, when it comes to its instruments. So, not only has the presented model bypassed a major pitfall of traditional SWOT, that of the quantitative absence, but it has provided an array of many pertinent strategic options that have the potential to enrich SWOT as an instrument and provide tactical advantage for situation analysis of maritime clusters.

The basis of this advantage derives from the fact that any compiled SWOT framework includes a dichotomy of categorical items within. This dichotomy can very well translate into a contingency table, and a crosstab can be formulated. Within this inclusive resonance of the two instruments, that allows us to seamlessly introduce one into the other, lies the key to understanding its potential. Simply by introducing a relevant investigatory level in situation analysis, the feasibility of situation analysis is widened, and this, without belittling any other analytical aspect, or constraining any other analysis from implementation. So as far as the sequential procedure of SWOT is concerned, scanning for pertinent strategic factors instigates the analysis. Once the strategic factors that involve the case at hand have been extracted, and they have been classified as per their dichotomic nature, the SWOT framework may be compiled.

As the above preliminary step is achieved, one can proceed with any qualitative methodology (as many that were introduced herein), and once this is complete, a ranking of each factor of the SWOT analysis may be extracted. From this ranking, the basic crosstab may be formulated, and through it, the pertinent measures of association calculated. At the same time, the qualitative methodology to be utilized does not pose as a prerequisite to cross-tabulation, for the latter may be utilized independently. Once the strategic factors have been extracted and the inventory compiled, the factors themselves can be assigned a numeric designation (a weight), that can be situated within a range of extremes. The range may portray the extremes of the strategic factors’ impact, and each distinct weight, the ‘significance’ of a discrete strategic factor. Thereby, after the compilation of the inventory, each strategic factor can be assigned a numerical signature, based on a range of extremes that signify the factor's impact.

The crosstab with the conditional probabilities may be generated, through a statistical analysis software package. Conditional probabilities may be very useful in comparing the items within the crosstab. In addition, they can serve as the basis for statistical decision tests. A rudimentary question that is pursued, is if the conditional probabilities within the domain of exposure bear statistical difference. This answer will facilitate the distinction as to the dependent relationship of exposure regarding a positive qualitative attribute. The statistical distinction will signify, within a given confidence interval, if the basic determinant of the qualitative attribute derives from the external or internal environment. This may have many repercussions within the situation analysis case, for it offers a statistical decision test in weighting the outcome of a cross-tabulated SWOT analysis. The statistical decision test that will be burdened with extracting the answer, is Pearson's chi-square test, whilst considering the samples independent (un-paired). If we are to model the cases as dependent (paired), we would proceed with the McNemar test.

For the selection of either (or both), the interpretation of the data within the model must be sanctioned, for both selections have a case. Since the count within a categorical variable has not been considered as a derivation of an intensity scale, but a distinct case within itself, then the distinction of un-paired samples is valid. In the same interpretation, if we move to consider that the cases may be correlated in any way, we would be bound to select paired data modelling. Though, it should be noted, that for the sake of the analysis, and since the construct itself is a model, both representations could be used, so long as their distinction is clarified.

The analysis begins with the representation of each SWOT item with a numerical value, and then these numerical values are summed, as per their categorical distention. When extracting the crosstab, the manipulation of the data may continue, with the calculation of the conditional probabilities. Apart from the value of these metrics as self-sufficient markers, the statistical tests that can spawn from them can pose a grave stepping-stone to situation analysis. If we are to consider the data as independent (un-paired), then we would look to Pearson's chi-square test, where the null hypothesis pertains to the independence of the qualitative attribute to the exposure (to the external environment), versus the alternative hypothesis, that any attributable factor of the exposure to the environment is not due to pure chance. Through statistical software, we can test the hypothesis. If the p-value generated is lower than the significance levels widely considered (either $\alpha = 5\%$, or $\alpha = 1\%$), we can reject the null hypothesis. Thus, the hypothesis of independence of the categorical variables is rejected, and by extension, there is statistical significance in the result. Within this example, the exposure to the external environment affects the outcome of the qualitative attribute.

In the case that we consider the sample as paired data (dependent samples), we must use McNemar's test. Within this test, the null hypothesis and the alternative hypothesis remain within the same framework as before. Where Pearson's chi-square answers the question whether the conditional probabilities with the case and within exposure are statistically identical, McNemar's test compares the total percentages (marginal probability) within the total exposed to the external environment, and the percentage of the total cases of the positive qualitative attribute. We can obtain a statistically significant result from McNemar's test as well. So even if we consider the data paired, in this example, the result of the qualitative attribute bears dependency upon the exposure to the external environment. We have considered two statistical hypothesis tests from the model, that both, depending on the treatment of the data, can infer as to the statistical significance within the categorical variables. Apart from these, the extraction of the measures of association, through statistical software, is straightforward, as well.

Limitations and future directions

The common agreement between academia and industry, as a rudimentary thesis may extend, is that ‘everything is at constant change.’ This realization is what gave scientific domains such as strategic management the stature they hold today, and what led to the interest towards industrial clusters, and maritime clusters, as a special case of the former. Strategic management will provide any entity with the instruments to effectively and efficiently manage change in the external and internal environment, whereas maritime clusters are living examples of the successful consolidation of stakes, among and between all environmental categorizations. Maritime clusters prove that constant change can not only not be malignant, but that change can be manipulated and taken advantage of, for collective and sustainable benefit, not only for a single entity, but for an agglomeration of organizations. Strategic management will provide the analytical arsenal to document, portray, model, evaluate, and control this process. Within this particular synergy, the importance of strategic management for maritime clusters (and vice versa) is evident.

For their mutual understanding, the domain of strategic management and the case of maritime clusters can actively benefit each other. The former may tailor instruments, frameworks, and models that will guide clusters towards collective sustainability, whereas the latter will provide a rich terrain to test these, but also to germinate new ones. Within this exact perspective, the model herein has been tailored. Maritime clusters are identified as strongholds of organizational health that benefit from any strategic interpretation. From this conceptual origin, resonance was investigated within other applicable instruments that may stand to benefit the analysis of competitiveness within maritime clusters. From a critical review of the literature concerning SWOT analysis, it is evident that the framework is an inspiration for many quantitative techniques, and the formulation of analytical models. Thus, an extension of these methodologies is proposed, through cross-tabulation; a construct that can be utilized independently, as well. This methodology pertains to a simple yet robust method that serves to strengthen SWOT analysis, and its analytical potential.

The construct presented herein pertains to a model. As such, it has been formulated with according modelling allowances. For the model to function as a rudimentary crosstab, the initial assumption of the categorical intensity to be considered as a numerical representation of the cases of each category, may find hindrance within its validity. For the model to handle its repercussions, it must be accepted that each strategic factor may be quantified within a sample range that is equal for all the strategic factors. Furthermore, we should be able to sum all the strategic factors within a category, for the latter to be represented as a single digit. As a conceptual framework, this may stand, though it may not be applicable to all cases. Since the quantification of the factors does not have to follow an objective methodology, then the numeric portrayal may be contested. But, then again, so can the initial SWOT inventory itself. A basic advantage of the model is that it can circumvent this issue, when used in tandem with another methodology. Because the model can be used within another methodological perspective, and as a standalone analytical construct, its advantage is strengthened, for it can seek and solidify synergies.

The inclusive nature of the construct may prove to multiply its applicability. Any analytical methodology that is tailored to be used for a SWOT analysis perspective, may pertain to a numerical designation for each SWOT category. Then, the model can be used in succession to any other methodology that can produce a numerical designation for the SWOT inventory. Of course, this process is not without its own pitfalls. When any other instrument is utilized before the model, and its results are fed into the crosstab, the contingency table itself will contain any error embedded within the raw data. Since the construct is prone to error propagation, mitigative strategies must be employed, or, at the very least, its capacity to reproduce and maybe proliferate any error within its intake, must be acknowledged. On the other hand, this deficiency may be an opportunity to measure the exact extent of error propagation, and tailor specific instruments for its mitigation.

As any model, this construct is relinquished, so that it can be tested, contested and enriched, whilst always serving its purpose, within the documentation of analytical competitiveness for maritime clusters. The instrument may be used within situation analysis of maritime clusters, or its applicability may be investigated elsewhere. In any case, the model may be able to contribute, even with a speck, to a better understanding of the nature of competitiveness within maritime clusters, in a manner that can facilitate towards the enrichment of strategic management. Many cases can stem from the utilization of the model, and many more methodologies may be formulated using the rudiments that have been presented herein.

Conclusions

Within this work, a structured literature review with respect to the topics of industrial and maritime clusters is conducted, to return the notion that the importance of strategic management within these industrial entities, cannot be overstressed. Strategic management is what may set apart excellence from dysfunction, within an industrial cluster. The complementarities of cooperation and competition that are evident in industrial clusters serve to construct a network of members that is based on trust, mutual respect and protection within and between the components (as well as for the cluster itself). This network germinates extreme innovation capacity, to the point that knowledge creation and management can be considered as its second nature. These instances all converge to provide every member of the cluster with the competitive position it pursues. All this is based on a framework of mutual and symbiotic culture.

For this culture to be sustained, the management of strategy holds a predominant role, because all environmental dynamics and interactions, may serve to sanction, or in turn, threaten, its competitiveness. Since the concepts of competitiveness and strategy are linked, then the enrichment of the domain of strategic management with feasible and efficient instruments, may serve the flow towards the sustainability of competitiveness. Especially since maritime clusters provide propitious competitive advantages for the regions therein, due to the diversified and dynamic nature of the maritime sector, the advancement of strategic management instruments for their benefit is crucial, and may have lateral importance to many fields, and economies, as well.

The first step of strategic management, that of situation analysis, can be considered as a very important aspect for the formulation and effective implementation of strategy within a cluster. For its factual manifestation, many methodologies have been tailored, each with its own strengths and weaknesses. A very popular framework of situation analysis is that of SWOT, that pertains to the consolidation of strategic factors based on their environmental origin, and qualitative assessment. To tackle the bias that may be inherent in traditional SWOT analysis, many quantitative methodologies have been administered upon the original framework that range from simple quantification, to very complex mathematical applications. After the conceptual correlation of the basic pillar of strategic management (the vision), with the theory of organizational health, an corollary is developed. Organizational health is a vision that must be infused within any given organizational culture. As such, efficient industrial clusters can be regarded as the practical applications of this culture of health and symbiosis.

To facilitate this culture, instruments for use in situation analysis cases can prove to be very beneficial. From a comparative analysis with epidemiological studies, resonance with strategic management can be observed, and a very efficient instrument of the former can be seen to be applicable within SWOT analysis. Many quantitative applications that have been tailored to address the bias of traditional SWOT may generate a numeric designation for each SWOT category. This output can be utilized as input in a basic two by two contingency table, to surrender a qualitative arsenal to the situation analysis case at hand. In addition, this methodology can be used independently from any other, as is demonstrated herein. The process may begin with traditional SWOT analysis, by extracting the pertinent strategic factors and situating them within a SWOT category. Then a numeric designation as to each strategic factor's weight can be assigned, and the weights of each category summed, with according modelling allowance. With a total number of 'cases' for each SWOT constituent, a crosstab is formulated, and many indicative calculations may be performed, that range from simple calculations of risk, to measures of association and statistical decision tests.

All these calculations have the potential to benefit the management of strategy within a maritime cluster, for each may provide a relevant and further level of detail and understanding. Through this model, the case that concerns the situational analysis of a maritime cluster may be strengthened, either from the standpoint of a proceeding analysis, or as a discrete step in strategic management. As is demonstrated herein, the model formulated can assist towards a versatile configuration of metrics and typologies. This methodology can be utilized efficiently, since it pertains to simple calculations that can facilitate the requirements of industry, but at the same time can stand as the basis for further quantitative formulations that can contribute to the literature. The application of cross-tabulation may find other relevant applications in strategic management and this instance may be interesting to address in future studies.

III (5) – A Hybrid SWOT Analysis Methodology for Maritime Clusters

Agglomeration economies do present themselves as a vessel of strategic competitiveness, for they hold many factors that may render them as the backbone of a propitious niche; their analytical potential surfaces as a very inviting eventuality for strategic management. It would not be out of place to conjecture that a SWOT analysis venture could be proposed whence analysing these economies, for said instrument harbours a methodology that relates to couplings of conflicting parameters, striking a balance between scientific validity and inclusive practical coherence and materiality. Whilst adhering to this benchmark, this work proposes a novel methodology with respect to SWOT analysis that originates from a critical review of strategic factors concerning maritime clusters and the extraction of an inventory compiled from said review. From this inventory a contingency table is constructed, and pertinent statistics calculated. Through this methodology, analytics can be generated and utilized with respect to maritime cluster strategic analysis; by extension, effective policy and/or strategy formulation may be fabricated. In addition, the methodology of inventory formulation and crosstabulation can be applied in other cases of study, thus expanding the scope and applicability of said SWOT analysis.

Introduction

From the body of knowledge concerned with strategic management, one may be led to remark that SWOT analysis surfaces as the most resilient of techniques, for it is a readily available instrument providing the formulation of an effective strategic framework through situation analysis. Although its origin remains obscure, it has proven time and time again to be the strategic instrument of choice for over half a century and for a good cause: SWOT analysis provides a concise photograph of the strategic environment involving the case at hand and at the same time hints towards clear strategic directions that should be pursued in order to achieve strategic might. In its years of active presence, a wide variety of SWOT analyses has been proposed (such as fuzzy quantified, analytical, and quantitative SWOT) and is available for use today. Its evolution and diversification come hand in hand with its critique, as is the case with any instrument, for it does not come without its own caveats.

For a SWOT analysis to be compiled, a list of strategic factors with respect to an entity and its environment must be generated. This is the only constraint of SWOT; it requires an entity operating within an environment. We can get a glimpse as to how this constraint is simultaneously an advantage, for the plethora of systems to date are impacted by their environment as they are open and not isolated systems. SWOT analysis comes as a reminder that an eco-systemic approach is more than mandatory whence pondering reference to strategy, for we are not alone and our system is analogous and sensitive to its environment; sustainability is not the output of the optimized utilization of our resources, but rather how these outcomes of resources intertwine with their respective environment.

This could be a cause of the instrument’s resilience; it sets a base for a holistic approach to situation analysis as the first step of strategic management. Its simple structural concept procures the feasible components that should be pursued. Rendering the inventory of strategic factors within a two by two table gives a relevant static view as to the existential characteristics that should concern us from two perspectives, the internal and the external environment. The simultaneous portrayal of these factors is the initiation of strategy formulation, as the weighing of strengths and weaknesses with respect to opportunities and threats will be the critical factor of how to tackle the future. As we witness shifts of interest towards more holistic and environmentally harmonized solutions, we may observe that SWOT analysis was already there, for it always included the environmental element, as it always hinted to the harmonized appreciation and respect of environmental factors as to their critical importance for the acquisition of a sustainable competitive advantage.

