CLUSTER MODELS, FACTORS AND CHARACTERISTICS FOR THE COMPETITIVE ADVANTAGE OF LITHUANIAN MARITIME SECTOR

Rasa Viederyte[1], Rimantas Didziokas[2]

[1,2]*Klaipeda University, Lithuania*

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Abstract

Paper analyses several cluster models on the basis of competitiveness: Nine-factor model, Double diamond model, Funnel model of cluster determinants, Destination Competitiveness and sustainability models, which are related to Porter's Diamond model and concentrate to the classical one - adopt M. Porter's Diamond model methodology to the evaluation of Lithuanian Maritime sector's clustering on the basis of competitiveness. Despite the advances in cluster research, this model remains a complex one and something that is hard to adapt to a real economic environment. However, this model with some extends and implications can be applied to explain the emergence and development of Maritime sector clustering.

Although clustering analysis on the basis of M. Porter's Diamond model highlighted its advantages, the interconnection of factors and their influence on the clustering, the economic theory has not yet provided a model that allows both the analysis and the definition of a process for implementing a successful clustering research.

The adoption of M. Porter's Diamond model creates convenient theoretical basis and has practical implication for real Lithuanian Maritime sector's clustering abilities evaluation. It also helps to systemize basic cluster characteristics, that can be identified in the Maritime industry and measure the reasonable impact factors, which are identified in Lithuanian Maritime sector.

The type of the article: *Theoretical article.*

Keywords: *Diamond model, competitive advantage, Maritime sector, clustering.*

JEL Classification: *L16, Q14, Q32.*

1. Introduction

Today competition takes place not only within companies but increasingly within sectors. During the last decades, scholars and business people started paying more attention to industrial sectors. The competitive advantage of a company is largely determined by the characteristics of the sector the company belongs to and by the way it organises the activities and uses the resources in its value chain relative to its competitors (Lakhal *et al.*, 1999). Due to the global nature of markets, specialization and innovation are essential in maintaining competitive advantage. In this process the establishment of sector is a quintessence (Alvarez *et al.*, 2009), allowing companies to focus on and develop their core activities.

Problem of the research – could it still be useful to renew the Porters Diamond Model for competitiveness environment evaluation of the Lithuanian Maritime sector industry?

The main purpose of the paper is to analyse several clusters models (Nine-factor model, Double diamond model and others) on the basis of competitiveness and concentrate on the classical one – adopt M. Porter's Diamond model methodology for the evaluation of the competitive advantage of Lithuanian Maritime sector's clustering.

However, for national competitive advantage to occur and be identified, it is not sufficient to have amount of successful but unconnected industries (Benito *et al.*, 2003). It is also important to develop regional, country-based industries that are productive, competitive and related to each other through various supporting synergetic conditions. According to M. Porter he value creation

potential of industries – their competitive advantages, is derived from the configuration of interrelated determinants.

In his earlier work, Porter (1990) developed a model which identifies the key sources of competitiveness, named Diamond Model. The model presents that competitiveness is gained from four interrelated influences according to 1) factor input conditions, 2) demand conditions, 3) related and supporting industries, and 4) the context for firm strategy and rivalry. The geographical concentration that occurs in clusters among actors enhances the processes of interaction between these four factors. While the diamond model is well-known to cluster researchers, we feel it is important to comment the model.

Background for research. Many of the studies (Wergeland, 1999; Heaver *et al.*, 2000; Langen, 2002 and others) present investigations of the various maritime related sectors in conjunction and analyze how they fit together. Others (Knarvik *et al.*, 1999; Manus, 2007 and others) look for potential linkages between the service-oriented shipping sectors and the manufacturing-oriented ship industry sectors.

Although the literature on industrial sectors is abundant and is still increasingly tremendously, most of the literature focuses on the most of the explaining reasons for the success of such kind of regions and does not solve the question how these specific sectorial industry profiles come into existence. In most of the case studies (Zhang etc., 2006), this question is presented for the specific situation of the region that is observed. That is to say, those studies to some extent can be described with very specific explanation for specific emergence and development of a specific sector clustering.

