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Geographical Sources of Firm Innovation: Maritime Suppliers in Møre & Romsdal

A quantitative approach

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Acknowledgements

This master thesis marks the accomplishment of my Master of Science in International Business and Marketing at Aalesund University College.

As part of my master degree within International Business and Marketing I have chosen the subject of my thesis based on personal interest and work experience in the maritime industry. As such, several of the issues in this work gives me as a writer extra motivation and experience to pursue this topic. It is important that innovative development takes place in firms to stay globally competitive in the future. As such, I have chosen the topic due to my curiosity for the maritime sector and their sources of innovation. Therefore, this thesis presents and discusses several issues which are relevant for innovation oriented companies not only for firms within Møre and Romsdal, but also other Norwegian companies in similar industries.

First of all I would like to thank Professor Rune Dahl Fitjar for his kindness of providing me an adequate questionnaire. I would also like to thank Møreforskning for providing me a list of classified firms within the maritime Møre and Romsdal cluster. A thank to all the companies that have taken their time and effort to participate in my quantitative research. All the respondents gave me valuable information and enhanced my knowledge about both industry and firm innovation dynamics.

Most importantly, I would like to extend my deepest gratitude to my supervisor, Professor Erik Nesset for sharing his insights, his enthusiasm and interest in my thesis. He has provided valuable guidance throughout the entire writing process of this master thesis.

Finally, I acknowledge that my approach can be considered new and experimental. Therefore, I recommend that additional research is completed to further analyze the innovation tendencies in maritime Møre and Romsdal cluster. That said I hope that my work can provide a starting point for more knowledge about cooperation and knowledge flows between local and external partners.

“It is the long history of humankind those who have learned to collaborate and improvise most effectively have prevailed.”

- Charles Darwin

Abstract

Recent literature discusses the geographical sources of firm innovation. However, there are disagreements regarding the relevance of international linkages and knowledge flows over local interactions in clusters. New research indicates firm innovation is both the result of Science, Technology, Innovation (STI) and Doing, Using, Interacting (DUI) of firm learning. Fitjar & Rodríguez-Pose (2013) contribute to this debate by classify different types of firm interaction into STI-mode interaction (with consultants, universities, and research centres) and DUI-mode interaction, distinguishing between DUI interactions within the supply chain (i.e. with suppliers, customers) or not (with competitors). This thesis adopts the methodology of the authors to analyze the sources of innovation of the maritime suppliers in the Møre and Romsdal cluster. This population is chosen as the suppliers are known as highly knowledge and innovation driven. By means of logit regression analyses, the findings indicate that both DUI and STI-modes with regional partners have an insignificant effect for innovation, while regional firm interaction outside the supply chain may be associated with lower level of innovation. However, collaboration with international linkages within the DUI-mode supply chain matter for innovation. These findings are discussed in terms of the geographical importance of local and non-local knowledge flow for the maritime suppliers in Møre and Romsdal.

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1. Introduction

It has been widely acknowledged that innovation is crucial for sustainable competitive advantage and economic growth (Edquist, 1997; Schumpeter, 1948; Waxell & Malmberg , 2007; Porter, 2008; OECD, 1999). Not surprisingly, innovation studies have become a key research area and led to an array of theories, concepts and methodologies. The traditional view emphasizes local interaction in close geographical clustering between agents as a prerequisite for innovation (Porter, 1990; Bathelt, 2001; Baptista & Swann, 1998). The main argument is that industrial districts (clusters) provide the best context for the promotion of localized learning (Asheim, 2002).

While the traditional views argue that local clusters are key element for the innovative capacity of firms, the recent literatures have been stressing the importance of establishing communication channels to the outside world (Bathelt et al. 2004; Bramwell et al. 2008; Fitjar & Rodríguez-Pose, 2011, 2012, 2013). The global business world is driven by international interaction and feedback mechanisms that cross industry boundaries (Boschma & Iammarino, 2007). International linkages are a prominent characteristic of many successful clusters around the globe (Bresnahan et al. 2001).

But if innovation is one of the keys to prosperity, then precisely how does this happen? A variety of scholars have tried to demonstrate the sources of the innovation processes. Two streams of innovation modes stand out. First, is the "Science, Technology, and Innovation" (STI) mode. This mode is based on science and technology, which is driven by investment in research and development (R&D) and by human capital. Second, is the experienced based "Doing, Using and Interacting" (DUI) mode. This mode, on the other hand, emphasize learning-by-doing, by-using and by interacting, and is based on interactive experience and practice (Jensen et al. 2007; Lundvall & Lorenz, 2008; Fitjar & Rodríguez-Pose, 2013). As a result, the innovation process can be seen as DUI and STI-modes of firm learning, combined with both local and global interaction that has to work together to foster firm-level innovation (Isaksen & Nilsson, 2012; Fitjar & Rodríguez-Pose, 2013).