Another internal strength of SWOT is that it is a very versatile instrument, for the list-view of strategic factors is an invitation to the stochastic nature of analysis and welcomes observatory conclusions and criticism. On the other hand, this absence of determinism may be considered detrimental, for whence conclusions need to be extracted and directions sought after, objectivity should be the compass. A frightening consideration for any party compiling a strategic factor inventory is that the critical selection will not be accepted by the client (whether external or internal), or worse yet, will not be substantiated by a realistic turnout. But still we would venture to state that even if a primary compilation of factors and their importance does not prove to have a material component, it can hold as a proof of the evolution of the mechanism determining these factors, for in acknowledgment of said deficiency, we can observe the tarnished road of assessment of our own analytical approach and move along with new wisdom. So, in its handicap, we can still savour latent advantages. Still in its approach, it harbours the same inadequacy as the balance sheet; it may be good enough for an instant and in a world where the basic rule of thumb is that everything is changing, this has to be taken down as a serious consideration: this instrument is standing across and may be severely distanced from a panacea eventuality.

This analysis is generated through an exceptionally subjective protocol and thus, since its methodology lacks analytical objectivity, it can be contested. Firstly, the critique originates from the as-is compilation of the factors. Each one is receptive to acute criticism, for its origins may diverge from analytical formulation and through this divergence the seed of doubt and objection is free to germinate. Few methodologies can claim the subsistence of this instrument as a practical everyday tool, or as the utility beyond an analytical technique seeking a competitive edge. The reason is that it presents in its ideal form an intra-sensical approach with respect to as-is circumstances and their aetiology; the categorization of the basic factors that affect the entity under analysis, under two approaches, whether of a beneficial or unfavourable attribute and whether of an internal or external origin. From its conceptual formulation, SWOT-based situation analysis can point to a plethora of subsequent methods that may be utilized, from analytical techniques, to further conceptual constructs such as the TOWS matrix. It could be stated that the latter is the next step of the SWOT technique, for by utilizing the elements of SWOT we can formulate four basic discrete strategic directions.

As mentioned, our strategic factor procurement may prove susceptible to systematic and random error, presenting itself as selection bias as well as measurement bias and indeed error propagation. If no analytical approach with respect to the factors is introduced, we may deem the precedence of selection bias, whereas with the presence of an analytical technique we cannot prove the absence of measurement bias. As deriving from its beneficial aspect of versatility, its included factors are not a deterministic approach to reality, rather an immiscible instance of subjectivity. The subjective factor along with the absence of a guiding principle as to the priority of each factor render the instrument with respective potential, for it follows the ‘garbage in, garbage out’ instance; if our factors are biased thence so will our results diverge from materiality and our analysis from pertinence. But as with any instrument contained in human operation, this too must be placed within a materiality theory approach, with definite and respective margins for errors.

As to the entities analysed, industrial clusters are considered as a pillar of competitiveness, innovation, and sustainability for today's economies, as they may hold viable competitive advantages for various industries and nations; they seem to be the practical manifestation of the proverb that ‘in unity there is strength’ and slightly transform it to *in proximity there is strength*. For decades their analysis has been a very viable and fruitful territory, either from an academic perspective or that of a practitioner's and this since they hold a plethora of characteristics that are considered more than gratuitous from every respect. Either considering Silicon Valley or Hollywood, the latent construct is the same; clusters offer the promise of prosperity. Therefore, their analysis is nurtured so eloquently, for they coexist with those most basic of instincts, that within clusters lies abundance and sustainability; that the individual entity will extract strength from the lot and that this strength will be exacerbated from synergistic unity. Clusters are such a marvellous case of study for they entail the most harmonious instance of cooperative strategies and a formal application of the Nash equilibrium in its purest form. In this work an extended methodology for SWOT is proposed, to be utilized in order to extend and streamline the strategic analysis of maritime clusters.

Agglomeration economies, networks, and clustering

Whether from its widely accepted formulation from Marshall (1920), to its evolution from Hoover (1948), the phenomenon of geographical concentration and its corollaries is one that provides grave interest to research, whether concerning physical or functional clustering (Oakey et al. 2001), or cultural clusters (Mommaas 2004) wherein the knowledge spillover paradigm may set the base for conflict and whence research is required for mitigation of issues and assortment of stakes; we observe in a glance that innovation and creativity are pillars of clustering, even if this is considered cultural. The subsequent derivative that the cultural aspect may create should not be overlooked, whether regarding agglomeration or clustering, for it seems as a basic component of industrial clusters as well, wherein the neo-post-Fordism economy seems to germinate and leads to a knowledge society, even if this is emanating from the creative industries (Evans 2009): the environment wherein a cluster formulates cannot be deemed a priori unimportant and its dynamics with the cluster unindicative.

Attempting to grasp the threads and rudiments of industrial clusters, the pillars present themselves as innovation and knowledge dynamics. Clusters may be considered directly correlated to knowledge creation (Bathelt et al. 2004) through linkages that are of paramount importance to that most tantamount of values, efficiency (Maskell and Lorenzen 2004); a correlation of clusters to intra-structured and organized markets surfaces. Cooke (2001) investigates innovation specifics with respect to agglomeration economies and industrial clusters and Maskell (2001) validates knowledge creation deriving from intra-industry dynamics verifiable through industrial clusters. The issue of innovation within industrial clusters can hold as a topic of analytical research (Baptista and Swann 1998). Asheim and Coenen (2005) utilize the concept of industrial clusters as regional innovation systems and investigate linkages of innovation regarding knowledge creation, under the framework of two knowledge management infrastructures. Clearly there is much evidence to support the claim of the clusters’ shared framework of values.

Clustering cannot be considered as a topic free of issues and debate, as Martin and Sunley (2003) illustrate in their decomposition of cluster theory. This is to be completely expected within a theory that is fluid if not fuzzy, as it changes drastically with any shift of focal attention. Malmberg and Maskell (2002) point out that within the abundance of theoretical constructs regarding industrial clustering, the instruments concerned with their validity and reliability are scarce. In addition, the importance of a construct holding knowledge management within its core is investigated. Gordon and McCann (2000) investigate industrial cluster theory’s ambiguity and propose mitigation policies through three distinct phenomena (pure agglomeration, industrial complex, and social networks) that are differentiated and distinguishable from clusters. Simmie (2004) argues that the industry cluster approach can be regarded as the vanguard of competitiveness, through its vessel that is innovation, though evidence may point to instances whence clustering is not inherent in innovation as a local geographical concentration and rather that innovation is a more globally distributed system. This is conceded through an analytical approach with respect to cluster theory. Molina and Yoong (2003) investigate the knowledge sharing parameter of industrial clusters, to extract a favourable condition of symbiotic and synergistic strategies from at first conflicting interests as well as the impact of shared culture and effective leadership. Skokan and Zotyková (2014) investigate industrial clusters from a business lifecycle perspective, with respect to performance indicators. From a policy perspective that has been a major consideration from the basic formulation of industrial cluster theory, the intricacies of public administration and its facilitation towards industrial cluster formulation can be analysed (Piperopoulos and Piperopoulos 2010) from a country's approach.

Instruments utilized to map clusters are present: Bennett et al. (1999) conduct cluster identification, rendering the high degree of services as a clustered sector and analyse cluster specifics. We witness instruments such as input-output analysis (Feser and Bergman 2000) as the instrument of choice for Binti Shuja et al. (2012) for the identification of Malaysian industrial clusters. Groznik (2009) provides the planning and support framework for an emerging logistics cluster through business model generation. Mapping, typologies, and taxonomy formulation promise much potential as to the further understanding of the functionality and dynamics of industrial clusters (Bazzoli et al. 1999). Hendry et al. (2000) utilize a five factor inventory as to the framework of localized industrial growth: networks of firms, resource skill base, network of supporting institutions, end-markets, and internal factors' strategies; wherein a basic pillar correlated with all clusters is investigated: the presence of a university or a large firm. This find may lead to propose a correlation with a centralized market, for many theories hold the claim that there is evidence of centrality. Perry (2007) points out these findings in the compilation of five clusters' forces: strong internal labour markets, market diversification, complex firms, hub and spoke networks, and spin-offs.

Maritime clusters

Maritime clusters provide a very attractive analytical base within a strategic management perspective, for many strategic aspects such as innovation, knowledge creation and management, network economies etc. have been found to bloom within said divide of industrial clusters. De Langen (2002) offers an analysis of maritime clusters whence again the issue of the core arises and provides a framework for the performance indicators of an industrial cluster, laid on the lines of agglomeration economies, internal competition, entry and exit barriers, and heterogeneity of the cluster population that formulate the cluster structure on the one hand, to team up with governance, on the other. Lee et al. (2014) provide a coherent analysis and the procurement of a competitiveness index for the shipping industry. Lam et al. (2013) stress the importance of governance within a port cluster framework as to the dynamics of competition of two ports, that of Hong Kong and Shenzhen.

Analysis can be generated from a country's approach utilizing Porter's (1990) initial framework whence there can be generated an inventory of factors affecting maritime clusters (Laaksonen and Mäkinen 2013). Benito et al. (2003) provide a concise analysis of the Norwegian maritime cluster whilst utilizing Porter's diamond as the analytical base. Shinohara (2010) provides an analysis of the Japanese maritime cluster, whence the core of the cluster is regarded as the shipping component and a value system of maritime clusters is introduced, coined as maritime cluster culture; analysis of its components including education, management, knowledge, and its occupational value system is conducted. Doloreux and Shearmur (2009) investigate the Canadian cluster to further analyse linkages of three regional clusters within it and a review of respective policies is presented. Flitsch et al. (2014) provide a multi-level approach to the analysis of policy in the North Sea with respect to its maritime transport cluster.

Doloreux and Melançon (2008) investigate the aspect of competitiveness for maritime clusters from the nature of innovation activities, in order to produce a structural dissemination of the componential differentiation of innovation and the link with knowledge intensity, as well as the considerations and limitations that have to be thought out with respect to clusters. The framework containing these results can be further utilized from a strategic management perspective. Monteiro et al. (2013) propose a cross-country analysis throughout Europe under a differentiation framework approach based on Porter, to provide a complete inventory of strategic factors to be utilized for benchmarking. Viederyte (2013) provides an in-depth analysis as to the proponents of maritime clusters and their potential hurdles as well. For the analysis of maritime clusters, various analytical techniques have been utilized, ranging from ecological niche theory (Jin and Zhen 2013), symbiosis theory and the Lotka-Volterra model (Zhang and Siu Lee Lam 2013) to the previously mentioned input-output analysis (Morrissey and O'Donoghue 2013), to state but a few.

SWOT analysis for maritime industries

There is substantial precedent in the utilization of SWOT for the analysis of maritime clusters, whether for official research reports (Directorate-General for Maritime Affairs and Fisheries 2009), reports of strategic analysis of maritime clusters (Andersson 2013), or immiscible research for the maritime industry: Arslan and Er (2008b) utilize the instrument combining strategic implementation with respect to safety in tankers and for safer bridge team organization (2008a). Chou *et al* (2012) tap into the strategies of carriers as per the effective situation analysis of container ports (2013). Fuzzy quantified SWOT is utilized by Celik and Kandakoglu (2012) in an approach wherein literature is screened in order to extract strategic factors instated in the model; Celik et al. (2009) generate quantitative output and use it as SWOT input for strategy formulation in port management. SWOT is used in a variety of the sectors of maritime clusters, with respect to maritime development in fisheries (Rapisarda et al. 2014), as well as port administration (Keceli 2011) with reference to development of innovative strategic dimensions, or future potential and strengthening (Rathman et al. 2014).

Chang (2011) utilizes SWOT to document the maritime industry potential from South-West England. The sector of short sea shipping is analysed utilizing SWOT, rendering a plethora of insight as to its capabilities and potential (Runko Luttenberger 2013). Genc and Guler (2006) present an analysis of marinas through SWOT in order to propose future strategic directions. Thanopoulou (2012) gives an overview of bulk reefer operations utilizing the instrument, in order to provide viable future directions. Murphy and Landamore (2009) tackle the issue of search and rescue operations with autonomous underwater vehicles and SWOT is one of the analyses included. The good thing whence utilizing SWOT analysis for maritime clusters, as can be extracted from literature, is on the one hand, the fusion of versatility of the instrument, and on the other, of maritime cluster theory, for it holds a great extent of applications, with regard to either physical or conceptual constructs.

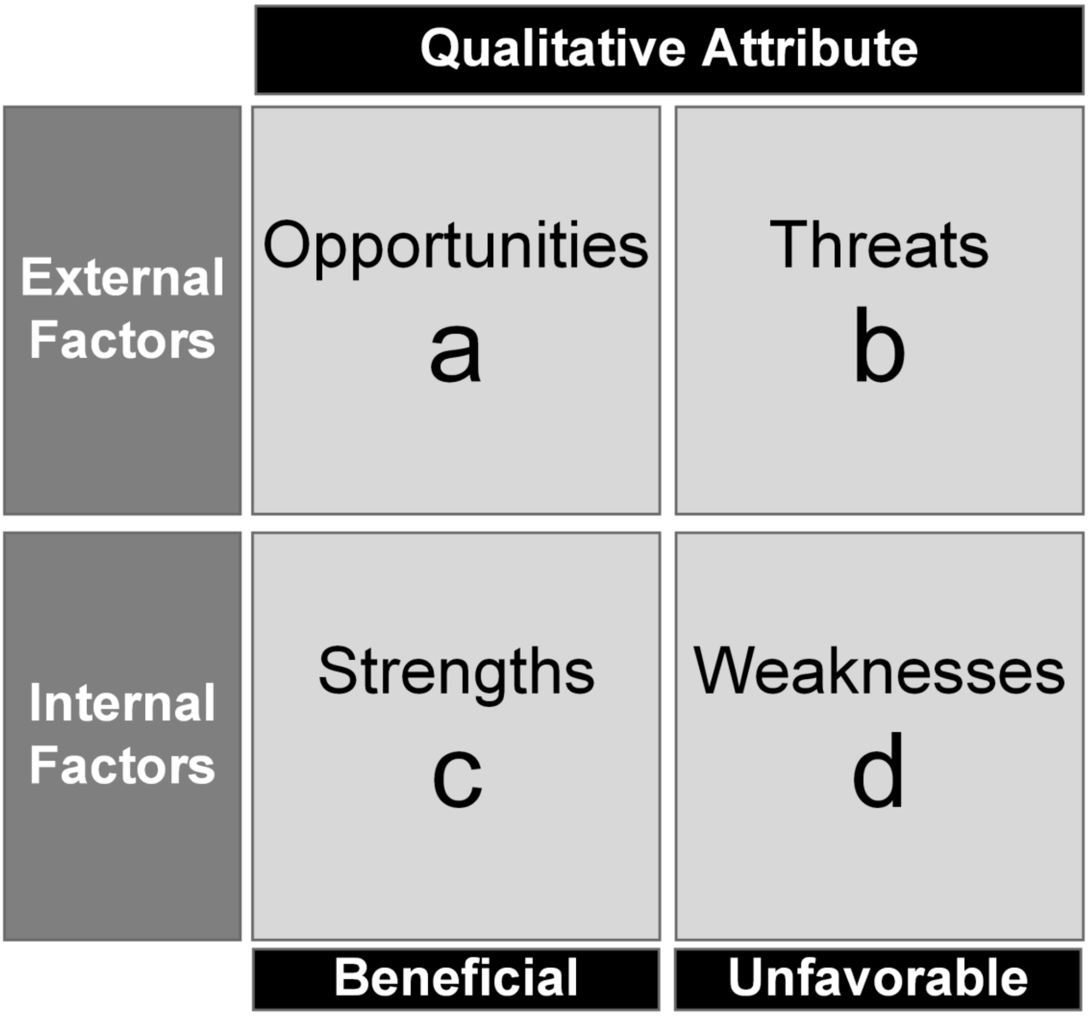


Figure 30: Generic SWOT (Source: author).