Industrial clusters, such as Maritime clusters, have been defined by leading scientists in the past and they are still vital-adopted for regional economic development as clusters in particular regions enhances regional long-term competitive advantages. Thus, clusters are geographic concentrations of interconnected companies, specialized suppliers and service providers, firms in related industries, and associated Institutions (i.e. universities, licences agencies and trade associations) in particular essential fields that compete but also cooperate (Porter, 1990; Fernando *et al.*, 2012).

Presented research paper is valuable concerning the analysis of adopted Diamond model, which could be useful for measuring competitiveness of the national Maritime environment in which individual business units, organizations and industries operate. Adoption of M. Porter's Diamond model methodology for clustering abilities evaluation in Lithuanian Maritime sector is original and on the basis of real sector clustering abilities economic evaluation, which was never presented before.

2. Method

A central point in this research is therefore the Porter's Diamond Model. A deductive approach is applied in this article. Used research methodology: scientific literature analysis and synthesis, primary and secondary data collection, non-experimental research. Concerning the theoretical approaches, the case study of Lithuanian Maritime Sector clustering on presented Porter's Diamond Model determinants here is summarized.

3. Results

Before starting, it is necessary to deal the term, which will be used in this article – cluster. Having similarities with economic agglomerations, clusters are created by interrelations between firms that conduct business activities in the same field and in which innovation is an important power that influences the competition level and the companies' development stage (Krugman, 1991). Clusters include customers and distribution channels, manufacturers of raw and complementary products or services, companies related by knowledge, technology use or common inputs, linked industries, suppliers of specialized inputs, machinery, automotive services and specialized infrastructure, related institutions such as universities, other research organizations, training, standard-setting and licencing organizations and associations (Cortright, 2006). Maritime sector clustering processes on the basis of competitiveness perspective here are analysed through

cluster determinants.

There are some existing models in explaining the development of industrial clusters. Among them, Porter Diamond Model prominently stands out. Porter (1990) pointed out that huge variety of definitions and perspectives existed with the concept of competitiveness, as cannot term which one is best (Fernando *et al.*, 2012).

M. Porter's Diamond and related models importance

M. Porter developed Diamond Model to explain a specific national or regional competiveness. M. Porter used a diamond-shaped figure as the essential basis of a framework to illustrate the components of achieving the national (regional) advantage. M. Porter (2000) considers that the industrial cluster is the result of the four interrelated conditions combination that makes the "diamond of competitive advantage": factor conditions, demand conditions, related and supporting industries, and firm strategy, structure and rivalry.