A recent contribution of the STI and DUI-modes literature is the authors Fitjar & Rodríguez-Pose, (2013). They studied 1,600 Norwegian firms from variety of sectors by analyzing to what extent STI and DUI-modes of innovation are related to firm level in Norway. They classified different types of firm interaction into STI-mode interaction (with consultants, universities, and research centres) and DUI-mode interaction, distinguishing between DUI

interactions within the supply chain (i.e. with suppliers, customers) or not (with competitors). The conclusion to the authors stresses that firms engagement with external agents tend to be more innovative than firms that rely on their own resources for innovation. Both STI and DUI mods of interaction matter for innovation (Fitjar & Rodríguez-Pose, 2013). Hence, the following research questions for the present thesis are proposed:

1) *Does collaboration with different partners improve the likelihood of innovating?*
2) *Do different types of partners result in different innovations?*
3) *Is regional partnership more important than global partnership when it comes to innovation within a cluster?*

In order to address these issues, the present thesis follows the methodology developed by Fitjar & Rodríguez-Pose, (2011, 2013). However, while Fitjar & Rodríguez-Pose (2013) analyses was based on firms from all kinds of sectors, I will provide a more homogeneous sample by focusing on one particular sector. The context is the maritime suppliers of Møre and Romsdal (shortened to M&R) cluster located in the west coastal region of Norway. This industry is characterized as knowledge and innovation driven, making this population appropriate. Although the M&R region is relatively small, this industry constitutes an interesting empirical context. Møre and Romsdal is home for one of the world's leading offshore clusters. The cluster covers the entire value-chain (from ship design to ship operations) of the offshore market that delivers the most modern and advanced offshore vessels in the world (NCE Maritime, 2012). It received the status of Norwegian Centre of Expertise Maritime in 2006 (NCE Maritime, 2012). However, the global environment for the maritime industry is changing rapidly. Increasing competition, environmental solutions along with technology progress are some of the triggers of the current challenges. In order to meet these challenges, firms need to innovate if they are to stay in the game (UGLAND, 2013).

According to Bathelt et al. (2004) relative few studies have provided satisfactory empirical evidence of the superiority of local over non-local interaction. Similar to Fitjar & Rodríguez-Pose, (2011) the potential quantitative methods to uncover the mechanisms through which firms in clusters harvest knowledge and innovate, has been largely overlooked. Further whether local interaction and global value chains are linked to different types of innovation has rarely been demonstrated, especially within a cluster.

The contribution in this thesis is thus to offer more insight on whether local or global collaboration with different partner types are conducive to different types of innovation and fill a gap in the existing literature. In order to get a more in depth understanding of the factors behind the innovation I will distinguish between product, process and radical innovation. However, it is believed that in the maritime M&R cluster regional DUI-mode network are more effective than non-regional ones in producing innovation, whereas the opposite is true for collaboration with STI-mode partners. Figure 1 depicts the theoretical links of this thesis. The economic performance is only for illustrative purpose as innovation is believed to enhance business performance, but will not be treated in this thesis. Further, types of innovation are assumed to be influenced by different geographical sources of STI and DUI modes, as well as control variables firm size and R&D local.

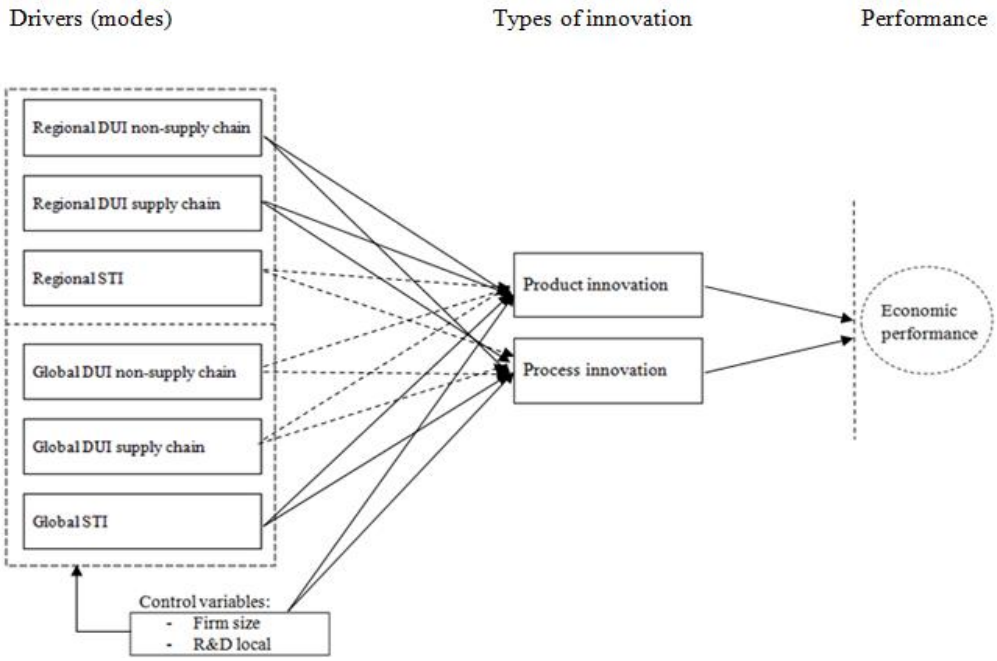


Figure 1: Conceptual model

This thesis is organized in 9 chapters and has the following structure: The first chapter contains the introduction. Chapter 2 portrays the theoretical background for innovation and its sources, where the hypotheses are established based upon previous literature and the research of Fitjar & Rodríguez-Pose (2011, 2013). Chapter 3 describes the context M&R maritime cluster and its characteristics. Chapter 4 contains the method and data collection, followed by validity and reliability, and the operationalization of the variables. Chapter 5 and 6 presents the results and discussion of the research. Chapter 7 and 8 gives implications and limitations. While finally, chapter 9 gives conclusions and final remark of the present thesis.

2. Theoretical framework

2.1 Innovation and its genesis

Over the past 30 years, innovation management is an increasingly covered topic in scientific and management literature (cf. figure 2).