Meta-calculations through crosstabs

We are able to observe a marvellous plethora of diversity, differentiation, and evolution for SWOT analysis, although the field of a meta-calculation deriving from said analysis is relatively barren, as most research is focused in tackling the prime issues with respect to SWOT, that are its lack of factors' prioritization and objectivity. There lies good cause to pursue a concrete analytical methodology that will provide a more conclusive result and a more definite and correct strategic direction. After the utilization of a methodology and the generation of the respective results, we will have a complete inventory of factors with their weights and a priority, for it boils down to four distinctive markers, one for each dimension of the SWOT instrument. Whence introducing the crosstab instrument the direction hints feasibility: any consolidated SWOT analysis can pertain to a simple two by two contingency table. The components of the two by two crosstab can be identical to those of the SWOT analysis, for in its generic form (Figure 30) it contains a dichotomy of qualitative attributes, either beneficial or unfavourable, and a categorization with respect to the environment, whether it's internal or external.

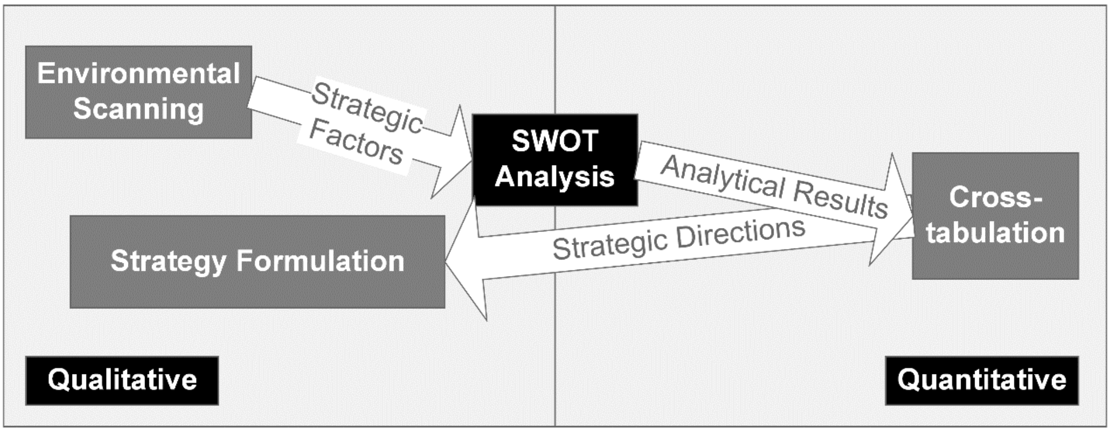


Figure 31: The strategy formulation process (Source: author).

Through this approach, all strategic factors affecting the entity under analysis may be entitled to a category and in a later stage analysed and processed, with any methodology selected. There is an abundance of methodologies and its fermentation dynamic, following the growth of the body of knowledge it regards. An extension of the methodology is proposed herein, irrespective of the one selected for the analytical SWOT analysis: to consider the inventory of strategic factors that embodies the analysis as the intake of a crosstab, thus adding a step in the process, between strategy formulation and SWOT (Figure 31). To battle the traditional SWOT analyses' weaknesses, many analytical approaches have been proposed, so we are led to the fusion of hybrid methodologies, both including qualitative and quantitative aspects.

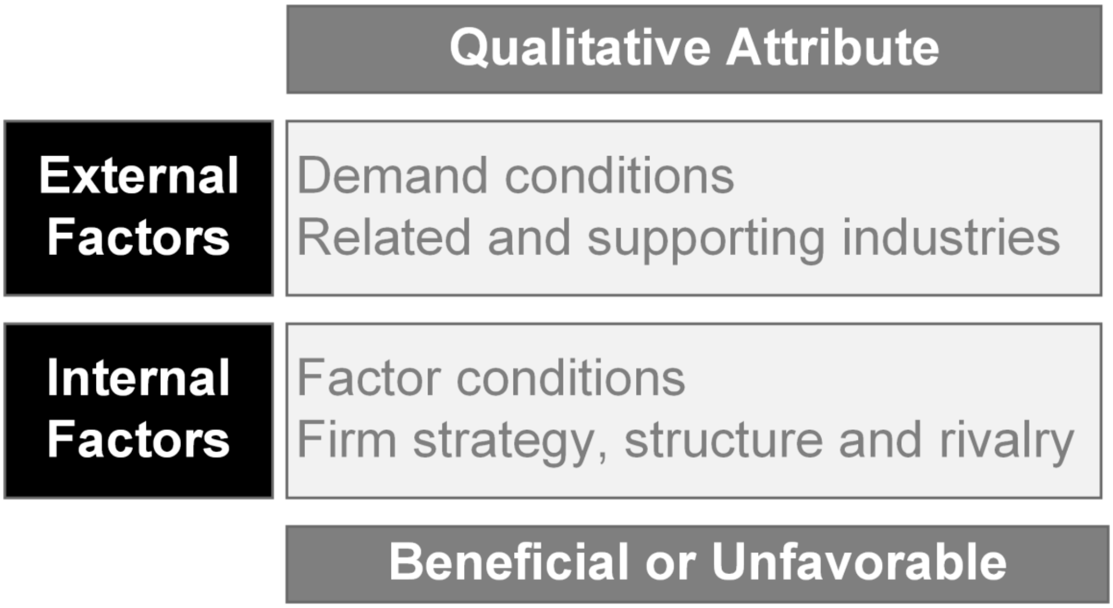


Figure 32: SWOT fused with the 'Diamond model' (Source: author).

A further calculatory level is introduced and the scope of analytical potential widened. Through this framework, the analytical inventory regarding cross-tabulation will be made available, thus extending the analytical perspective of SWOT analysis, without hindering other aspects. For example, for the extraction and analysis of competitiveness we may utilize Porter's (1990) diamond within a SWOT perspective (Figure 32, where 'Government' and 'Chance' are excluded) and further categorize our strategic factors based on specific dimensions we deem appropriate, remaining in the qualitative sphere. Once the qualitative inventory has been generated, it will relate to a table such as Table 29, that includes an indicative SWOT analysis for a maritime cluster (Andersson 2013).

Thence we can utilize any analytical methodology we find pertinent in order to extract a quantitative result with respect to the strategic factors of the inventory. These results can be consolidated into the form of Table 30, where through random no. generation (for the sake of this example) the sums of each dimension are calculated. From this point on, the crosstab can be formulated (Table 31) and the possibilities within rows and columns calculated.

Table 29: SWOT analysis of the Klaipeda maritime cluster (Source: Andersson 2013).

Strengths	Weaknesses	Opportunities	Threats
1. Major public investments in research and innovation capabilities through the EU structural funds.	1. Limited industrial activity in most maritime areas, except for shipbuilding, ship repair and stevedoring.	1. Overcome traditional mismatch in capabilities between industry and research community to create good conditions for building innovation capacity that meets future demand from emerging markets.	1. The innovation capabilities are in many areas weaker relative to other European maritime clusters, and it may be difficult to catch up and become competitive.
2. National recognition as a maritime cluster.	2. Weak research capabilities in maritime technology.	2. Strengthen the innovation landscape by drawing on public support and recognition, regional concentration, and strong networks.	2. Lack of well-defined structures and mandates for cluster facilitation may inhibit development and obstruct much needed engagement from private actors.
3. Regional concentration of activities and strong natural networks for communication.	3. Mismatch between research capabilities and industry needs.	3. Access and exploit European structural funds.	3. Lack of human capital may make it difficult to exploit the opportunities brought by the investments in physical infrastructure.
4. Strong research capabilities in marine sciences.	4. Lack of well-defined structures and mandates for cluster governance and facilitation.	4. Influence European policy though the Lithuanian	4. Limited private investment may cause the development to stagnate.

		Presidency in the EU.	
5. Extensive industry activity in the shipbuilding, ship repair and port related sectors.	5. Low engagement of large firms and limited access to private investment.	5. Harness the capacity that is under development through the large investments in the cluster.	—
6. Competitive wages in a European context.	—	—	—

Table 30: Ranking of SWOT factors (Source: author).

Strengths		**Weaknesses**		**Opportunities**		**Threats**	
S1	65	W1	95	O1	86	T1	45
S2	45	W2	4	O2	45	T2	65
S3	65	W3	0	O3	54	T3	2
S4	98	W4	55	O4	12	T4	54
S5	65	W5	45	O5	32	T5	0
S6	45	W6	0	O6	0	T6	0
Total	**383**	**Total**	**199**	**Total**	**229**	**Total**	**166**

*Table 31: The crosstabulation of Environment * Attribute (Source: author, SPSS™ output).*

Environment * Attribute Crosstabulation					
			Attribute		Total
			yes	no	
Environment	yes	**Count**	**383**	**199**	**582**
		% within Environment	65.8%	34.2%	100.0%
		% within Attribute	62.6%	54.5%	59.6%
		% of Total	39.2%	20.4%	59.6%
	no	**Count**	**229**	**166**	**395**
		% within Environment	58.0%	42.0%	100.0%
		% within Attribute	37.4%	45.5%	40.4%
		% of Total	23.4%	17.0%	40.4%
Total		**Count**	**612**	**365**	**977**
		% within Environment	62.6%	37.4%	100.0%
		% within Attribute	100.0%	100.0%	100.0%
		% of Total	62.6%	37.4%	100.0%

For this example, the range of zero to a hundred has been selected, and random numbers have been generated, to designate each factor. Once each factor has been assigned a numerical reflection, these can be compiled within a table. Once this compilation has been generated, the sum of each SWOT category may be calculated. Then the crosstab can be compiled. This step does introduce a modelling allowance that depending on the situation analysis case, may vary in importance. For example, one may argue as to the fact that, for example, strength four and five may not be able to be summed together, as ‘strong research capabilities in marine sciences’ (S4) cannot bear a conceptual relevance to ‘extensive industry activity in the shipbuilding, ship repair and port related sectors’ (S5); in this manner, the argument may be extended to nearly all the factors, between, and among categories. To address this anomaly, we must go back to the foundations of the framework, and the treatment of its threads.

In the manner that a factor such as ‘strong research capabilities in marine sciences’ (S4) may not have any relation to cannot bear a conceptual relevance to ‘extensive industry activity in the shipbuilding, ship repair and port related sectors’ (S5) as items, their conceptual semblance is there, nonetheless. The latter pertains to the fact that they both serve as a favourable qualitative attribute, and on this basis, they can be added, merely as such. So, it may be of some importance to note that, the addition is not performed on the signification of the items, but upon their designation within the dichotomy of the categorical variable. In addition, the qualitative scale itself is not considered as a ranking of intensity of the factor, but more as a representation of quantitative frequency. In this manner, each sum can be scaled as a collection of cases.

By performing the transformation of our SWOT analysis into a crosstab, a range of meta-calculations may be generated. One of the basic measures in statistics whence two by two contingency tables are regarded is the relative risk and through this framework we may calculate relative risk whence the objects lie in a SWOT analysis construct (Table 32). Instead of event and no-event we will have beneficial and unfavourable qualitative attributes and whence the intervention is concerned, this can regard to the environment, or the origination of the factor, whether it is of external or internal origin. Thence risk in the external environment can be designated as opportunity to threat (a/b from Figure 30) and risk in the internal environment as strength to weakness (c/d from Figure 30). The division of the two will render the calculation of the comparative environments, their harmonic co-existence and the compatibility between them.

Table 32: The measures of association (Source: author, SPSS™ output).

Risk Estimate			
	Value	95% Confidence Interval	
		Lower	Upper
Odds Ratio for Environment (yes / no)	1.395	1.072	1.815
For cohort Attribute = yes	1.135	1.025	1.257
For cohort Attribute = no	0.814	0.692	0.956
N of Valid Cases	977		

A high value of the risk ratio will indicate that the external beneficial conditions are more dynamic than the internal ones and that the cluster has to strive to keep up (cf. with the potential in policy extensions), whereas a figure of one or close to one will point to a harmonic eventuality between the qualitative attributes in the external and internal environment. Thus, we have demonstrated the applicability of a risk ratio calculation within an analytical SWOT analysis perspective; its potential can be put to practical trial. As far as our random no. example is concerned, the results point to a harmonically existing eventuality of qualitative attributes (as the risk ratio=1.135). The odds ratio further strengthens this result, as it regards the impact of the environment within favourable qualitative attributes to that of unfavourable qualitative attributes. We could conclude that risk calculations could present a degree of utility within topics of strategic management.

Table 33: The results of the Chi-Square tests (Source: author, SPSS™ output).

Chi-Square Tests					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.169[a]	1	.013		
Continuity Correction[b]	5.839	1	.016		
Likelihood Ratio	6.145	1	.013		
Fisher's Exact Test				.015	.008
Linear-by-Linear Association	6.163	1	.013		
McNemar Test				.161[c]	
N of Valid Cases	977				
a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 147.57.					
b. Computed only for a 2x2 table					
c. Binomial distribution used.					

Since our raw data is categorical, we can perform statistical decision tests (tests of independence) as well (Table 33). If we consider the analysis derived from independent samples we may select Pearson's Chi-square test of independence, whereas if we consider the samples dependent (paired) we will select the McNemar test. In our example it is interesting to note that the un-paired samples instance generates the conclusion that we reject the null hypothesis of samples' independence, whereas in the paired samples eventuality, the null hypothesis is not rejected and we cannot conclude that there is dependence of samples (there is no statistical significance).

Conclusions

Through the addition of an extra step to the process of strategy formulation, a wide variety of further calculations can be considered. The applicability and the analytical potential of SWOT analysis are enriched. The strong point of this methodology is that it will perform adequately regardless of the methodology that generated its intake.

That said, it will also bear any bias infused in the previous steps and even exacerbate same. Caution should be taken in any case concerning applicability. Through the conceptual model proposed herein, a variety of studies may be generated to further analyse and critique the model's validity and reliability. The first step would probably be to put the construct to the test and compare results with other methodologies in order to investigate convergence.

Industrial clusters are a very fruitful area of study and maritime clusters are an eventuality of an industrial cluster that may provide a strategic sweet spot for individual, firm, country, and various other stakes. Pairing maritime clusters' strategic analysis with an instrument as versatile as SWOT gives us a potent area of considerations and promising results from an analytical standpoint. Maritime clusters and SWOT analysis share a plethora of characteristics, amidst versatility and promise; that is why they could be considered as pertaining to paired rudiments and hence one can be utilized in harmony by the other, inconsequentially of the scope of the study, whether it's assessment of instrument validity, analytical potential, or traditional strategic analysis. Although this methodology originated from the study of maritime clusters, its application is not restricted to this domain; though the synergies surfacing from the analysis of maritime clusters are hopefully apparent.