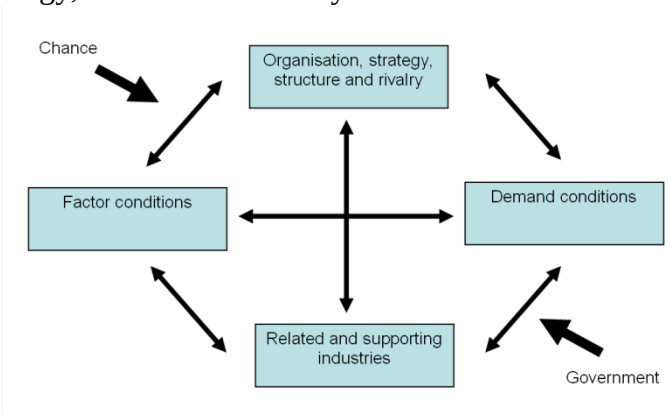

Figure 1. Porter's Diamond Model

1. Factor conditions: these conditions include factors of production such as specialized infrastructure, skilled labour force, and educational institutions that all companies in the cluster can use it. Demand for products and services from the specialized cluster will increase, because no other known type of location could provide the same complex of services and products.
2. Demand conditions: demanding customers will influence industry cluster companies to continuously innovate and stay on the high-top position. Cluster companies must cooperate with their customers in order to meet their needs and follow them. Meeting and identifying the demand of customers will help cluster firms to compete more successfully in global markets.
3. Firm strategy/rivalry: this factor refers to the conditions governing corporate organization and aspects of rivalry among firms strategies in the same cluster. If cluster companies choose to continuously overview, renew and invest, then they will remain competitive (Zhang etc., 2006). If these companies compete with others in the same industry cluster, they will be motivated to constantly innovate in order to differentiate themselves from their rivals. Both firm strategy and rivalry influence regional competiveness drawing on regional innovation systems dynamics.
4. Related and supporting industries: this aspect refers to the contemporary of capable, locally-based suppliers and competitive related industries. Cooperation between companies and their suppliers creates innovations (Zhang etc., 2006), because it is necessary to those companies to exchange knowledge and technologies about new services and products.

M. Porter argues (Zhang etc., 2006), that the more developed and intense the interactions between these four sets of factors, the greater will be the productivity of the firms concerned.

Chance: usually referred to such big reform and breakthrough as innovation, technology and knowledge transfer, general invention, technology, and market needs. Chance conditions are crucial to the industrial competitive advantage gaining.

Government: the decisions of government that influence the competitiveness of industrial clusters through different means such as policies and strategies, rules, regulations, taxation, etc.

As mentioned earlier, there are many debates about Porter's Diamond Model. Developed countries domestic firms can establish competitive advantages depending on their home base. But to small counties economies, especially developing counties, the firms do not necessarily obtain their domestic economic equivalent to the diamond model, some of them lack enough large market, others lack capital and technology conditions.

Based on the Porter Diamond Model and trying to introduce some adoptions to the Diamond Model, many researchers developed their explanatory models to nation competiveness (Boja, 2011; Manus, 2007 and others). They also can be viewed as models to explain the emergence and evolution of Maritime cluster factors and conditions.

Rugman and D'Cruz (1993) argues, that only home country Diamond cannot explain and analyse the competitive sources of Canadian firms, because of the America-Canada Free Trade Agreement, multinational activity between two countries are increasing. Based on this point, Rugman and D'Cruz developed Double Diamond Model (Figure 2).

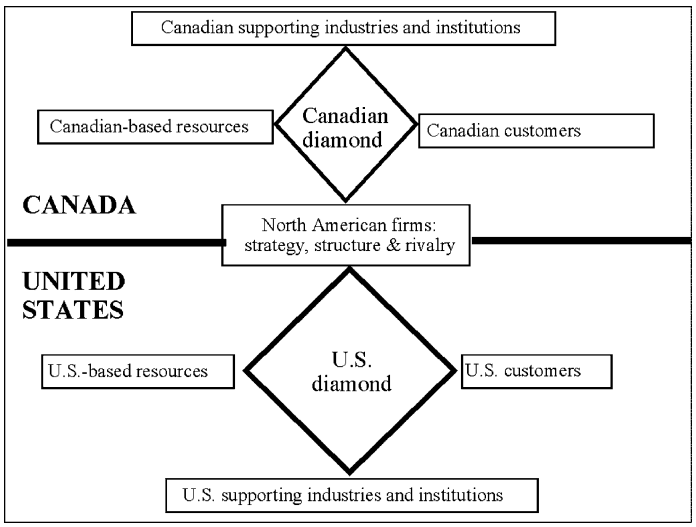

Figure 2. Rugman and D'Cruz Double Diamond Model

Because this Rugman and D'Cruz model was applied just for Canada and USA economic relations, other scientists (Moon, Rugman & Verbeke, 1995) further expanded Generalized Double Diamond Model, which is appropriate to all small countries' economies (Figure 3).