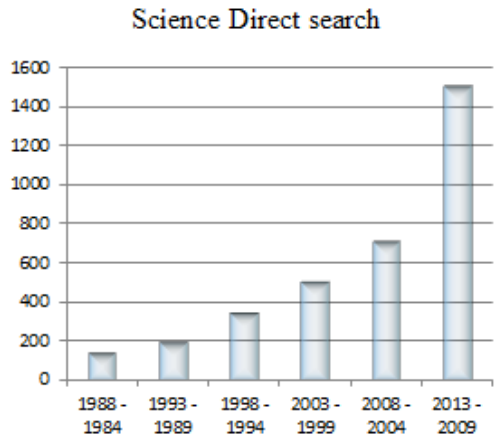


Figure 2: Number of papers and books about innovation management over the years as searched in Science Direct (Search: innovation management. Fields: keywords, abstract, title. In: all books and journals).

The interest for this particular area is given the realization that successful innovation provides firms with advantages over its competitors (Lipczynski et al. 2013). Schumpeter was one of the pioneers in recognizing that innovation was the principal driver of competitive advantage and economic growth. Much of the theoretical and empirical analyses of the economics of innovation are based on his ideas (Schumpeter, 1928,1948). Already in 1934, Schumpeter explained the important role of innovation. He argued that technological change by means of innovation as the fundamental motivation behind the growth and development of the capitalist economy. However, one of the central point's regarding interpretations of empirical work on innovation is the lack of a clear definition, which makes it difficult to compare results or to generalize them (Schiele, 2006). In its most basic meaning, the word "innovation" originates from the Latin word "novare" meaning renewing and indicates the introduction of something that did not exist before (Schiele, 2006). Schumpeter defines the concept of innovation widely, by including that innovation is a set of new upgradeable functions that change the methods of production. This creates new forms to organize work and to produce new products. It also enables the opening of new markets by creating new uses and consumption. Following this view, innovation can be defined as the actual use of change and improvements in a process, product or system that is novel to the institution developing the change (Freeman & Soete, 1997).

However, in modern economists view, a distinction is often drawn between product and process innovation. *Product innovation* refers to the act of bringing something new to the market place that improves the range and quality of products. While *process innovation*, refers to a new way of making or delivering goods or services (Lipczynski et al. 2013). The distinction between product and process innovation is not always obvious. New products often require new approaches of production; and new production processes often alter the characteristics of the final products. Accordingly, one firm's product innovation may be another firm's process innovation (Lipczynski et al. 2013). By looking at this from an even more narrow classification, definition of innovation has been suggesting that both product and process innovations can also be "radical" or "incremental" innovations. Thus, *incremental* innovation can be contrasted with *drastic* innovation. The incremental innovation makes a small change to an existing process or product. Drastic or radical innovation introduces a completely new type of production process with a wide range of applications and gives rise to a whole new genre of innovative products usually new to the market (Fitjar & Rodríguez-Pose, 2013). The major difference captured by the labels "radical" and "incremental" is the degree of technological novelty, and hence the degree of new knowledge, embedded in the innovation (Un, 2010). Table 1 shows an overview of the different innovation types. Though seldom examined, radical innovations are important to the economic sustainability of firms in industries that are dependent on competitive research and development for competitive advantage and long-term survival (Koberg et al. 2003).

Table 1: Overview of innovation types and its characteristics (Sources: OECD, 2005; Terziovski, 2007).

Type of innovation	**Characteristics**
Product innovation	Product innovation is the introduction of a product or service that is new or significantly improved with respect to its characteristics or intended uses.
Radical product innovation	Radical innovations produce fundamental changes in products or services that are new to the market.
Incremental product innovation	Incremental innovations build on existing knowledge and occur continuously in the firm. These innovations lead to small improvements in products or services.
Process innovation	A process innovation is the implementation of a new or significantly improved production or delivery method. Process innovations can be intended to decrease unit costs of production or delivery, to increase quality, or to produce or deliver new or significantly improved products.

Radical process innovation	Radical innovations produce fundamental changes in processes that are new to the market.
Incremental process innovation	Incremental innovations build on existing knowledge and occur continuously in the firm. These innovations lead to small improvements in processes.

Degree of novelty	**Characteristics**
New to the firm	The minimum entry level for an innovation is that it must be new to the firm. A product or process method may already have been implemented by other firms, but if it is new to the firm (or in case of products and processes: significantly improved), then it is an innovation for that firm.
New to the market	Innovations are new to the market when the firm is the first to introduce the innovation on its market. The market is simply defined as the firm and its competitors and it can include a geographic region or product line. The geographical scope of new to market is thus subject to the firm's own view of its operating market and thus may include both domestic and international firms.

2.2 Innovation and Cluster

However, innovation cannot only be seen from a technological perspective, but has to be understood more as a social process (OECD, 1999). Accordingly, drivers of innovation are based on the idea of networks. Within these networks, new knowledge and information is developed in close interaction exchange with a series of network partners (Schiele, 2006). Firms in this collective learn by formal and informal interaction that can be seen as a process of know-how accumulation or a learning process both within and outside the firm (Breschi & Malerba, 2005). Therefore firms are not regarded as isolated, individual decision-making units (Edquist, 1997), but should rather be understood as an interactive and systematic process. As stated by OECD (1999) networks of innovation are the rule rather than the exception, almost all innovative activity involves multiple actors. Thus, the innovation process can be understood as a process of interactive learning where actors involved enhance their know-how (Lundvall & Lorenz, 2008).