III (6) – Crosstabulation of the TOWS matrix

Industrial clusters have for decades been considered as a predominant sanctuary for competitiveness; a kind that is generated through symbiotic characteristics that are disposed to flourish through innovation dynamics. The research extract, that within industrial clusters, knowledge creation and innovation that lead to competitiveness can thrive, comes effortlessly. Within an industrial cluster the scarcity principle nearly vanishes, and competitiveness may be attained through collective prosperity. Maritime clusters can be considered as rudimentary in the formulation of regional strategic advantages, primarily since the maritime sector holds a distinct and prevalent effect within any given economic cycle. Within the instruments formulated for industrial cluster research, the ones pertaining to strategic management do stand out, since effective strategy is a major factor of influence towards the health of an industrial cluster. Sustainable, adaptive, and innovative strategy is what sets these clusters apart, majorly because only within a strategic interpretation, can the opulence of a maritime cluster move into focus. Within this context, maritime clusters provide a rich framework for the generation and assessment of quantitative and qualitative methodologies and instruments; the present work aspires to contribute within this body of knowledge. The TOWS matrix, that can stand as the factor responsible for effective strategy formulation, is paired with cross-tabulation methodologies in order to relish the latter's arsenal of analytical potential. By introducing cross-tabulation within the TOWS matrix, an array of calculations can be relinquished that will in turn facilitate the process of strategy formulation. The application of this model may prove to be the instigator of sustainable competitiveness within a cluster, but furthermore, the instrument may find applicability within a plethora of strategic management cases.

Introduction

Industrial clusters are an object of study that soon become an object of subsequent admiration, because within them, a plethora of agreeable attributes, characteristics, and dynamics, may not only reside, but thrive, nonetheless. For instance, within industrial clusters, there seems to find solace a continuum that extracts instances of mutual opulence and collective prosperity. These traits, that seem to be shared within all efficient industrial clusters, suggest that within these industrial entities, a critical mass of innovation dynamics gives birth to sustainable competitive advantages for the firms within. These sustainable competitive advantages would not or could not reside outside the cluster. This goes to show that a firm that maybe would toil within any given setting, might thrive within an industrial cluster. This reincarnates industrial clusters to symbolizing beacons of collectiveness and mutuality. Thus, the arrival to an industrial cluster's first paradoxical instance, that of the degeneration of the scarcity principle, leading to an evident scarcity paradox. This paradox would be the initial stance of analysis, for within it lies the key to understanding both the threads of industrial clusters and the caveat of the scarcity principle as well. As a firm pillar of economic theory, the scarcity principle stands to provide a given moral stand, as well as a latent underlying philosophy, that within a given geographical location, the quantity of resources is not infinite.

The aforementioned creed, that within a given location all natural resources should be treated as scarce, may pose as a discrete thread of a much needed requisition of respect towards the natural environment, by not treating proximity as an ever providing system; alas, within an industrial cluster it is just not applicable. This primal conflict of industrial cluster activity does pose itself as a paradoxical element, should an analysis consider the scarcity principle as a given. That the scarcity principle should be embedded in the foundation of any analytical query, is a proposition that does hold water, for it provides a quasi-level playing field for any proximate members. It also sets the tone of competitive dynamics within the proximate geographical location, for all stakeholders are aware of the resources that are to be exploited in order to obtain a competitive advantage. By extension, and taking under consideration modern strategic management thought, while a firm will promote its distinctive competence in order to obtain a sustainable competitive advantage, she will proceed to compete with other firms that are active within the given operations theatre. This understanding provides a very simple model for the interaction and subsequent evolution of proximate competition; since a resource is finite, the firms will compete for the given amount of the distinct resource. By extension, a question may surface as to the procedure that will be followed when a resource will render itself obsolete. Of course, one could argue that the willing manifestation of the post-scarcity era will be the fixation and subsequent competition for another scarce resource, but through this prism a vicious cycle does emerge. As firms within a given proximity simply drain natural and other resources within a continuum, the question of sustainability surely becomes evident. Since firms strive for permanence and sustainable operations (that within themselves will reinforce the existence of the firm), the paradigm of resource scarcity does surrender its appeal and a novel understanding of sustainable activity may be afoot.

Within an industrial cluster setting, there seem to be a plethora of conflicting stakes that thrive altogether. The difference may be that any if not all resources pertain to potential resources and thus are utilized as before, but with the important distinction of life cycle continuity. This differentiation uncovers a basic latent ideal that can be found embedded in industrial clusters and many natural systems at large, that is, the culture of mutualism. Within industrial clusters, there are no destructive dynamics, but rather, a plethora of entities that coexist as one system, wherein the traditional understanding of scarcity theory is enriched with knowledge creation and innovation that in turn facilitate the blossoming of collective activity and unity that is engorged in a cluster. All the notions presented could not come to pass without that most basic characteristic of clusters, strategic management; the basis for all inherent activity within a cluster, is strategy. Strategic management is the catalyst that will facilitate all mutualistic dynamics and will formulate the sustainable competitive advantage of all entities within the cluster, to the point that it will seem that the competitive advantage belongs to the cluster itself. Within this domain, strategic management is the facilitator of competitiveness, through the formulation of quantitative and qualitative instruments that are tailored in order to assess and model said competitiveness. This work pertains to such instruments, as it entails a novel approach as to the utilization of the TOWS matrix, that is nonetheless a very effective instrument for strategic management.

Strategic management and maritime clusters

Industrial cluster dynamics come to alleviate the requirement of a more sustainable and constructive paradigm, through contesting the scarcity principle. The understanding of zero-sum eventualities that is adamant within a scarcity principle-woven world, is deconstructed and replaced with a dynamic and diverse culture of symbiosis, exact to natural occurrences. In nature, the paradigm of resource scarcity simply does not exist in the abstract, only in the absolute. That goes to say that in most, if not all-natural systems, abundance is more evident than scarcity (McDonough and Braungart 2002) and all activity is focused on obtaining a sustainable competitive advantage against predatorial eventualities, albeit environmental or systemic. But all this activity does not render geographical proximity scarce, but conversely more versatile and richer. It is as though all entities through striving towards individualistic survival, contribute towards the evolution of the whole super-system; that there exists a latent systemic drive within these natural constructs, that enables collective prosperity rather than zero-sum games. A first observation should be that these occurrences may not hold an infinite life span; these systems portray the extraordinary qualities for a time within their span of activity and not within an infinite continuum. Thus, nature will foster initiation or birth, growth, maturity, and decay (again, exactly as within clusters) in a cyclical manifestation and for all levels of focal length, albeit a resource, an entity, or the sum of all systems that compose nature. A subsequent observation would be that there is evident correlation with Adam Smith's (1776) 'invisible hand' and all its eventual corollaries, since (within industrial clusters) individual good is found to *somehow* guide the collective benefaction of the region.

The notion of the evident correlation of natural systems' dynamics with the absence, albeit paradox, of the scarcity principle, along with the eventuality of unhindered (and healthy) activity, that builds towards sustainable and collective mutualism, provides the cornerstone of industrial cluster theory. Thus, the two basic pillars that are mutually inclusive within industrial clusters, emerge as the circumvention of the scarcity principle, through a mechanism and process that is maybe not that transparent, and a culture of self-maintenance, that again, through an oblique process, tends towards individual as well as collective tenacity, at least with respect to survival and evolution. A first attempt for understanding both these elements could emerge from the apparent realization that the scarcity principle is self-evident. There is no way to create energy ex nihilo, as is dictated by the first law of thermodynamics and the law of the conservation of energy. As the first law of thermodynamics is the application of the law of conservation of energy for thermodynamic systems, so is the scarcity principle an application of the same law, but for systems of economies. As an isolated system for thermodynamics cannot produce energy but can only transform it, so do economies utilize finite resources and transform them into commodities, services, and need-fulfilling products. Since the scarcity principle has such an airtight case, one must ponder as to the superficial divergence of industrial clusters from said principle and hazard a rational explanation for this discrepancy.

An initial explanation would situate itself as the eventuality that there are exceptions to the principle and that many natural systems that seem to break the scarcity principle by offering collective prosperity, are just instances of the scarcity principle's non-inclusion and thus, both the scarcity principle theory and many instances where it is not applicable can be valid simultaneously. A deeper investigation as to the issue though will reveal not only the absence of exception from the principle, but an absolute adherence towards its foundation. In order to explore this argument, one must backtrack to the law of conservation of energy. The law states that an isolated system cannot create and/or destroy energy, but merely transform it from one form into another, all the while keeping the sum of all energy a constant. If the sum of energy is to remain constant, thence the implicit conclusion with respect to resources is that they are neither created nor destroyed, rather transformed. Within this transformation, the initial form of the resource diminishes, leading to the point that this may be rendered exhausted. That a resource has been spent, in no way implies that it has been destroyed, or that another has been created from scratch, rather, that all resources may be undergoing a plethora of transformations within their lifecycle. Thence the question remains, why there resides a possibility that within a given geographical location and for a given time span, there seem to be competing entities all thriving simultaneously? And this implying a given and finite number of natural resources, all with the scarcity principle valid and correct. The answer is as credible as it is effortless. The entities do not compete upon a given amount of resources; they compete upon what may be considered a resource in the first place. Through this prism, the law of conservation of energy and the scarcity principle are not violated within any given scenario. Thus, the issue becomes one of visibility, or rather, of the ability to realize what a resource may entail.

Through this argument, one may ponder that the only way for a self-evident law of nature to remain un-breached and an apparent manifestation of collective prosperity (that is indisputable in so many natural systems) to be explained, is to reconsider what a resource entails in the first place. The narrow approach will discard mutualism as a discordance, an unyielding violation of a sound principle, whereas through a more inclusive approach, the (at first) paradoxical nature of collective sustainability will explain itself as a mere variation of the same principles. Thus, it will be a question of interpretation and subsequently, culture, if and how the scarcity principle is violated within an industrial cluster, for it is not only conflicted, but diligently adhered-to, nonetheless. At first, the scarcity principle will pertain to the finite number of resources that have to be competitively and rigorously claimed by a different number of entities that are active in a sector. At a subsequent level of detail, collective prosperity may be achieved within a given geographical location of finite resources by a growing number of firms, whence what may be conceived as such is regenerated. The only eventuality of the materialization of this version of the scarcity principle is through a never-ending plight that will reincarnate as the constant struggle of novel methods, ideas, and solutions; what is widely considered to be the process of innovation. If the constituent of innovation is added to the threads of scarcity theory, thence the latter is not only not contested within so many natural systems that show such semblance to industrial clusters, but is adamantly reinforced, along with its backbone, the law of conservation of energy. All this theory requires to manifest any effectiveness and materiality, is the catalyst of strategy.

The basic approach of the latest years with respect to industry clusters, was the realization of the importance of strategic management within. From the rudiments of the theory, strategic management threads are apparent, but its explicit mention can only be traced in recent decades. Though Alfred Marshall (1890/1920), the first of neoclassical economists (Pinto 1975), is mostly noted to have commenced the threads of modern industrial cluster theory, the father of location theory, von Thünen (1826), provided an excellent model for the effective concentration of economic activity. Within his work, there is mention of the appeal that Adam Smith's (1776) work had imposed. Smith's amazing construct of the 'invisible hand' that will guide a 'domestic industry' towards prosperity does formulate resonance to what today we would coin as industrial cluster dynamics. Thus, though Adam Smith is not formally attributed with an explicit contribution to the theory, there can be observed a correlation with his most infamous mention and cluster specifics. The entanglement of industrial clusters with instances that lean towards the paradoxical and the mysterious are merely one trait of clusters that facilitated many requirements for the emergence of strategic management. The latter is the vessel that pertains to the deconstruction of industrial clusters' obscurity, into analytically enabling traits. These obscurities are apparent in modern theory as well, many times in the form of paradoxes, such as the 'location paradox' (Porter 2000).

Though the cluster concept is not without caveats, albeit with respect to its applicability to specific industries (Steinle and Schiele 2002), or with reference to the theory itself (Ortega-Colomer 2016), recent research converges to the notion that maritime clusters provide inherent sources of regional competitive advantage

(Antonopoulos 2016). Even though the main industry from which the cluster has emerged may differentiate itself, regional competitiveness does seem to stem from an industrial cluster capacity (Doronina et al. 2016). The agreement always seems the same, that the fuel of clusters is innovation (Mazur et al. 2016). This process may very well be the output of an innovation system, or based on a specific constituent of innovation, such as collaborative innovation (Schaffers et al. 2016). Clusters do require severe scrutiny as to the process of innovation and provide a plethora of analytical potential thereof (Xie et al. 2016). Whichever the case, industrial clusters seem to be very important for strategic management (Dewally and Shao 2015). This may be since practice shows that one has a great influence over the other (Schiele 2008), to the point that they may be intertwined with innovation dynamics as well (Rocha et al. 2010). Organizational adaptation may be added to the list (Niu 2010), along with trust (Niu et al. 2012), and information networks (Casanueva et al. 2013), as drivers of industrial clusters' strategic management.

Crosstabulation of the matrix

The TOWS matrix (Figure 33) can be utilized as an effective instrument for mapping the different strategies available to an entity that is active within an industry cluster. Within a maritime cluster, it can pose as an extremely beneficial aspect of the strategy formulation process. Its potential strategic combinations are its major asset, for among the combinations of strategy, a firm may find a pertinent one and through this, benefit the cluster's super-system. Along with the SWOT analysis methodology, that is TOWS' preceding step, the strategy formulation process for a maritime cluster can be streamlined and efficient. The methodology is utilized extensively within maritime clusters, albeit from a port perspective (Zauner 2008), or within the focal length of a national cluster (Nordic Centre for Spatial Development 2016). The analysis may be utilized within the exploration capacity of potential growth drivers (Danish Ministry of Economic and Business Affairs 2006), or for analysing national competitiveness (ECOTEC Research and Consulting 2006). As SWOT analysis is utilized formally to present an analytical view for situation analysis, the TOWS matrix may be utilized as its progression, towards the process of strategy formulation.