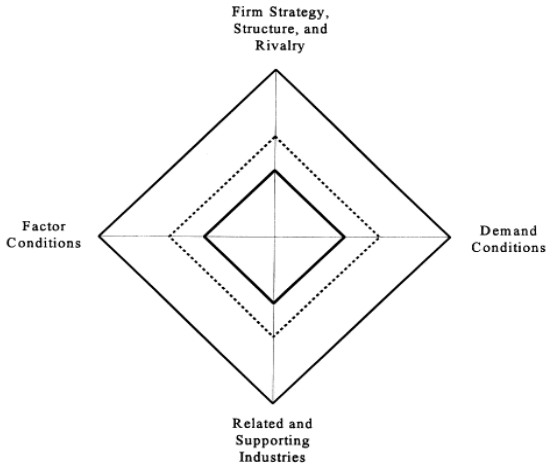

Figure 3. The Generalized Double Diamond Model

In this model (Figure 3) the Diamond consists of domestic Diamond and international Diamond, also global Diamond. The inside-line shows the domestic Diamond; the outside-line

represents the global Diamond and the line between them stands for the international Diamond, which means multinational activity (Moon, Rugman & Verbeke, 1998).

Other model, the Nine-Factor Model, was created by South Korea scientist Cho D. Sung (1994). Based on country's experience, author argues that the determinants of competitiveness can be grouped into two divisions: 1. Material factors including resource endowment, commercial environment, related and supporting industries and domestic demand; 2. Human force factors, which consist of labour force, politicians and bureaucrats, entrepreneurs and professional managers, and they all create, inspire and control other four material factors and improve the competitiveness.

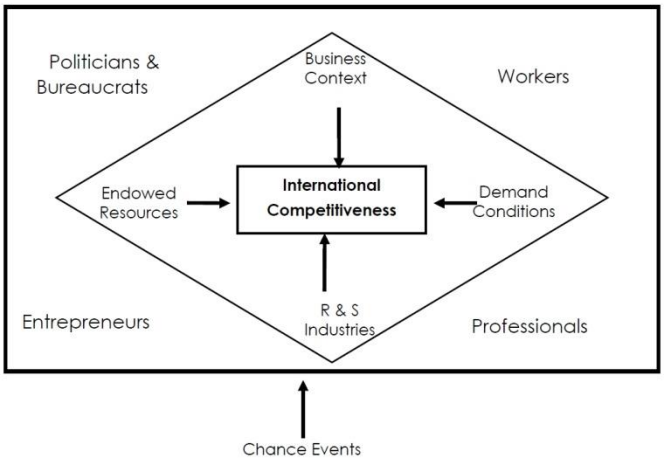

Figure 4. Nine-Factor Model

It has to be mentioned, that above represented models are based on the specific economic background, thus these models inevitably have their own limitations.

Another model defined by Solvell (2008), is built around the actors which decisions and actions can influence the cluster development (Figure 5).

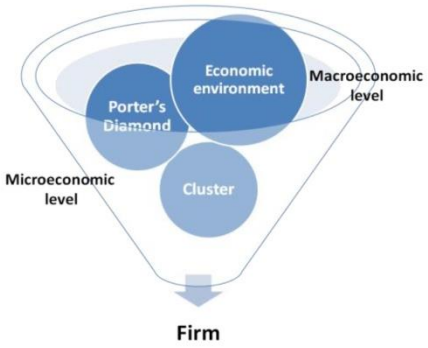

Figure 5. Funnel model of cluster determinants

The cluster is an economic case that is affected at all economic conditions (Solvell, 2008): (1) locally by microeconomic and regional development policies; (2) macroeconomic – by the country and global economic environment; (3) at company level by the economic relations inside the cluster structure.

Over the past two decades, field of research has been grown which has forced to develop a theoretical and conceptual basis for achieving the competitiveness level. The contemporary stage in the developing knowledge and competitiveness theory having achieved a convenient basis upon which to identify relevant attributes of destination or cluster competitiveness, as an added value in turning the focus of research move towards achieving relative importance of attributes on productivity and competitiveness. In the decade of 1990's, Crouch and Ritchie developed a conceptual model of destination competitiveness, by combining the factors and conditions in Porter's Diamond model (Fernando *et al.*, 2012) (Figure 6).

Figure 6. Ritchie and Crouch Destination Competitiveness and sustainability model

Their model presents destination competitiveness, which is based upon destinations' resource achievement and abilities to deploy resources and acknowledge the power and impact of global macro environmental conditions and competitive micro environmental effects, (Ritchie and Crouch, 2010). Inspired by the idea of making more competitive towards tourism sector, Dwyer and Kim introduced an integrated model by combining the main elements in Crouch and Ritchie model and Diamond model (Fernando *et al.*, 2012).