A well-known author within the field of networking is Porter. He argues that today's economic map of the world is dominated by networks or what he calls "*clusters"*. They are "critical masses - in one place - of unusual competitive success in particular fields". Clusters are not unique, they are extremely typical - and therein lies the paradox: the enduring competitive advantages in a global economy lie increasingly in local settings (knowledge,

relationships, motivations) which distant rivals cannot imitate (Porter, 1998). This argument mainly considers the role of the local environment for competitiveness and growth, where one highly recognized outcome of clusters is innovation (Porter, 1990; Isaksen, 2009). Because of the advantages clusters are expected to bring with them, several terminologies of cluster throughout the history have been created depending on the field of interest e.g. industrial districts (Marshall, 1920) the new economic geography (Krugman, 1991) regional innovation systems (Cooke et al. 1997), and clusters (Porter, 2008).

The pioneer within the field of network can be traced back to the late 19th century under the heading of "industrial districts" by the economist Alfred Marshall (1920). He emphasizes the link between co-location by firms and economic efficiency as firms would group together into clusters in order to benefit from positive externalities associated with their respective activities (Schiele, 2006). Marshall further argues that by concentrating in specific regions firms achieve several advantages. These advantages are said to be easier access to, and reduced costs of, certain collective resources such as a specialized inputs, infrastructure, or access to a local labor market for specialized skills (Bramwell et al. 2008). Building on the theories of industrial district, Michael Porter has developed some of the most influential ideas within the field of clustering.

Porter (2008, p. 213) on the other hand defines clusters as: "geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (for example, universities, standards agencies, and trade associations) in particular fields that compete but also cooperate."

Even though this definition is broad and do not provide the underlying drivers for innovation, it gives a clearer picture of the dimension of networks that is made up of firm collaboration and knowledge exchange. It is reasonable to state that to a varying degree, that all the contributions of the network concept presented above is carried out as a social process embedded in a social structure that encourages interaction among several actors (Andersson et al. 2004). It has been argued in the literature that firms located in clusters are more likely to innovate than firms located elsewhere (Beaudry & Breschi, 2003; Bathelt et al. 2004; Porter, 2008; Isaksen, 2005; Baptista & Swann, 1998). Underpinning this argument Isaksen & Hauge (2002) states that clustering may work as an instrument that can stimulate firms' innovation activity and competitiveness. The potential benefits that firm agglomeration derives from

being located within a cluster arise primarily from the ready access to a collective set of resources available to firms co-locating in the same region (Gertler & Wolfe, 2006). Porter's (1990) work is consistent with this approach, where Porter emphasizes the competiveness of a nation or location is measured by the level of productivity of its industries. A nation depends on its industries ability to innovate and to stay competitive. In order to explain this phenomenon, Porter (1990) developed a framework based on a 4-year study of 10 countries, leading to the introduction of "Porter's diamond model" (cf. figure 3).

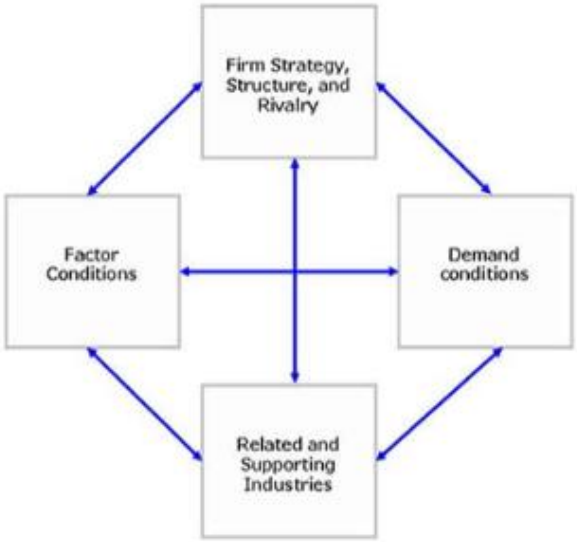


Figure 3: Porter's diamond model of national competitive advantage (Author revision of diamond model originally published in Porter, 2008).

The model illustrates four attributes that individually and as a system constitutes to analyze industries competitiveness. It assumes that domestic competitive interaction and rivalry stimulates firms to innovate and improve efficiency. Each factor affects each other and is dependent on the state of the other factors in the model. The diamond framework of innovativeness and competitive advantages includes the following variables:

- *Factor conditions.* Describe a nation's position of production, such as human resources, physical resources, knowledge resources, capital resources or infrastructure, necessary to compete in any given industry.
- *Demand conditions.* The nature of sophisticated home-market demand for the industry's product or service. As a consequence the firms get pressured to innovate faster and to create more advanced products than those of competitors**.**

- *Firm strategy, structure and rivalry*. Constitute the context for competition in the cluster, as well as how firms are created, organized, and managed. The presence of domestic rivalry is presented as important due to its pressure to innovate in order to upgrade competitiveness.
- *Related and supporting industries.* Produce inputs which are important for innovation and internationalization. These industries provide cost-effective inputs at the lowest possible transaction. In addition they also participate in the upgrading process, thus stimulating other companies in the chain to innovate (Porter, 2008).

In addition to these components, there are two residual influences; government and chance. The *government* plays a vital role in shaping the environment; i.e. investment in infrastructure, tax regimes, and various support and subsidy schemes, that shape the competitive environment of firms. Government interventions can occur at local, regional, national or supranational level. *Chance* on the other hand, is events that are outside of control of a firm. Pertinent issues are the increased environmental awareness (Porter, 2008). Other examples are market cycles, exchange rates, and oil price levels or new technology that on the extreme can erode entire industries (Benito et al. 2003).