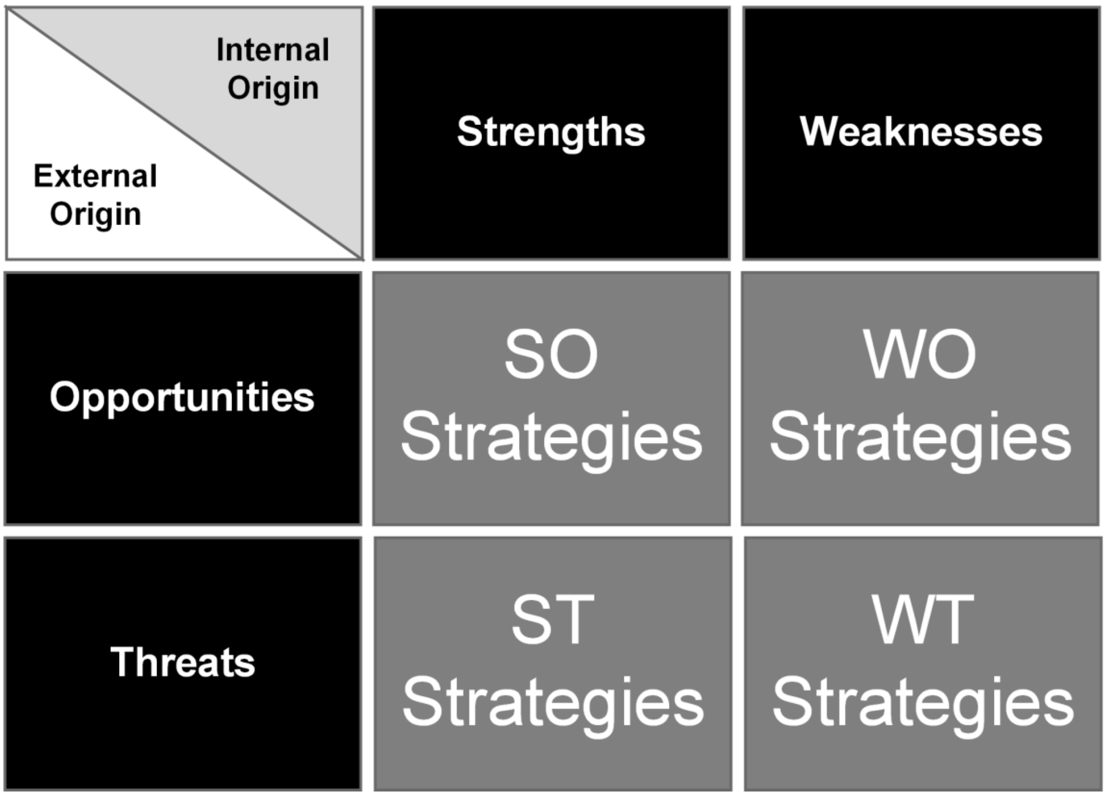


Figure 33: The TOWS matrix (Source: author).

Through the utilization of the TOWS matrix, an analytical quantitative constituent may be absent, and this may pose a hurdle for the efficient utilization of the instrument. This drawback may subside if cross-tabulation is introduced within the TOWS matrix items. The TOWS matrix results may be quantified and summed; for any item of the matrix, its quantitative elements may formulate a sum, such as, $a = \Sigma SO_n = SO_1 + SO_2 + \ldots + SO_n$, rendering a numerical result for each category. Thence, a basic crosstab (Figure 34) may be formulated.

The categorical variables of the crosstab can be the general categories of the TOWS matrix, or the preceding SWOT analysis items. Through this methodology, a novel instrument is relinquished, with the potential to portray different interpretations of the quantitative items. Through the numeric and statistical manipulation of items within the crosstab, statistical decision tests and risk factors may be calculated and interpreted, in order to portray any relevance and interdependence between the categorical variables. For example, basic measures of association can be extracted, based on the type of strategy formulation or case that is pursued.

Categorical variable 1 / Categorical variable 2	State 1i	State 1ii
State 2i	$a = \sum_{n=1}^{n_{SO}} SO_n$	$b = \sum_{n=1}^{n_{WO}} WO_n$
State 2ii	$c = \sum_{n=1}^{n_{ST}} ST_n$	$d = \sum_{n=1}^{n_{WT}} WT_n$

Figure 34: A generic crosstab (Source: author).

Within crosstabs' plethora of methodological instruments, measures of association stand out as simple and practical items that enable the analysis with further informative potential. Especially for maritime clusters, measures of association can signify strategic essence, since they will provide readily available factors that guide any indication of association between the items of the crosstab. The attributable risk (AR = a – c = SO - ST) will show the relevance of the external environment within the formulation of strategies. The risk ratio [RR = a * (c + d) / c * (a + b) = SO * (ST + WT) / ST * (SO + WO)] will manifest the favourability of strengths with respect to opportunities, to that with reference to threats. Consequently, the odds ratio [OR = (a / c) / (b / d) = a * d / c * b = SO * WT / ST * WO] will present the impact of the external opportunities in creating favourable instances. In addition to measures of association, a plethora of further calculations may be administered, thus forming a calculatory arsenal that can be tailored with respect to given strategy formulation requirements.

Conclusion

A cost-effective methodology is relinquished that may hopefully prove to be effective in its practical utilization, within the domain of strategy formulation, in maritime clusters. Through the calculatory potential introduced by cross-tabulating the TOWS matrix, a plethora of statistical calculations may be administered, that will provide further guiding and decision-making tools for the formulation of strategy within maritime clusters. The model is constrained by the limitation that for it to function, a quantitative understanding of the case must be portrayed. The latter may be susceptible to random as well as systematic error, not to mention error propagation. These hurdles may be overcome with diligent and materialistic processes that will guide operations towards the effectiveness of strategy. Through this process, the competitiveness of maritime cluster members, as well as the competitiveness of the maritime cluster itself, may be assessed and pertinent strategic directions may be outlined.

III (7) – Situation analysis forecasting: the case of European maritime clusters

Within the literature concerned with aspects of competitiveness, innovation, and strategic management of industrial clusters, the body regarding forecasting of strategic management is still nascent. This work aspires to render a contribution within the domain of strategic management forecasting, through the indicative case of European maritime clusters. For this end, a two-tier model is formulated. A quantitative SWOT methodology that derives from the fusion of a quondam situation analysis and crosstabs' theory is generated, to lead to the utilization of the crosstab's conditional probabilities as transition probabilities that compile the transition matrix of a Markov chain. Through this methodology and the successive Markov chain's transition matrices, we extract strategic forecasts for a devised European maritime cluster case. This work relinquishes a novel application with respect to strategic management forecasting, that provides a dichotomy of practical interpretations and scenarios for quantitative situation analysis. Thus, it may enable effective real-time decision making, in synergy with the quantitative methodological instrument. The situation analysis forecasting model may find applicability in a plethora of strategic management cases, wherein forecasting may be desirable. It may as well pertain to an intrinsic methodology for situation analysis forecasting of maritime clusters.

Introduction

Industrial clusters provide the ground for the extraction of the threads of competitiveness, innovation, and sustainability, so much so, that, regional communication, national cooperation, and economic policy, are much affected by and/or focused towards agglomeration economies. The concept, alas, does not come without its own drawbacks and limitations (Martin and Sunley 2003; Sonis et al. 2008); hence, critical attention must be devoted to any analysis, since generalizations may prove misguided. But this may hold truth for nearly any theory. In addition, the absence of analytical instruments may as well fortify the concept and provide the opportunity for further empirical validation (Malmberg and Maskell 2002). Indeed, today, much of European consideration focuses in cluster manifestation, as well as the provision of the instances that will warrant a cluster's prosperity. In the United States, as well, much attention is directed towards industrial clusters, though, one could argue that in the European Union, this is predominantly manifested from policy-making entities. Other regions of the world as well, strive to leave their mark of healthy industrial clusters. Altogether, clusters are popular, because they can be considered as the cornerstone of collective prosperity, within, as well as, among, national economies.

As an individual facet of prosperity, maritime clusters and their European counterparts, are supported from a joint framework of diverse stakeholders, engaged to strengthen and proliferate their numerous benefits. Even though the cluster concept is not a panacea for the sustainability of any economy, European maritime clusters do seem to pose as the vanguard of many economies' competitiveness and viability (and this is one of the reasons that led to their selection as a case study, herein). Therefore, one can witness a lot of focus and energy directed towards their streamlined oversight and operation. Due to their predominant link with regional competitiveness, industrial clusters prove to set the board for strategic management. Maritime clusters, because of their inescapable wealth concentration, size, and extraordinary effect upon any given economic cycle, provide effective analytical ground for the pursuit and evolution of strategic management topics. Indeed, maritime industry dynamics are proven to strengthen regional sustainability; thus, it cannot come as a shock that maritime clusters are considered as havens of national competitiveness.

A framework that is utilized extensively when effective situation analysis is required is the depiction of pertinent strategic factors within four distinct categories that is widely known as SWOT analysis. This analysis consists of two dichotomic categorical variables. One variable regards the origin of each strategic factor, albeit internal, or external. The other variable is concerned with the qualitative attribute of the factor; whether it is beneficial, or unfavourable. The SWOT framework has been used within many situation analysis cases and from many standpoints, including maritime clusters. Along with Porter's five forces (for the task environment – analysis of the industry), and the 'Five C' analysis (that includes general forces – societal environment), SWOT pertains to one of the most popular constructs for situation analysis.

SWOT analysis' major strength is the provision of a concise snapshot of the strategic environment. But because it is an inventory, the relative ranking of strategic factors may prove to foster ambiguity, for even implicitly, a 'traditional' SWOT analysis points to the equal importance of the strategic factors; a rare (if ever possible) occurrence. This, along with the fact that one may leave out an important strategic factor (or even include an irrelevant one), provides the drive towards the potential disarray of SWOT. Over the years, a plethora of instruments has been formulated to mitigate these issues that have come to hold a distinct body of knowledge. The latter is coined as quantitative SWOT analysis, for it includes quantitative methodologies to rank, prioritize, and generate hierarchies for the strategic factors. These, in turn, may optimize the analysis and provide relevant conclusions and effective decision-making capacity.

This work considers a quantitative SWOT analysis as precedent and utilizes its results as the initial calculatory intake for a two-tier forecasting model. The intake facilitates the generation of a crosstab, and the subsequent calculation of transition probabilities that will provide the ground for SWOT-based situation analysis forecasting via Markov chains. This strategic foresight model will hopefully strike applicability as a potent instrument for strategic management forecasting. The instrument's formulation materialized through the research of European maritime clusters, with the objective of quenching their predominant demand for potent strategic management. This does not mean that the construct may not be applicable within other geographical clusters, of any kind.

Management of strategy within maritime clusters of European context

European maritime clusters

Industrial clusters have long been regarded as the essence of viability and a benchmark of economic analysis. From the time of Alfred Marshall, who is widely accepted as the father of the theory, and his economies of agglomeration (Marshall 1890/1920), the theory threads are evident and may be linked directly to modern research. The latter would be encapsulated with Porter's theory, his definition of clusters as "geographic concentrations of interconnected (…) organizations in a particular field", and his extensively utilized diamond model (Porter 2000). Based upon Porter's definition, European maritime clusters would then be defined, as, 'regional European concentrations of interconnected organizations, within the maritime sector.' The importance of geographical complementarities, riddles practice and theory, whenever industrial clusters are concerned. These agglomerations of economic activity affect innovation, knowledge creation, and networks (Casanueva et al. 2013). As such, they are part of a festering collection of analytical instruments (Potter and Wattsy 2011) and form the theme of specific case studies (Suhail 2014). Maritime clusters are the objects of investigation for many diverse applications, ranging from the point of view of value creation (Hammervoll et al. 2014), to the extraction of distinct innovation drivers (Pinto and De Andrade 2013).

Europe has formally recognized the importance of industrial clusters, in many directions and from all levels of policy drafting. This extends to instituting specific organizations, instruments, and metrics, such as the *European Cluster Excellence Scoreboard* (European Cluster Observatory 2013), to better understand and safeguard the cluster effect. The important role of maritime clusters for European economies is acknowledged centrally, by the European Commission and satellite organizations, as well (Policy Research Corporation 2008). Maritime clusters add complementary dimensions to regional economies as well as (through) their linkages to international trade. Especially in Europe, maritime clusters play a crucial role in the development of regional economies, through their dynamics (Fernández-Macho et al. 2015). The concept of industrial clusters finds such resonance in the maritime industry, due to the might and organic differentiation of the maritime sector (Salvador 2014).

Analysis of maritime clusters provides a fruitful research perspective for many disciplines. Their evolution can be modelled with interesting results, through predator–prey equations, wherein forecasting constituents may be included as well (Zhang and Lam 2013). Maritime clusters set the board, especially from a strategic management standpoint (Benito et al. 2003). Analyses of competitiveness for specific countries, based on their maritime cluster’s competitiveness (Pinto and Cruz 2012), or for specific EU regions such as the Baltic (Laaksonen and Mäkinen 2013), wherein the effects of maritime clusters on regional economies can be documented, are readily available. Another interesting outcome of the analysis of maritime clusters is the extraction of many analytical methods and applications, ranging from cluster formulation analysis methodologies (Karlsen 2005), to specific linkages of European maritime clusters to other sectors (Brandt et al. 2010).

These types of clusters are interwoven with innovation and competitiveness, within a regional context (Chang 2011). Their importance is stressed explicitly, in specific topics, such as cooperation between distinct European countries (Pinto et al. 2015), or in the whole of the European Union (Mitroussi 2008). European maritime clusters may provide the basis for the extraction of many interesting strategic conclusions, as in Fløysand et al. (2012), where the study of two maritime clusters (Møre and Hordaland) within the Scandinavian Peninsula, renders an in-depth analytical perspective of maritime cluster dynamics. Lazzeretti and Capone (2010) map shipbuilding clusters in Tuscany, to extract pertinent strategic directions, as well as policy implications and recommendations. Brett and Roe (2010) analyse the maritime transport sector in the Greater Dublin Region, with respect to its maritime cluster status and potential. Clustering of the maritime sector can also formulate the analytical frame for studies of environmental and climatic change. The maritime clusters of Northwest Germany are used by Osthorst and Mänz (2012) to provide a typology of climate adaptation. Apart from established maritime clusters, research may focus on unattested or unofficial clusters, as in the case of Piraeus (Pardali et al. 2016; Zagkas and Lyridis 2011).

Effective strategic management is a core aspect of a healthy industrial cluster. If we were interested to contribute within this body of knowledge, we could pick out a distinctive type of cluster, based on a central industry and/or activity. The case of maritime clusters stands out, since the maritime industry offers a distinct dynamism within a regional economy that, in cases, even comes to identify national strengths as an outcome. The examples of the Greeks, with respect to ownership, and the British, in creatively dominating maritime (among others) services' markets, are among many that stand out. If we were to narrow our focal length to a regional type of cluster, European maritime clusters could provide a prototype for investigating strategic management topics and testing its instruments. This notion does not presuppose that other types of clusters may not be vibrant cases of strategy, or that clusters of other localities may not be of major interest. In the United States, in fact, the study of clusters has attained a whole new level, as relinquished within the results of the *Institute of Competitiveness*. The study of the maritime cluster of Panama has rendered the effect of the canal's expansion to the whole region (Pagano et al. 2016). To provide another example outside Europe, the dynamics of the Japanese maritime cluster (Shinohara 2010), when analysed, portray results of merit, with respect to corporate culture and sustainable competitiveness. With the above disclaimer in mind, the selection of European industrial clusters, as the case within this work, though not arbitrary, does not pertain to exclusivity.

SWOT analysis for the maritime sector

SWOT has been utilized extensively for the maritime sector. Arslan and Turan (2009) provide an assessment of the marine casualties in the Strait of Istanbul, through SWOT. The Turkish maritime industry's flagging out issue is documented with fuzzy quantified SWOT by Celik and Kandakoglu (2012). An analysis of the port community of the Turkish maritime industry is made available through the framework, from Keceli (2011). Thanopoulou (2012) provides an overview of the bulk reefer segment of the maritime sector with a SWOT review. Rapisarda et al. (2014) utilize the instrument to provide an evaluation of the fishing system in Sicily, whereas Rathman et al. (2014) provide an extensive analysis (through SWOT) of the Port of Ploče. Wan et al. (2015) use SWOT paired with the analytic hierarchy process (AHP), within a novel scenario for the Chinese maritime industry.