Although, Porter's cluster theory has faced criticism for its profundity, it has proven as the most influential and still convenient tool for analysis of cluster environment and has become a classic concept in the field (Maritime cluster analysis on the Central Baltic region, 2012).

As the message of clustering was discussed in 90's by Porter, is quite challengeable and still in wide variety of discussions in present research times. The clusters are relevant to all types of geographical locations and different in their activity areas, size, economic impact, but as in common, exhibit positive impacts of company productivity proximity. Globalization has given more impact to specialization as new clusters develop in transition economies and old clusters in advanced economies focus on much more advanced or specialized activity areas or disappear.

Cluster characteristics and factors in the Lithuanian Maritime Sector

The adopted M. Porter's Diamond model could create convenient theoretical basis and have practical implication for real Lithuanian Maritime sector's clustering abilities evaluation. It also could help to systemize basic cluster characteristics, that can be identified in the Maritime industry competitiveness patterns and measure the reasonable impact factors, which are identified in Lithuanian Maritime sector, in whole clustering abilities evaluation system, based on adopted Diamond model structure.

As pointed earlier, there are four critical areas for testing industrial sector clustering features: Factor conditions, Demand conditions, Firm strategy, structure and rivalry and Related and supporting industries. In addition to those features of a country's competitive area, there are two meaningful influences: Government and Chance – that may have impact on a level of success achievement. Each of those elements will be theoretically analysed in the following context of the Lithuanian Maritime Sector.

Factor conditions. Factor conditions concerning Lithuanian maritime sector, cover several components from economic, cultural, educational, technological and other important areas. Access to specialized competence in particular research through technology transfer, technology and

market knowledge increases the quality of products and services. Klaipeda University and Lithuanian Maritime Institute are the main suppliers for such specialization competences.

Regarding the factor of input conditions, the Diamond model focuses the importance of specialized inputs such as availability and cost for labour, capital and land. Such specialized conditions develop to fit the needs of a particular economic activity, such as the availability of trained labour force or a research infrastructure that is specifically oriented to the cluster's company's needs (Teigland *et al.*, 2007). These conditions are important as local factors since they are difficult to be allocated and difficult to imitate in other geographic regions.

Lithuanian Maritime Sector creates its own important factor conditions such as skilled resources and technological basis. Influenced conditions such as a labour power or scarce raw materials tend companies to develop new methods and this innovation often leads to a national long term comparative advantage. Even Lithuanians do not have strong linkages to maritime traditions and culture, the knowledge and competence also maritime cultural identity strengthening of those that work in a sector is on the premium importance. A dependence on exports and imports through the seaports, shipbuilding, ship repair and cargo transfer have strengthened the connections to maritime activities and provided a rationale for developing a maritime educated workforce.

Physical resources such as access to modern shipyard, well developed infrastructure and superstructure are vital for Lithuanian Maritime Sector. Despite of seasonal variables, Lithuanian maritime port is active through round-year period.

Demand conditions. The maritime industry is by its nature a global industry. Maritime industry demand conditions reflect the Global demand trends. Lithuanian Maritime sector companies follow the situation in global market and successfully operate within various niches in global shipping markets. Most of the turnover comes from overseas trade in the Shipbuilding and ship repair sector and the similar figures are for maritime services industry, shipyards.

Lithuanian Maritime Sector companies successfully develop products, primary and support services, know-how and commonly wishes to become and industry leaders in the global market. Although much of the activity in the maritime sector is internationally oriented, demand conditions in the home market remain important.

Demanding customers put pressure on local firms to develop new products and services also care about rate of innovation, what later leads Maritime sector companies to trade in global market. While the local market size can strongly influence local competitiveness, demand conditions are accepted primarily as qualitative factors in the context of an industrial maritime sector. Thus, the diamond cares that sophisticated and demanding local buyers contribute to a cluster's productivity and competitiveness basis. A strong specialized local market forces local companies anticipate global activity areas and economic trends.