Together these components constitute a theoretical framework for analyzing the conditions and innovativeness for developing industrial clusters. Each of these components will be examined in chapter 4 in the context of the Møre and Romsdal maritime sector from a supplier's perspective. It should also be noted that although Porter's diamond model contributed to the revolutionary development of explanations on national competitiveness, it has not been free from criticism. The model focuses primarily on the home-base of a country, and needs consideration of the international context to fully explain the national competitiveness of small and open countries (Rugman & D'Cruz, 1993).

2.3 Opening the cluster black box: Knowledge spillovers and local buzz

Clusters have by various researchers been characterized as innovative and unique phenomenon. However, a drawback within the cluster literature has been to uncover the precise channels and mechanisms that are involved in the spill-over process. This has led to the criticism of local knowledge spillovers being a "black box" (Breschi & Lissoni, 2001). To shed light on some of the drawback of proximity relations, different kinds of knowledge and

interaction has to be highlighted. The ability to innovate often emerges as a result of interactions between industry actors. In the form of business relations, collaboration, or social interaction between competent suppliers, demanding customers, competitors and rivals that possess complementary knowledge and skills (Porter, 1990; Waxell & Malmberg, 2007). The reasoning is that the interplay and interactions between actors within the cluster create new knowledge. Access to new knowledge is seen as one of the key ingredients for successful innovation and consequently firm performance. Knowledge can be described as facts, information and skills acquired through experience, work or education (Oxford English Dictionary). Knowledge flows through networks of informal and formal ties enables firms to build a broad pool of knowledge outside the firm (Simard & West, 2005). It is also critical to differentiate between different kinds of knowledge spillovers (Wolfe & Gertler, 2004). A common distinction in the literature has been that knowledge can either be easily **"**codified", meaning it can be standardized and written down in documents. Or it can be "tacit", referring to knowledge that is best mediated through face-to-face interaction and geographical proximity (Audretsch & Feldman, 2004). Tacit knowledge can often emerge from experience gained at the workplace, and through learning by doing, using and interacting (Lundvall & Lorenz, 2008). While, codified knowledge is easier to transfer over long distances than tacit knowledge (Gertler, 2003). Thus knowledge may rest on geographic boundaries, where the cost of transmitting information presumably rises with distance. According to Bathelt et al. (2004) new value can be created when locally embedded knowledge of the tacit kind is combined in novel ways with and accessible external knowledge. However, knowledge is not a public good produced outside the firms. Knowledge accumulates in time through usage, due to learning from experience, trial-and-error and is a particular input (Boschma, 2005). Implying that being part of a network enables a firm to exploit knowledge developments and facilitating problem-solving tasks through the sharing of experience obtained when dealing with similar technologies (Baptista & Swann, 1998). Hence, strong clusters foster innovation through heavy knowledge flows and spillovers (Muro & Katz, 2010).

However, Breschi and Malerba (2001) argue that the broader set of factors that support the effective transfer of knowledge in clusters is related to the high level of embeddedness of local firms in a very thick network of knowledge sharing. This is supported by close social interactions and by institutions building trust and encouraging informal relations among actors. As a consequence, geographical co-location suggests that within a cluster, actors benefit greatly from spatial proximity as well as cultural (institutional) proximity (Gertler,

1993). Advantages of proximity arise from continuous monitoring and comparing (Bathelt et al. 2004). Regional networks are reinforced by social and cultural bonds that result in a kind of 'social solidarity' made possible by geographical proximity and frequent face-to-face interaction (Baptista & Swann, 1998; Boschma, 2005). Even in the absence of contact, firms know about their competitors and understand their actions since they operate under the same rules (Bathelt & Taylor, 2002). Interaction may take place within a firm and between firms and other organizations. Firms may interact via various ways to access knowledge outside their boundaries. These benefits of local interaction have been advanced by Storper & Venables (2004), where they identified what they see as a particularly important subset of urbanization economies, which they termed "buzz". The buzz refers to information and communication ecology created by face-to-face contacts, co-presence and co-location of people and firms within the same industry and place or region. More narrowly this buzz consists of "mutual understanding of new knowledge and technologies, as well as shared cultural traditions and habits within a particular technology field, which stimulate the establishment of conventions and other institutional arrangements" (Bathelt et al. 2004, p. 38). Participating in the local buzz does not require particular investments. Clustered firms are, almost by definition, surrounded by a tight web of gossip, opinions, recommendations, judgments and interpretations (Maskell et al. 2006). Underpinning Marshall's (1920) famous notion of 'industrial atmosphere', that something is 'in the air ', and is limited to the people within a particular region or place. This sort of information is more or less in the vicinity of people who are located within the region and who participate in the cluster's various social and economic spheres (Bathelt et al. 2004).

2.4 Cluster Innovativeness: A result of both local and global interactions

However, in the more recent literature, the clustering ''effect'' on the innovation activities of firms have been called into question (Bathelt, 2001; Gertler, 2003; Maskell et al. 2006; Fitjar & Rodríguez-Pose, 2011). While the traditional view on cluster is that physical proximity is essential for the innovative capacity of firms (Baptista & Swann, 1998; Bathelt, 2001; Gertler, 2003), too much proximity may also have negative impacts on innovation. "Regions may become locked into rigid trajectories, which weaken their learning capability. This is especially true for highly specialized regions that may be confronted with a spatial lock-in" (Boschma, 2005, p. 14). The clusters become stuck in established routines and ideas, and networks of inter-related and installed knowledge that no longer yield increasing returns and