The utility of the framework is not restricted within the research domain, as European maritime firms and agencies find it useful, as well. The Danish Ministry of Economic and Business Affairs (2006) has utilized SWOT to portray the strategic factors of the Danish maritime cluster. The European Commission (Policy Research Corporation 2009), utilizes the framework to assess the role of maritime cluster organizations as dynamic members within the European maritime sectors. Andersson (2013) employs discrete strategic factors to assess an array of European maritime clusters through SWOT. As can be extracted, SWOT analysis is a dynamic instrument with many pertinent applications, variations, and potential, to be utilized from a wide range of stakeholders. It is up to debate and interpretation whether it renders the optimal instrument. Seldom may a statement as to the exclusivity of any one situation analysis' instrument be valid. But we may accept, that in many cases of strategic management within maritime sectors, SWOT is effective. By extension, its selection, study, and evolution, for the strategic management of maritime clusters, may hopefully prove advantageous.

Temporal perspectives within strategic management

Strategic forecasting

Strategic management has been very closely linked to sustainable innovation (Smith et al. 2014); a prime characteristic of industrial clusters as well. But to attain innovation through the repercussions of effective strategic management, we require adamant environmental scanning, through situation analysis. Since we accept that, any one instrument of situation analysis may not render perfection, we must reference one special pitfall of SWOT analysis. The framework (much like the balance sheet), is a static depiction of the case at hand. In a world where the only given constant is that *everything is changing*, a static consideration of a case may very well prove destructive.

If we were to be interested in extending and evolving the applicability of SWOT analysis, we should move to consider the addition of a temporal perspective. This upgrade of sorts would provide the framework with the arsenal of forecasting, for a tactical purpose. Not surprisingly, forecasting of strategic management topics has long been an object of interest. A lateral descriptive term is coined as ‘strategic foresight’ (Martinet 2010). A close consideration of forecasting has been utilized in strategy (Smith 2008) and its importance stressed through various applications and instruments (Doval 2010). Resonance can be witnessed between topics of strategy and foresight. Thus, forecasting instruments may play a crucial role in strategic management and situation analysis. The model formulated herein aspires to commit to such a direction.

Formulation of the forecasting model

The first step towards the formulation of the model is the compilation of a simple two by two contingency table. We suppose that a previous methodology has been applied, within a quantitative SWOT analysis perspective, and provided the crosstab’s numerical intake. If this has not been the case, then we could employ a method, to render a numerical designation for each SWOT category, and produce the crosstab. Thus, we are interested in the crosstab’s eight conditional probabilities. Let (Ω, F, P) be a probability space, with outcomes denoted as ‘Ω,’ events as ‘F,’ and the function that designates the probability of an event, as $P: F \rightarrow [0\ 1]$. By Kolmogorov’s definition, the conditional probability of event *i*, given that event *j* has materialized, is $P(i \mid j) = P(i \cap j) / P(j)$, if $P(j) > 0$. These probabilities may be utilized as a discrete instrument in SWOT analysis. Under the SWOT perspective, for instance, the probability of a positive qualitative attribute given an internal origin, will be designated by (the probability of) strengths.

Lateral to the above, we may gather that our analytical domain includes a temporal dimension. We may assume, that within its continuum, future outcomes are dependent solely on the present state, and not upon preceding states. If this notion stands, then we can regard our analysis as a stochastic process wherein we have states (the four categories of the SWOT analysis) and transitions within and between these states. This rendition portrays a factual perspective of strategic management. Systems (and their environment), may be constantly within a fluid state, and we may be prepared to face the possibility, that, a strength today, may become a weakness tomorrow. This is one of the reasons that strategic management can informally, but aptly, be regarded as, 'the management of change.' Within this rationale, all the categories of SWOT may encounter such transitions and may be led to face some interchange with each other. The above theoretical framework forms the foundation for the second tier of the forecasting model.

We consider a construct made up of the four SWOT states and the transitions among them. In addition, we suppose that the process is stochastic, with $X = \{X_n: n \geq 0\}$, where $X_n \in S$ marks the state of the process, at the temporal station of n. As before, the stochastic process $\{X_n: n \geq 0\}$ is on a countable set of variables S, defined within the probability space (Ω, F, P). Within this space, again, P is a probability measure of the F events, wherein the finite-dimensional distributions are $P\{X_0 = i_0, \ldots, X_n = i_n\}$, where $i_0, \ldots, i_n \in S$, $n \geq 0$. Thus, we have devised a Markov chain, if the stochastic process $X = \{X_n: n \geq 0\}$, for any $i, j \in S$, and $n \geq 0$, satisfies $P\{X_{n+1} = j \mid X_0, \ldots, X_n\} = P\{X_{n+1} = j \mid X_n\}$ and $P\{X_{n+1} = j \mid X_n = i\} = p_{ij}$. The latter condition pertains to the transition probabilities that compile the transition matrix of the Markov chain, $T = (p_{ij})$, and satisfy $\sum_{i\in S} p_{ij} = 1$, $i \in S$. The former condition, $P\{X_{n+1} = j \mid X_0, \ldots, X_n\} = P\{X_{n+1} = j \mid X_n\}$, requires that the future state, given the present state, is conditionally independent of the past states.

The first condition could hold for a situation analysis case, where, only the present state of events will dictate the future, and not any state before the present. The second condition may stand, as time may not pose any constraint to, not change per se, but the probability of change. The probability that the Markov chain follows the sequence $i_0, i_1, \ldots, i_n$, is calculated through the multiplication of the respective probabilities $p_{i0, i1} \ldots p_{in-1, in}$. In terms of the transition matrix T, we would gather that $p^n_{ij} = \sum p_{i, i1}\, p_{i1, i2} \ldots p_{in-1, j}$. The sum of this equation renders the probability $P\{X_n = j \mid X_0 = i\}$. Hence, $P\{X_n = j \mid X_0 = i\} = p^n_{ij}$.

We have arrived at the rudimentary strength of the Markov chain, wherein we can obtain the probability of a future state (n), by calculating T^n. Consequently, the conditional probabilities $P(i \mid j)$ of the crosstab may pertain to the transition probabilities p_{ij} of the Markov chain. Through this prism, to arrive at any dichotomous state of the categorical variable, we may have an origin, in twain. For example, if X = {internal environment: 1 = yes 2 = no} and Y = {beneficial qualitative attribute: 1 = yes 2 = no}, and $p_{i|j} = P(X = i \mid Y = j)$, whereas $p_{j|i} = P(Y = j \mid X = i)$, we are to arrive to a strength with the transition probability $P(i = 1 \mid j = 1)$, or with the transition probability $P(j = 1 \mid i = 1)$. The conditional probabilities can compile an 'enriched' crosstab, such as the one in Table 34.

Table 34: The cross-tabulated SWOT analysis (Source: author).

			Beneficial qualitative attribute	
			Yes ⇒ Y=1	No ⇒ Y=2
Internal environment		Count	**Strengths a**	**Weaknesses b**

	Yes ⇒ X=1	Conditional probabilities within ‘environment’	$P(j = 1 \mid i = 1) = a / (a+b)$	$P(j = 2 \mid i = 1) = b / (a+b)$
		Conditional probabilities within ‘attribute’	$P(i = 1 \mid j = 1) = a / (a+c)$	$P(i = 1 \mid j = 2) = b / (b+d)$
	No ⇒ X=2	Count	**Opportunities c**	**Threats d**
		Conditional probabilities within ‘environment’	$P(j = 1 \mid i = 2) = c / (c+d)$	$P(j = 2 \mid i = 2) = d / (c + d)$
		Conditional probabilities within ‘attribute’	$P(i = 2 \mid j = 1) = c / (c + a)$	$P(i = 2 \mid j = 2) = d / (b+d)$

One of the two conditional probabilities of each category may represent transition and the other, the probability of remaining in the same state. The conditional probability P (j = 1 | i = 1) = a / (a+b) may be regarded as the probability of a ‘strength,’ remaining as is, whereas P (i = 1 | j = 1) = a / (a+c), may pertain to the probability of arriving at a ‘strength,’ from an ‘opportunity.’ The latter would signify the transition probability of p_{41}, whereas the former, the steady-state transition probability p_{11}. By extending this rationale to the entire contingency table, we would arrive at a transition matrix as in Table 35.

Table 35: The initial transition matrix (Source: author).

T=	$p_{11} = P(j = 1 \mid i = 1)$	$p_{12} = P(j = 2 \mid i = 1)$	0	0
	0	$p_{22} = P(i = 1 \mid j = 2)$	$p_{23} = P(i = 2 \mid j = 2)$	0
	0	0	$p_{33} = P(j = 2 \mid i = 2)$	$p_{34} = P(j = 1 \mid i = 2)$
	$p_{41} = P(i = 1 \mid j = 1)$	0	0	$p_{44} = P(i = 2 \mid j = 1)$

By using this rudimentary transition matrix as a calculatory origin, T^k will give the probabilities of the transition from one state to another, in k steps. Within the conceptual origin of the model formulated, we will be able to obtain future states, as resulting from the subsequent powers of the transition matrices. A devised case study, based on an established strategic analysis of a European maritime cluster that illustrates the above, is as follows.

The case of the Solent maritime cluster

We consider the SWOT analysis of the Solent maritime cluster (Andersson 2013), wherein a comprehensive extraction of the strategic factors pertaining to the cluster is performed.

Table 36: The strategic factors (i = 1, …, 9) with numeric designation (Source: author).

Strengths		**Weaknesses**		**Opportunities**		**Threats**	
S1	35	**W1**	35	**O1**	56	**T1**	35
S2	95	**W2**	25	**O2**	65	**T2**	15
S3	15	**W3**	5	**O3**	50	**T3**	35
S4	85	**W4**	25	**O4**	95	**T4**	65
S5	15	**W5**	31	**O5**	58	**T5**	45
S6	75	**W6**	98	**O6**	65	**T6**	95
S7	65	**W7**	65	**O7**	45	**T7**	65
S8	56	**W8**	0	**O8**	95	**T8**	12
S9	0	**W9**	0	**O9**	2	**T9**	32
$\sum S_i$	**441**	$\sum W_i$	**284**	$\sum O_i$	**531**	$\sum T_i$	**399**

This maritime cluster is a major source of employment and income for its region; it is a leading trade hub as well, and it incorporates many military and commercial manifestations. It includes a very strong network of members and physical infrastructure, but public investment and large firms active within, are both, relatively absent.

Table 37: The crosstab formulated from the sums of the qualitative SWOT analysis (Source: author, SPSS™ output).

Environment * Attribute Crosstabulation					
			Attribute		Total
			yes	no	
Environment	yes	Count	**441**	**284**	**725**
		% within Environment	60.8%	39.2%	100.0%
		% within Attribute	45.4%	41.6%	43.8%
		% of Total	26.6%	17.2%	43.8%
	no	Count	**531**	**399**	**930**
		% within Environment	57.1%	42.9%	100.0%
		% within Attribute	54.6%	58.4%	56.2%
		% of Total	32.1%	24.1%	56.2%
Total		Count	**972**	**683**	**1655**

	% within Environment	58.7%	41.3%	100.0%
	% within Attribute	100.0%	100.0%	100.0%
	% of Total	58.7%	41.3%	100.0%

With the application of a quantitative methodology we may extract a numeric outcome for each strategic factor (i = 1, …, 9), as presented in Table 36, where a numeric value is generated for every strategic factor (values fall within the range of zero to one hundred and were acquired from a random no. generator solely for demonstrative purposes). Once we have compiled the corresponding ranking of each strategic factor, we may perform the addition of each category to obtain the sum of each respective item of SWOT. These totals will be relinquished as calculatory intake to compile the crosstab within Table 37.

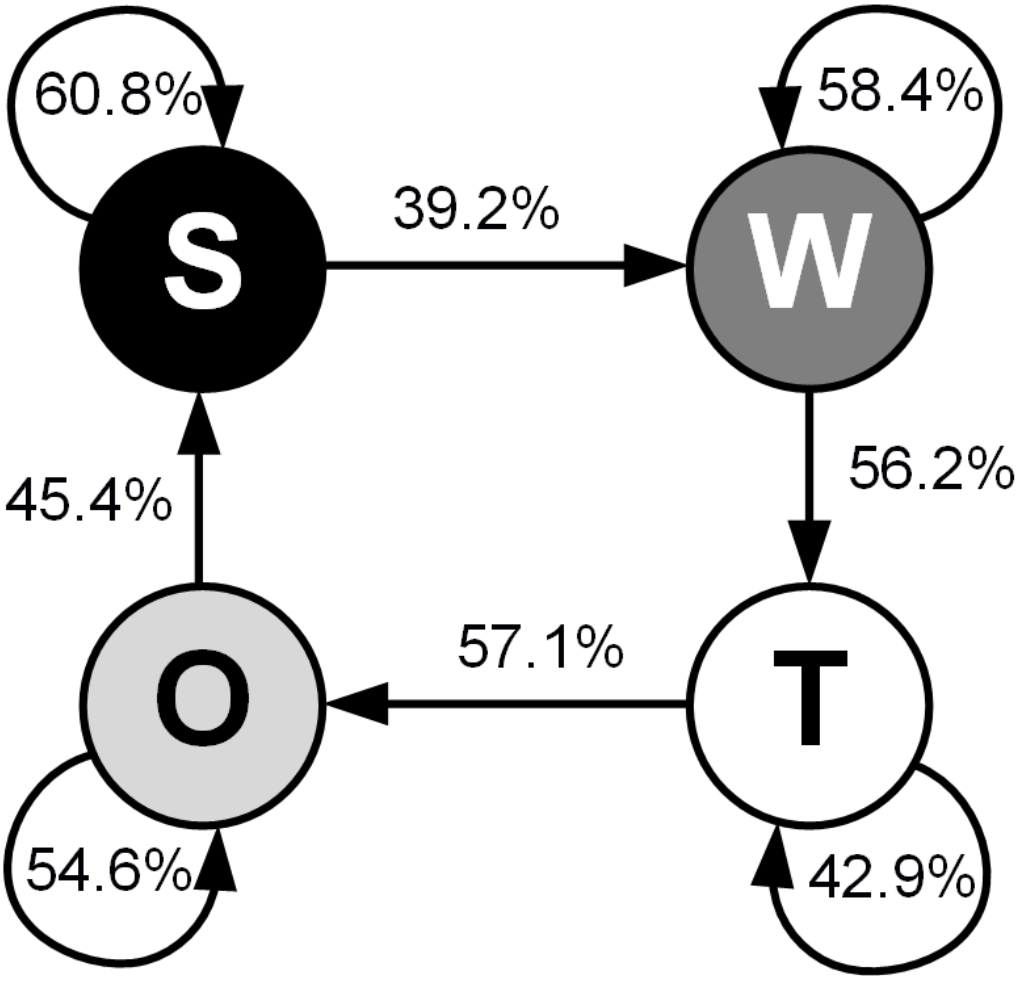


Figure 35: Transition diagram of the first Markov chain scenario (Source: author).