However, many of the Lithuanian maritime sector companies are strongly dependent on a set of very few customers and manage very narrow markets, level of innovation also depends on innovation demand formed by customers.

Firm strategy, structure and rivalry. Major part of the Lithuanian Maritime Sector firms is internationally identified and internationally competitive. Although most of these companies are well-known in Baltic Sea region market. Strong competition in national and international environment plays important role in competitive environment both: nationally and internationally.

The Diamond model focuses mostly underlining the importance of local rivalry. The idea is that local rivalry fulfils intensity and an economical dimension to the competition that most companies perceive in the global market. Firms in a local environment tend to develop relations of rivalry, where the company down the road is often seen as the "prime enemy". Benchmarking in relation to countries neighbours (companies and networks) is more direct, mostly for reasons of local prestige and partly because direct comparison is simplified (Malmberg & Maskell, 2002).

Local rivalry forces Maritime sector firms to move beyond basic advantages that the home country may enjoy, such as low factor costs. Cooperation between companies tended to happen most often for activities related to common interests between firms, however it is difficult to recognize clear relationships and collaboration aspects generally. Most of the companies try to

strengthen the efficiency and innovation separately; despite of other Maritime sector companies needs even on the basis of collaboration abilities and outputs.

Related and supporting industries. It must be noted, that there's no industry without linkages to cooperation between. Reliable access to good quality supplies at the right price is the key to make a profit while keeping customers satisfied. Also, complementary competences are needed to cover new ground in the development of new products and processes (Benito *et al.*, 2003).

Related industries to Lithuanian Maritime Sector can be identified as industries which partly coordinate and share activities in the value-chain and the those which produce complementary products related to the core industry: Communications and IT industry, electricity equipment manufacturing industry, metal products, machines and equipment manufacturing industry, chemical industry and related sectors representing research and education part, also public services transferring and marketing. Although, institutions like Klaipeda University and Lithuanian Maritime Institute are valuable providers of new knowledge in analysed sector, still there is a lack of permanent strong relations for research and development (R&D) relations between research institutions and Sector companies; most of R&D contacts with the scientists are based on personal initiatives for separate periods of the "problem-solving" or "task-solving" collaboration basis. According to the survey, shipping services during the past two years had lower contact intensity with R&D institutions than ship building and ship repair had the closest contact.

Finally, in terms of related and supporting maritime industries, the Porter's Diamond model points to the issue that innovation, productivity and competitiveness tend to be shared through synergy effect across firms and industries locally. In other words, the presence of a set of world-leading suppliers in separate regions may positively impact the upgrading of other companies in the local economic system by not only helping to develop production and reduce transfer costs, but by also further enhancing competitiveness through innovation in agglomerated developments.

When local supporting industries are competitive (Mohamed, 2010), companies enjoy more cost share, cost effective and innovate inputs. This effect is strengthened when the suppliers themselves are strong international competitors.

Government and Chance. Lithuanian government plays an important role in shaping the environment in which Lithuanian Maritime sector companies compete. Government instruments are: tax regimes, large-scale investments in infrastructure and port superstructure, various support and subsidy schemes, which affect competitiveness of the firms and its agglomerations. The policy emphasis by following the requirement of Structural funds affecting policy was re-directed towards upgrading skills, resources and capacity in Maritime sector, instead of previous focus on costs sharing and costs reducing strategies. Although for shipping companies' tax policy issues still are their prime policy instrument target since 1990.

The Lithuanian Maritime Sector is meaningfully was influenced by a variety of chance factors – factors that largely outside the scope of control of individual participants in an industry (Benito *et al.*, 2003). One of the influencing factors is concerned with the Ministries control areas – the same Maritime Sector industry elements are under the control of different Ministries: Port as control area belongs to Ministry of Transport and Communications, while maritime sector companies, mostly representatives of shipbuilding and ship repair sub sectors, are under Economy ministry control area.

Other examples range from economic factors like market cycles, exchange rates, oil price levels to such factors as new technologies that on the extreme can affect industries efficiency. In terms of technology development speed, the most profound undoubtedly is the IT and communications area, which may open unforeseen developments in logistical systems (Stopford, 2002).