may even cause negative externalities. The advantages of local spillovers within a cluster then become a source of weakness (Martin & Sunley, 2006). This type of lock-in may be solved or prevented by establishing global networks, providing access to the outside world that bring in new knowledge from trans-local relationships (Camagni, 1991). In other words, knowledge will spill over effectively between regions when complementarities exist in terms of shared competences. Such complementarities are captured by the notion of what Asheim et al. (2011) call, "related variety". The notion of related variety is crucial, because inflows of extra-local or global knowledge that are similar or complementary to existing competences in the region may particularly improve interactive learning, and thus innovation (Asheim et al. 2011). Hence, the literature on clusters does not account for inter-sectorial linkages among regions. The fact that new variety may be brought into the region through the establishment of extra-local linkages, such as a diversified set of trade partners has been overlooked (Boschma & Iammarino, 2007, p. 2). Implying that cluster economic prospects depend not only on its local interactions but also on its ability to identify and access external knowledge sources located faraway (Bresnahan et al. 2001; Bathelt et al. 2004; Maskell et al. 2006).

Therefore, the significance of establishing communication channels to the outside world has received increasingly attention in the recent literature (Bathelt et al. 2004; Wolfe & Gertler, 2004; Maskell et al. 2006; Bramwell et al. 2008; Fitjar & Rodríguez-Pose, 2011). The term "global pipelines" have been proposed by Bathelt et al. (2004) when referring to extra-local (global) knowledge flows. Global pipelines are purpose-built connections between a given local firm and partners to the outside world. These partners can range from i.e. customers, competitors, suppliers or clients, to universities or research centers (Fitjar & Rodríguez-Pose, 2011). Bathelt et al. (2004) further argue that the more firms within a cluster engage in buildup of non-local pipelines the more news and knowledge about markets and technologies are "pumped" into internal networks from which local actor's benefits. Firms develop global pipelines not only to exchange knowledge of products or services, but also to benefit from outside knowledge inputs and growth impulses that are necessary for innovation processes (Maskell et al. 2006). Thus it is suggested that pipelines may be better suited for radical innovations (Fitjar & Rodríguez-Pose, 2011). Hence, successful clusters are those that are effective at building and managing a variety of channels for accessing relevant knowledge from around the globe (Bathelt et al. 2004). Similar to Fitjar & Rodríguez-Pose (2013), Owen-Smith & Powell (2004) conducted an empirical research from the Boston biotechnology industry where they demonstrated that access to new knowledge does not just

arise from local interaction but often acquired through global interactions. Distant contexts can be a source of novel ideas and specialist insights that are useful for innovation processes.

However, identifying the location of external valuable knowledge and building pipelines to access to that knowledge is only part of the challenge when attempting to increase a firm's innovative capability. An equally large task is to establish the ability to assimilate the information arriving through pipelines and to apply it successfully towards commercial ends (Bathelt et al. 2004). The firms rest on their absorptive capacity to identify, interpret and exploit the new knowledge (Cohen & Levinthal, 1990). Further, the performance of global pipelines also depends on the strength of pre-established social relationships and the quality of trust that exists between the firms (Wolfe & Gertler, 2004; Bathelt et al. 2004). Bathelt et al. (2004) state that the precise mix of local buzz and global pipelines present in each distinct cluster can vary, depending on supply chains, technologies and markets segments. Some industries might for instance require more buzz than others, while other industries would need more pipelines. However, a mix of both local and global interactions is always required to ensure continued growth and innovation (cf. appendix A: illustration of dynamics of local buzz and global pipelines). Thus clusters can be seen as nested within, and impacted by regional and national innovation systems, as well as, global relationships (Wolfe & Gertler, 2004).

2.5 Modes of innovation

What is often neglected in the literature is what kind of extra - regional linkages or diversified set of partners that may be crucial for firm innovativeness (Tödtling et al. 2009). From the discussion about local buzz and global pipelines, it may be important to have relationships that bring new knowledge in the region through a wide range of sectors located elsewhere (Boschma, 2004). Newer research indicates that firm innovation is both a result of Science, Technology, Innovation (STI) and Doing, Using, Interacting (DUI) of firm learning. Where STI-mode is based on the production and use of codified scientific and technical knowledge, the DUI-mode relies on informal processes of learning and experience-based know-how[1]. At the firm-level the DUI and STI- modes may be viewed in the need to reconcile theories of the

[1] These two modes of innovation have been advanced by the authors Jensen et al. (2007) who have tried to bridge the gap between these two modes of innovation by considering two main ways to organize learning and innovation processes in firms. Later the debate about STI and DUI- modes has been further developed and defined by Fitjar & Rodríguez-Pose (2013) who contributes to the debate by analysing to what extent STI and DUI-modes of innovation are related to firm level innovation in Norway.

firm giving stronger emphasis to codified scientific knowledge and theories focusing on firms as learning organizations (Lundvall & Lorenz, 2008). Further, Jensen et al. (2007) conducted an emprical analysis that illustrated that the DUI and STI-modes of firm learning contributed to innovative performance. The results showed that the two modes of learning were practiced with different intensities in different firms, in addition firms combining STI and DUI-modes were more innovative. The authors Fitjar & Rodríguez-Pose (2013) have further contributed to this debate by classifying different types of firm learning into interaction partners. Namely, STI-mode interactions include relations with universities, research institutes, and consultancy firms. The DUI-mode interactions type encompasses relations with other firms in the conglomerate, suppliers, customers and competitors. DUI type interactions are in turn divided into those that fall within the regular supply-chain (interaction with suppliers and customers) and those which do not (interaction with competitors) (Fitjar & Rodríguez-Pose, 2013). The characteristics of DUI and STI –modes of firm learning are examined separately in the following two sections.