Along with the compilation of the crosstab, we calculate the respective conditional probabilities from which we formulate the two distinct scenarios of our Markov chains, as portrayed by the transition diagrams in Figure 35 and Figure 36.

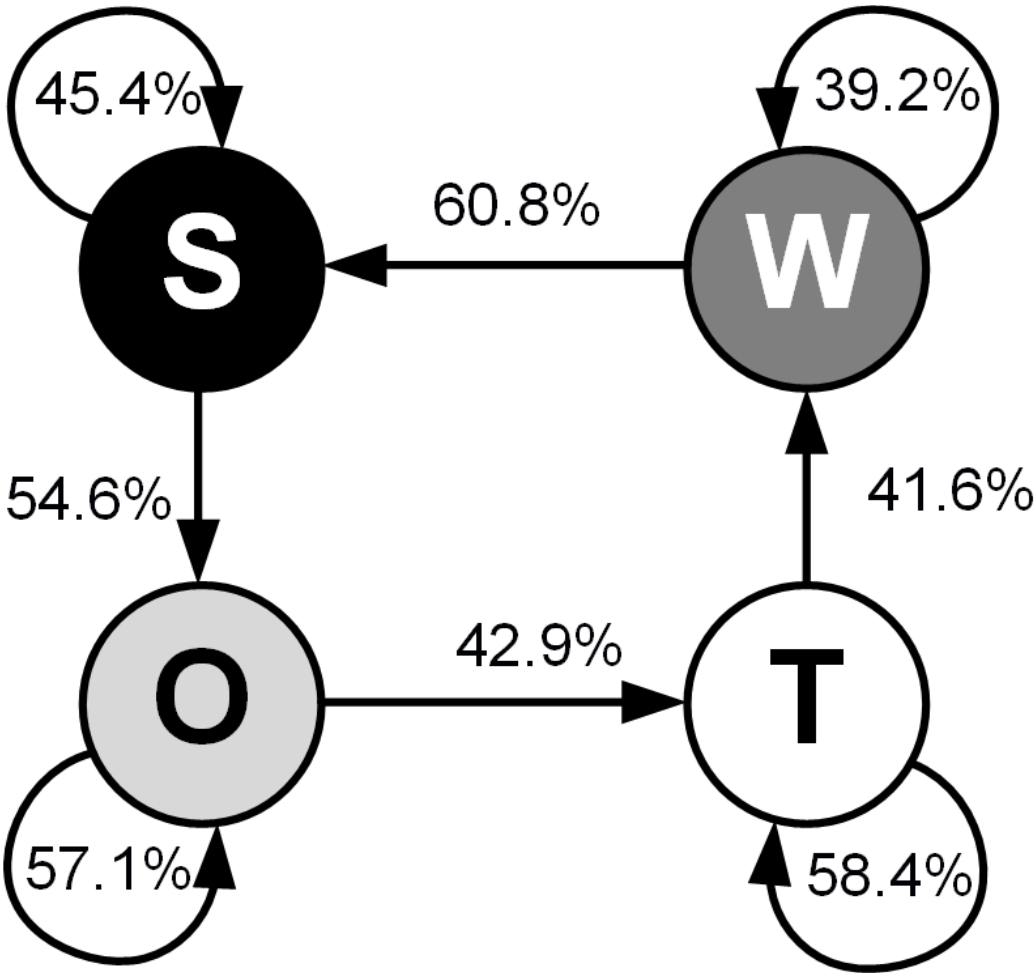


Figure 36 Transition diagram of the second Markov chain scenario (Source: author).

In both scenarios, we have a nested transition probability and a relief transition probability for each item-state. The difference of the two models lies within their theoretical qualitative construct. The first scenario considers that strength may lead to a weakness and may be formulated from an opportunity, whereas the second, indicates that a weakness can lead to a strength, which may in turn formulate an opportunity.

Through the selection of a specific scenario one can move to compose its transition matrix. For example, if we select the first scenario, we arrive at the transition matrix shown in Table 38.

Table 38: The first transition matrix (Source: author).

T =	60.8%	39.2%	0.0%	0.0%
	0.0%	41.6%	58.4%	0.0%
	0.0%	0.0%	42.9%	57.1%
	45.4%	0.0%	0.0%	54.6%

With matrix multiplication, we can obtain a forecast for the next temporal lapse, rendering the matrix of Table 39.

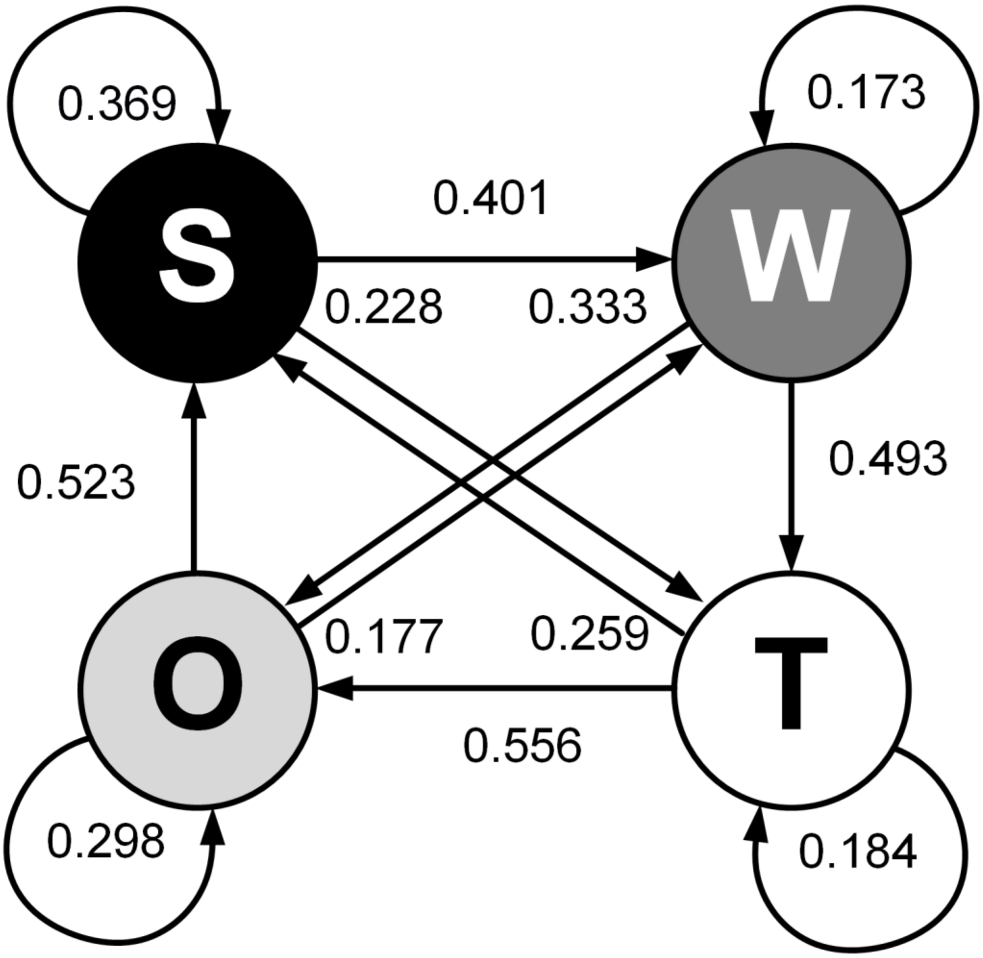


Figure 37: Transition diagram of the Markov chain after one lapse (Source: author).

The result of this transition matrix may be included within the original SWOT graph of the Markov chain that is depicted in Figure 37.

Table 39: The second transition matrix (Source: author).

T^2 =	0.369	0.401	0.228	0.0
	0.0	0.173	0.493	0.333
	0.259	0.0	0.184	0.556
	0.523	0.177	0.0	0.298

If we were to calculate a forecast for the next lapse, we would obtain the transition matrix of Table 40 (with its transition diagram portrayed in Figure 38).

Table 40: The third transition matrix (Source: author).

$T^3 =$	0.224	0.311	0.332	0.130
	0.151	0.071	0.312	0.463
	0.410	0.101	0.078	0.409
	0.453	0.279	0.103	0.162

We may observe that the states occupied by null transition probabilities in the first transition matrix are sequentially supplemented in further temporal states, thus enhancing the forecasting model. With the utilization of the situation analysis forecasting model, one can extract forecasts for the Solent maritime cluster that are based on its traditional SWOT analysis.

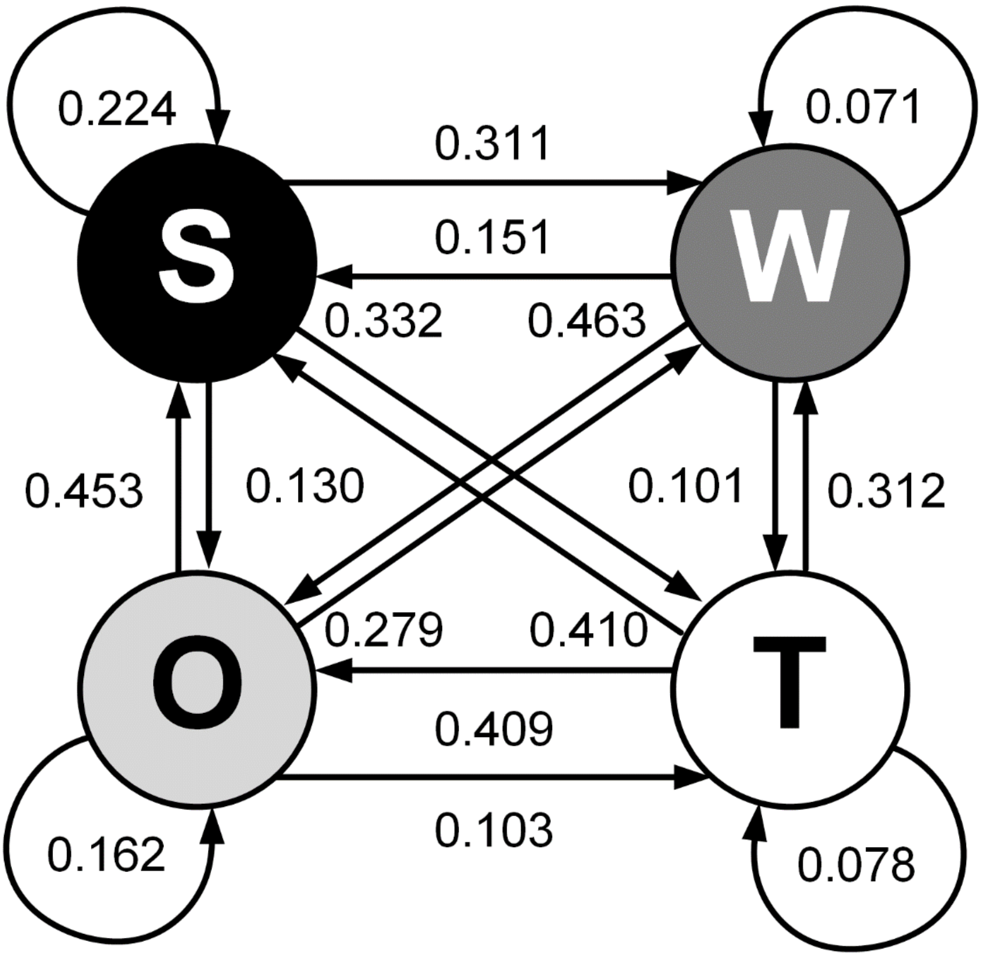


Figure 38: Transition diagram of the Markov chain after the second lapse (Source: author).

Through these forecasts, lucid strategic directions may be pursued and changes in the strategic environment may be detected from a supplementary analytical perspective. For example, one may point out that, as per the forecast, the steady-state probability of strengths is diminishing over time. If this is malevolent, then the major success factors of the cluster that pertain to networks, culture, and physical infrastructure may start to diminish. So, in turn, resources may be focused to securing these strengths, in the foreseeable future. Policy and governance may be shifted as well, accordingly. In the same manner, forecasts of the model can be generated for the other categories of SWOT and pertain to effective strategic foresight directions.

Conclusions

Industrial clusters may be considered as the vanguard of regional competitiveness. Due to the economic depth and breadth of the maritime industry, maritime clusters provide a fruitful testing ground for the domain of strategic management. One of the instruments prevalent within the latter, is that of SWOT. Many of the quantitative SWOT analysis instruments in use today can generate a numeric result for the items of the SWOT inventory. Originating from these numeric results, a model is formulated. First, through the fusion of the quantitative inventory with a crosstab, and then with the utilization of its conditional probabilities as transition probabilities, a Markov chain is created. Through this construct, strategic forecasts may be procured. These forecasts will hopefully aid towards the reinforcement of efficient situation analysis for European maritime clusters. The basic limitation of the model formulated herein is that it requires a preceding calculation in order to compile the initial contingency table. Hence, it relies (and is dependent upon) the rigidity and trustworthiness of its initial calculatory intake. Along with this fact come the constraints of each constituent of the model that are fused together, and thus compound its deriving limitations. Future research may venture to provide contingencies wherein the model's reliability and applicability may be tested, within factual strategic management scenarios, and its evolution pursued with respect to the utility of other instruments rooted in crosstab methodologies and/or Markov chains.

Publication list of Section III

(1) 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. DOI: https://doi.org/10.1016/j.marpol.2017.09.010

(2) Papadimitriou, S., V. Tsioumas, P. J. Stavroulakis, and I. G. Koliousis. (2019). “A strategic innovation framework for maritime clusters.” *MHCL 2019 Conference*, Bar, Montenegro.

(3) Koliousis, I. G., S. Papadimitriou, P. J. Stavroulakis, and V. Tsioumas. (2018). “The Management of Change within Maritime Clusters.” *FME Transactions*, 46(3): 360-366. DOI: https://scindeks.ceon.rs/article.aspx?artid=1451-20921803360K

(4) Papadimitriou, S., I. G. Koliousis, and P. J. Stavroulakis. (2016). “Analytical Competitiveness in Maritime Clusters.” *University of Piraeus*.

(5) Stavroulakis, P. J. and S. Papadimitriou. (2015). “A Hybrid SWOT Analysis Methodology for Maritime Clusters.” *IAME 2015 Conference*, KL, Malaysia.

(6) Stavroulakis, P. J., S. Papadimitriou, and E. Riza. (2016). “Cross-Tabulation of The Tows Matrix: A Novel Dimension for Assessing the Competitiveness of Maritime Clusters.” *ICTTE 2016 Conference*, Belgrade, Serbia.