Diamond dynamics

It must be noted, that the above mentioned factors and determinants have been analysed separately as if they were without linkages to each other. The effect of one point in this Diamond Model depends on others (Mohamed, 2010). As example, factor disadvantages will not support companies to innovate unless there is enough sufficient rivalry. The Diamond in this meaning is

self-reinforcing system. For example, a high level of rivalry often leads to the formation of unique specialized factors.

There is no still established method which could capture the all important interactions between the factors in the Diamond Models which obviously influence each other and which are continuously in conditions of change (Benito *et al*., 2003). Together they combine a complex, changes and it is whole system that establishes the competitive position of the Maritime Sector.

Strong and vital industrial sectors are recognized by their self-reinforcing upgrading systems, such as: pressure for innovation, complementary resources and knowledge externalities, which in turn lead to higher performance within rather than outside clusters (Porter, 1998; Benito *et al.*, 2003).

Fernando, I. (2013) explains, that the present stage in the developing destination competitiveness theory and knowledge having achieved a good basis upon which to identify relevant attributes of Maritime sector destination or cluster competitiveness, as particular value in turning the focus of research move towards assessing relative importance of attributes on competitiveness.

Despite of Porter's work, other researchers have continued to develop and have provided the explanation of some interesting insights, for example economic sociologists investigating innovation and learning processes in cities and regions and economists more focusing on the relationships between agglomeration structure and goals,, specialization rate and trade proximity. As a result coming from analysis, the level of attention and amount of studies which are focused on clustering analysis is still increasing.

4. Discussion

Porter's Diamond model methodology for competitive advantage model of Lithuanian Maritime sector is analysed and presented through four main attributes: Factor conditions, Demand conditions, Related and supporting industries, also Firm strategy, structure and rivalry. Additionally two following variables, that indirectly influence the Diamond, are analysed in the context of this Lithuanian industrial sector: Chance events and Government. These six attributes promote or impede the creation of competitive advantages.

All conditions are presented as favourable for Lithuanian Marine sector. Analysis results show effective and convenient Lithuanian Maritime sector clustering abilities evaluation methodology. Although clustering analysis on the basis of M. Porter's Diamond model highlighted its advantages, the interconnection of conditions, factors and effects on the clustering, the economic theory has not yet explained and provided principles of model that allows the definition and the analysis of a process for implementing a successful clustering research.

The original Diamond Model describes what criteria a business region must meet in order to build an international competitive cluster environment in a Macro Economic perspective (Ekelund et al, 2007). Therefore, some of these criteria must be beneficial for the individual companies, since a successful cluster is consisting of successful companies. This is how the criteria of the Diamond Model are converted into Micro Economic benefits.

Porter presents clusters from Micro Economic perspective, i.e. how the companies benefit from a cluster environment. Since the introduction of the Diamond Model, a number of theories from different schools have been presented. Porter argues his Diamond model to be generally applicable, but as other theories are presented over time, there are a number of benefits not mentioned in Diamond Model.

Although, cluster model via Diamond structure and its variations highlighted their principal advantages, the interconnection of factors, conditions and their effect on the cluster, the economic theory has not yet explained neither provided a principle model that allows to define and to analyse successfully cluster determinants on the basis of competitiveness.

Due to the economic relations complexity and environment conditions that define cluster, it is necessary to develop research and modify Diamond model, that the theoretical structured model is validated in practice by adopting it with any existing clustering case.

Generally it must be noted that M. Porter's Diamond model could be successfully renewed

and adopted for the measurement of the reasonable impact factors to the competitive environment evaluation of the Lithuanian Maritime Sector industry the necessary conditions, industries, strategies and structures evaluation by following the Diamond model methodology. Although the original Diamond model does not cover the determinants of internationally-linked advantages, it still stays actual methodology for the industrial competitive advantages evaluation and could be modified by adding international dimension.

It is necessary to continue research from theoretical and practical perspectives, so that the theoretical models could be validated in practice by testing it with any existing cluster case.

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