2.5.1 Science, Technology and Innovation mode

The STI-mode may be viewed as a linear approach to innovation which mostly concerns R&D activities. The linear model of innovation has looked at innovation from a scientific and technological perspective. Where larger firms who have more capacity to invest in R&D have been deemed to be more successful in innovating than those firms lacked capacity to invest in R&D (Fitjar & Rodríguez-Pose, 2012).

Much of the R&D activity takes place in-house or in collaboration with scientific institutions, such as research centres, universities and consultants (Isaksen & Nilsson, 2013). The reasoning being that firms look for a broader set of knowledge to specific problems they have with new products and/or processes which often trigger outside sources. In order to communicate with scientific institutions it is necessary for the firm to make knowledge explicit and translate problems into formal codified knowledge (Lundvall & Lorenz, 2008). This sort of knowledge is therefore assumed to be universal and can be shared across cultural context and boarders. The more firms interact with these scientific institutions, either formally or informally, the greater the probability is for innovation. Still, in order to adopt and produce innovations it will also be largely dependent on the human capital and absorbability available in the firm (Fitjar & Rodríguez-Pose, 2013). The R&D expenditures, advances in science and

technology (S&T), human capital and interaction with centers producing new knowledge have been identified as the main drivers to innovation in advanced economies (Cohen & Levinthal, 1989; Lundvall & Lorenz, 2008; Fitjar & Rodríguez-Pose, 2013).

However, high R&D-intensity does not necessarily result in innovation, or strong economic performance as it has been proven difficult to produce systematic evidence (Andersson et al. 2004). The paradox is that scholars have identified countries that produced an unexpected high innovation and economic performance in spite of the relatively lower investments in R&D and infrastructures. The linear mode of innovation thinking is that increased research and development generates technologically innovative products. Enables firms to gain competitive advantages and gain market shares, which eventually leads to economic growth (Kinkel et al. 2005). Despite this, Norway's R&D share of Gross Domestic Product (GDP) was 1.65 percent in 2011. Placing Norway in 24th place in the world, while rest of the Nordic countries was placed among the top seven in the world's most R&D - intensive countries. Yet, Norway had higher growth in productivity and income (Nortrade, 2010). The OECD has called this phenomenon the "Norwegian puzzle". The debate fueled by Norway's low percentage of gross expenditure on R&D relative to total Norwegian GDP has been in motion since 2004 (Gunnes et al. 2011). The Norwegian puzzle phenomenon can be partly explained by the experienced - based learning on doing, using and interacting mode, which is discussed in the following section.

2.5.2 Doing, Using and Interacting mode

Rather than viewing innovation as an output of R&D or pumping up the formal qualifications of human capital, the DUI-mode emphasize interactive learning among network of actors. Learning by doing and using, normally involves interaction between people and departments. This view of innovation is characterized by focusing on stimulating interaction, cooperation and knowledge exchange between firms (Isaksen & Nilsson, 2013). As a result, innovation in the DUI-mode can be understood as an outcome from institutions and interactions often putting the capacity to assimilate external knowledge at the heart of the process of innovation (Fitjar & Rodríguez-Pose, 2013). Therefore, firms wishing to innovate, rest on a knowledge base that they possess internally and/or must obtain from external partners (Cohen & Levinthal, 1989). People can learn about how to produce, use, or improve things by carrying out their activities of solving production problems, meeting customers' requirements and

overcoming various types of bottlenecks. Expertise of this kind comes from direct contact with a variety of sources, such as competitors, suppliers, customers and providers of different kinds of business services (Von Hippel, 1988). Suggesting that the DUI-mode is learning generated from on-the-job problem-solving where the exchange of experiences and know-how, through which firms find solutions to various problems that arise (Fitjar & Rodríguez-Pose, 2013). This type of learning most obviously refers to tacit knowledge that is often highly localized (Fitjar & Rodríguez-Pose, 2013).

Further, it has been commonly accepted, both in theory and practice, that successful innovation is accomplished by interactive processes between different actors (Morgan, 1997). Innovation in the firm is mainly produced by the capacity of the managers and employees to find solutions to market needs and requirements. While this kind of learning may occur as unintended, the DUI-mode can be intentionally fostered by building structures and relationships which enhance and utilize learning by doing, using and interacting. Organizational practices such as problem-solving groups, and task rotation, promotes learning and knowledge exchange, and can contribute positively to innovative performance (Lundvall & Lorenz, 2008, p. 6).

2.6 Hypotheses

Within the innovation literature it is widely accepted that knowledge flow and collaboration between various actors i.e. customers, suppliers, knowledge institutions are crucial for firms innovation outcome. While traditional literature on the innovation process emphasize firm innovation to be grounded in the regional or local level in dense networks of geographically proximate firms, recent literature have questioned the importance of extra-local (global knowledge) linkages for new knowledge. Hence, empirical research has shown that both local and non-local relationships and knowledge flows are crucial sources for interactive learning (Bramwell et al. 2008; Owen-Smith & Powell, 2004; Fitjar & Rodríguez-Pose, 2011, 2013). According to Bathelt et al. (2004) and Maskell et al. (2006) local buzz and global pipelines may be perfectly complementary as sources of firm innovation. While this has been further elaborated in Fitjar & Rodríguez-Pose (2013), they stated that the aspect about STI and DUI-modes of innovation may have very different geographical dimensions. Therefore it can be assumed that local knowledge spillovers and increasingly global knowledge sources to be important mechanisms for learning and innovation in the M&R cluster. But whether regional

interactions or global pipelines dominate in the maritime supplier firms' innovativeness remains to be demonstrated. Similar to Fitjar & Rodríguez-Pose (2013, p. 135) the present thesis classifies different types of firm interaction into STI-mode interactions (with consultants, universities, and research centres) and DUI-mode interactions, distinguishing between DUI interactions within the supply chain (suppliers and customers) or not (competitors). Within each of the STI-mode and DUI-modes a distinction has been made between collaboration with partner's located regional (in Norway) and outside the region (abroad). In the light of the presented literature review and the empirical research paper by Fitjar & Rodríguez-Pose (2011, 2013) hypotheses are established.