(7) Stavroulakis, P. J. and S. Papadimitriou. (2017). “Situation analysis forecasting: the case of European maritime clusters.” *Maritime Policy and Management*, 44 (06): 779-789. DOI: https://doi.org/10.1080/03088839.2017.1330560

Conclusions

Maritime clusters are important constructs of industry, for many viewpoints, inclusive of policy, academia, and practice. The impact of strategy within maritime clusters has not been researched extensively. Through this work, a baseline for the domain of the strategic management of maritime clusters is provided. This baseline is formulated through three distinct directions that pertain to the discrete sections of this work. The first includes the contributions within the theory of maritime clusters and incorporates the substantiation of the importance of strategy for maritime cluster research. The second refers to strategic analysis of maritime clusters and the third to the development of instruments for strategic management of maritime clusters. This work can provide the baseline for instruments and insights to be utilized from practitioners, as well as point to future research directions.

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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

Appendix C

No.	Document title	Authors	Year
1	The core competences of the Antwerp seaport: An analysis of "port specific" advantages	Haezendonck, E., Pison, G., Rousseeuw, P., Struyf, A., and Verbeke, A.	2001
2	Clustering and performance: The case of maritime clustering in the Netherlands	De Langen, P.W.	2002
3	UK tonnage tax: Subsidy or special case?	Selkou, E. and Roe, M.	2002
4	Riding the waves	[No author name available]	2003
5	Innovation, capabilities and competitive advantage in Norwegian shipping	Jenssen, J.I.	2003
6	A cluster analysis of the maritime sector in Norway	Benito, G.R.G., Berger, E., De La Forest, M., and Shum, J.	2003
7	Innovation brings success to Nordic countries	[No author name available]	2003
8	Regrouping for success	Segercrantz, H.	2004
9	Governance in seaport clusters	De Langen, P.	2004
10	Analysing the performance of seaport clusters	De Langen, P.W.	2004
11	Shipping and ports in the twenty-first century: Globalisation, technological change and the environment	Pinder, D. and Slack, B.	2004
12	Dutch shipbuilders pin hopes on navy modernisation	Lok, J.J.	2004
13	Cruise industry builds strong Finnish maritime cluster	[No author name available]	2004
14	The heart of the shipping industry	[No author name available]	2005
15	Collective action regimes in seaport clusters: The case of the Lower Mississippi port cluster	de Langen, P.W. and Visser, E.-J.	2005
16	Meritime meeting place	[No author name available]	2005
17	Scandinavia: Hothouse for maritime innovation	[No author name available]	2005
18	St. John's ocean technology cluster: Can government make it so?	Colbourne, B.	2006
19	The ambitious wager of Quebec's maritime cluster: Current situation and public policies | [Le pari ambitieux du cluster maritime du Québec: État de la situation et politiques publiques]	Doloreux, D. and Melançon, Y.	2006
20	Business game 2005 (port eCluster): The new learning approach	Ana, P., Silvia, G., Andrej, M., and Nataša, R.	2006

21	Chapter 20 Stakeholders, Conflicting Interests and Governance in Port Clusters	de Langen, P.W.	2006
22	Enhancing performance in a seaway	[No author name available]	2006
23	Quality of opportunity: Dutch defence industry braces for outcome of election	Janssen, J.	2006
24	Hitting the ground running	Yards, A. and Heikinheimo, J.	2007
25	When seafaring is (or was) a calling: Norwegian seafarers' career experiences	Mack, K.	2007
26	Logistic innovation in global supply chains: An empirical test of dynamic transaction-cost theory	Visser, E.-J.	2007
27	Employment of seafarers in the EU context: Challenges and opportunities	Mitroussi, K.	2008
28	Analysing training and education in ports	de Langen, P.W.	2008
29	Exploring the applicability of electronic markets to port governance	Lambrou, M.A., Pallis, A.A., and Nikitakos, N.V.	2008
30	Zeebrugge, or the emergence of a new oceanic gateway in the heart of the Northern Range | [Zeebrugge ou l'émergence d'une nouvelle porte océane au cœur du Northern Range]	Charlier, J. and Lavaud-Letilleul, V.	2008
31	Maritime clusters in diverse regional contexts: The case of Canada	Doloreux, D. and Shearmur, R.	2009
32	Port competition paradigms and Japanese port clusters	Shinohara, M.	2009
33	A comparative analysis of free trade zone policies in Taiwan and Korea based on a port hinterland perspective	Yang, Y.-C.	2009
34	Maritime education - Putting in the right emphasis	Ali, A.	2009
35	The potential for the clustering of the maritime transport sector in the greater Dublin region	Brett, V. and Roe, M.	2010
36	Maritime cluster of Japan: Implications for the cluster formation policies	Shinohara, M.	2010
37	Maritime clusterisation and cluster facilitators in the European Union | [POMORSKA KLASTERIZACIJA I CIMBENICI RAZVITKA U EUROPSKOJ UNIJI]	Batur, T.	2010
38	Development potentials and networks of maritime clusters in Germany | [Entwicklungspotenziale und Netzwerkbeziehungen maritimer Cluster in Deutschland]	Brandt, A., Dickow, M.C., and Drangmeister, C.	2010
39	An economic logistics model for the multimodal inland distribution of maritime containers	Iannone, F. and Thore, S.	2010
40	A collaboration service model for a global port cluster	Toh, K.K.T., Welsh, K., and Hassall, K.	2010
41	Study on resource integration and innovation of Bohai-circle ports	Lv, R., Zhang, F., Zhong, W., and Wei, B.	2010

42	Optimization of two-stage port logistics network of dynamic hinterland based on bi-level programming model	Ji, M.-J. and He, M.-Y.	2010
43	A framework for modelling and benchmarking maritime clusters: An application to the maritime cluster of Piraeus	Zagkas, V.K. and Lyridis, D.V.	2011
44	Maritime piracy: A Hong Kong perspective	McKinnon, A.	2011
45	An Innovation and Engineering Maturity Model for marine industry networks	Jansson, K.	2011
46	Information management in seaport clusters | [Upravljanje informacijama u lučkim klasterima]	Agatić, A., Čišić, D., and Tijan, E.	2011
47	Evolutionary game of co-opetition strategy among port cluster	Dong, G.	2011
48	A theoretical framework for the evaluation of competition between container terminal operators	Yap, W.Y., Lam, J.S.L., and Cullinane, K.	2011
49	Nor-Shipping 2011: Nor-Shipping 2011: Next generation shipping	[No author name available]	2011
50	Maritime clusters: What can be learnt from the South West of England	Chang, Y.-C.	2011
51	The strength of Malaysian maritime cluster: The development of maritime policy	Othman, M.R., Bruce, G.J., and Hamid, S.A.	2011
52	Maritime community and its human resource mobility	Inoue, K.	2011
53	Dutch innovation celebrated during Maritime Awards Gala	McFedries, R.	2011
54	Shipping Taxation	Marlow, P. and Mitroussi, K.	2012
55	Structuring a knowledge-based maritime cluster: Contributions of network analysis in a tourism region	Pinto, H. and Cruz, A.R.	2012
56	The dynamism of clustering: Interweaving material and discursive processes	Fløysand, A., Jakobsen, S.-E., and Bjarnar, O.	2012
57	A model optimizing the port-hinterland logistics of containers: The case of the Campania region in Southern Italy	Iannone, F.	2012
58	The private and social cost efficiency of port hinterland container distribution through a regional logistics system	Iannone, F.	2012
59	Cooperation or competition Factors and conditions affecting regional port governance in South China	Wang, K., Ng, A.K.Y., Lam, J.S.L., and Fu, X.	2012
60	Come fly the Dutch flag	Van Den Hanenberg, G.	2012
61	Cooperation is key for the Dutch maritime industry	Kraaijeveld, A.	2012
62	Economies of agglomeration and supply chain network effects in transportation and logistics clusters: The case of the Panama maritime cluster	Pagano, A.M., Sánchez, O., and Ungo, R.	2012

63	Dutch maritime innovations honoured	Van Den Hanenberg, G.	2012
64	A differentiation framework for maritime clusters: Comparisons across Europe	Monteiro, P., de Noronha, T., and Neto, P.	2013
65	Sea and littoral localities’ economy: Exploring potentialities for a maritime cluster - An integrated analysis of Huelva, Spain and Algarve, Portugal	Ortega, C., Nogueira, C., and Pinto, H.	2013
66	Innovation types in the Finnish maritime cluster	Makkonen, T., Inkinen, T., and Saarni, J.	2013
67	The influence of managers and organisational profiles in CSR decision-making. Ideas for implementation in the maritime sector	Arizkuren-Eleta, A., Gartzia, L., Baniandrés-Abendaño, J., Castillo-Mory, and E., Martínez-Lozares, A.	2013
68	Maritime cluster evolution based on symbiosis theory and Lotka-Volterra model	Zhang, W. and Lam, J.S.L.	2013
69	The Competitiveness of the Maritime Clusters in the Baltic Sea Region: Key Challenges from the Finnish Perspective	Laaksonen, E. and Mäkinen, H.	2013
70	Research on the maritime cluster competition based on ecological niche theory	Jin, J.-C. and Zhen, H.	2013
71	Evaluation of the relevance measure between ports and regional economy using structural equation modeling	Deng, P., Lu, S., and Xiao, H.	2013
72	Relationship between inland ports cluster of Tianjin port and regional economy based on DEA	Lv, J. and Chang, Z.	2013
73	Stakeholder management for establishing sustainable regional port governance	Lam, J.S.L., Ng, A.K.Y., and Fu, X.	2013
74	Evaluating the capabilities of port logistics based on structural equation modeling	Deng, P., Lu, S., and Xiao, H.	2013
75	Research on OD distribution of domestic coastal trade container shipping based on gravity model	Qing, S., Tao, D., and Cunyi, X.	2013
76	Holland goes Brazil	Van Den Hanenberg, G.	2013
77	Analysis of parameters and processes of Latvian seafarers' pool	Gailitis, R.	2013
78	Key innovation drivers in maritime clusters	Pinto, R.A.Q. and De Andrade, B.L.R.	2013
79	Maritime clusters evolution. The (not so) strange case of the Portuguese maritime cluster	Salvador, R.	2014
80	The establishment of the Danish International Ship Register (DIS) and its connections to the maritime duster	Sornn-Friese, H. and Lversen, M.J.	2014

81	General insights of the portuguese maritime economy and particularly of the algarve region: Contributing towards a strategic vision	Valadas-Monteiro, P.	2014
82	Energy and maritime clusters in the eastern Baltic sea region: Competitiveness through international inter-cluster cooperation?	Mäkinen, H., Laaksonen, E., and Liuhto, K.	2014
83	Modeling of economically sustainable information security management systems in seaport clusters	Aksentijević, S., Tijan, E., and Čišić, D.	2014
84	Seaport cluster labour cost reduction – A modelling approach	Tijan, E., Aksentijević, S., and Hlača, B.	2014
85	Simulation of administrative labour costs in seaport clusters	Tijan, E., Aksentijević, S., and Hlača, B.	2014
86	Conceptualizing seaports firms and functions as operational and institutional interrelations: The Gov-Ad-Man approach	Ibrahimi, K.	2014
87	Maritime policy in the North Sea region: Application of the cluster approach	Flitsch, V., Herz, N., Wolff, J., and Baird, A.J.	2014
88	Evolution of inland container distribution among the cluster of ports in the greater pearl river delta	Wang, A., Lai, S., and Mohmand, Y.T.	2014
89	An intermodal analysis of major seaports in Southern China	Guo, S. and Tang, L.C.	2014
90	Methods for strategic liner shipping network design	Mulder, J. and Dekker, R.	2014
91	The role of clusters in global maritime value	Hammervoll, T., Halse, L.L., and Engelseth, P.	2014
92	Conquering Japan	Van Den Hanenberg, G.	2014
93	Globalization and the Development of Industrial Clusters: Comparing Two Norwegian Clusters 1900-2010	Amdam, R.P. and Bjarnar, O.	2015
94	Cooperation and the emergence of maritime clusters in the Atlantic: Analysis and implications of innovation and human capital for blue growth	Pinto, H., Cruz, A.R., and Combe, C.	2015
95	Measuring the maritime economy: Spain in the European Atlantic Arc	Fernández-Macho, J., Murillas, A., Ansuategi, A., (...), Prellezo, R., and Virto, J.	2015
96	On seaport development and reform and their institutional determinants: A new theoretical approach	Ibrahimi, K.	2015
97	Economic Integration Development of Port Cluster and Port City	Wang, L. and Liu, D.	2015

98	Research on the sources of efficiency and implementation of transport logistics clusters	Postan, M. and Stolyarov, G.	2015
99	Dynamic regional port cluster development: case of the ports across Taiwan Strait	Bai, X. and Lam, J.S.L.	2015
100	The Revealed Competitiveness of Major Ports in the East Asian Region: An Additive Market Share Analysis	Kim, T.S.	2015
101	Features of the maritime clusters of the Atlantic arc	Ferreira, A.M., Soares, C.G. and Salvador, R.	2015
102	Italian maritime cluster and Genoa university: A collaborative partnership for the education	Figari, M., Bonvino, C.P., Damilano, G., and Gnecco, A.	2015
103	Multipliers, linkages and influence fields among the sectors of the Portuguese maritime cluster	Simões, A., Soares, C.G., and Salvador, R.	2015
104	Participative approaches to the Portuguese maritime cluster	Salvador, R., Simões, A., and Soares, C.G.	2015
105	Big data for the Norwegian maritime industry	Wang, H., Karlsen, A., and Engelseth, P.	2015
106	The Role of knowledge-intensive service activities on inducing innovation in co-opetition strategies: Lessons from the maritime cluster of the Algarve region	Monteiro, P.V.	2016
107	The impact of the Panama Canal expansion on Panama's maritime cluster	Pagano, A., Wang, G., Sánchez, O., Ungo, R., and Tapiero, E.	2016
108	Editorial Port Management Studies: Selected papers from the Conference of International Association of Maritime Economists Theme: "the Role of Maritime Clusters and Innovation in Shaping Future Global Trade" August 24-26 2015	Dooms, M. and Parola, F.	2016
109	Measuring relatedness in a multisectoral cluster: an input–output approach	Morrissey, K. and Cummins, V.	2016
110	The strategic factors shaping competitiveness for maritime clusters	Stavroulakis, P.J. and Papadimitriou, S.	2016
111	Québec' coastal maritime cluster: Its impact on regional economic development 2001-2011	Doloreux, D., Shearmur, R., and Figueiredo, D.	2016
112	Port choice strategies for container carriers in China: A case study of the Bohai Bay Rim port cluster	Yang, J., Wang, G.W.Y., and Li, K.X.	2016
113	Spatial structure of container port systems across the Taiwan Straits under the direct shipping policy: A complex network system approach	Wang, L. and Hong, Y.	2016
114	Port supply chain integration: analyzing biofuel supply chains	Stevens, L.C.E. and Vis, I.F.A.	2016

115	The impact of the 2008 financial crisis on the Portuguese maritime cluster	Simões, A., Salvador, R., and Guedes Soares, C.	2016
116	Big data and industrial Internet of Things for the maritime industry in North-western Norway	Wang, H., Osen, O.L., Li, G., (...), Dai, H.-N., and Zeng, W.	2016
117	The economic features, internal structure and strategy of the emerging Portuguese maritime cluster	Salvador, R., Simões, A., and Guedes Soares, C.	2016
118	The Dutch maritime cluster monitor 2016	[No author name available]	2016