2.6.1 Hypotheses of the geography of DUI – mode interactions

The role of networks, communities, and linkages has come forward in the investigation of sources of firm innovation. The early Schumpeterian model of the lone entrepreneur bringing innovations to markets has been overridden by actors working together in iterative processes of trial and error to bring about the successful ideas (Schumpeter, 1948; von Hippel, 1988; Freeman & Soete, 1997). These newer models of innovation have highlighted the interactive character of the innovation process, suggesting that innovators rely heavily on their interaction with customers, suppliers, competitors (von Hippel, 1988; Lundvall, 1992). In the realm of clustering, geographic proximity is perhaps the most foundational characteristics of agglomeration districts. The focus on interaction in studies of innovation reflects a wider trend of firm behavior that suggests that the network of relationships between the firm and its external environment can play an important role in shaping innovation. Many theoretical works in the literature assert that innovation and productivity are higher among geographically proximate firms than geographically dispersed firms (Baptista & Swann, 1998; Porter, 2008). The use of different language by agents and firms may imply that a large share of the knowledge exchange cannot be easily transformed. Knowledge spillovers may only occur between agents that share languages and face similar or related problems and can apply similar or related technologies. The underlying logic is that proximity enables flows of tacit knowledge and unplanned interaction which are sources for the innovation process (Wolfe & Gertler, 2004). DUI-type relationships are expected to involve more transmission of tacit knowledge and practical know-how, which is less easily transferred across geographical distance. As a consequence, knowledge flows are likely to be higher among firms in the same or related sector. This type of relationship will usually be within the supply-chain (Fitjar &

Rodríguez-Pose, 2013, p.130). Therefore the following hypotheses are proposed based on the theory stating that regional and increasingly global interactions within the DUI-mode are important explanatory factor for firm innovation:

> **H_1**: Regional DUI-mode supply chain interaction has a larger impact on *product innovation* than global DUI-mode supply chain interactions

> **H_2**: Regional DUI-mode supply chain interaction has a larger impact on *process innovation* than global DUI-mode supply chain interactions

On the other hand, Porter (2008), argues that firm innovation is enabled as a consequence mainly due to competitive factors. When it comes to collaboration outside the supply chain, such as competitors, firms get pressured to innovate faster and to create more advanced products than its rival firms (Porter, 2008). As the competitive environment becomes more intensified, individual firms are forced to cut their costs, and to produce better products and services than their competitors to sustain a competitive advantage. Additionally, geographical proximity will be an asset in DUI-type partnerships, making industrial cooperation within the region more efficient than industrial cooperation with partners outside the region (Fitjar & Rodríguez-Pose, 2013). Hence, DUI-mode interaction in particular outside the supply chain will often take place in close geographical proximity, as face-to–face contacts are more likely to reap tacit knowledge generated from local buzz than faraway ones (Storper & Venables, 2004; Fitjar & Rodríguez-Pose, 2013). Therefore the following hypotheses are proposed based on the theory stating that local and global network interaction is important exploratory factor for innovation:

> **H_3**: Regional DUI-mode interactions outside the supply chain has a larger impact on *product innovation* than global DUI-mode interaction outside supply chain

> **H_4**: Regional DUI-mode interaction outside the supply chain has a larger impact on *process innovation* than global DUI-mode interaction outside supply chain

2.6.2 Hypotheses of the geography of STI – mode interactions

In a knowledge-based economy, access to knowledge is a vital factor to any firm that pursues to sustain and enhance their competitive advantage. Porter (2008) argues that an important part of the clustering is proximity to research and universities. The notion that consultants, universities and research institutions are positive contributors to innovation in firms are widely supported in the literature (Fitjar & Rodríguez-Pose, 2013). Firms within a cluster can benefit from the presence of research institutions as they can provide expert knowledge and by providing graduates with higher education through which knowledge circulate throughout the cluster (Rothaermel & Ku, 2008). In the M&R region there are three colleges that are expected to contribute to regional development through research and education and through direct collaboration with business. The region also has research institutes that conduct applied research, often for private companies. However, this will not necessarily mean that the best research institutes, universities or consultancies with necessary knowledge are located in the firm's immediate nearby (Fitjar & Rodríguez-Pose, 2013). Firms will search to maximize value for money and look for partners that can provide knowledge at a given cost and benefit. The STI-mode cooperation will possibly be even more effective in global networks due to the ability to link to nodes of excellence. STI –type collaboration is primarily based on codified and universal knowledge that may be less affected by efficiency-loss across geographical distance. This may be because of the more formal nature of STI collaboration that geographical proximity may play a limited role in innovation. As a consequence, it is likely that STI-mode innovation will rely on a strong global dimension (Fitjar & Rodríguez-Pose, 2013). Therefore following hypotheses are proposed:

> **H_5**: Global STI-mode interactions have larger impact on *product innovation* than regional STI-mode interactions

> **H_6**: Global STI-mode interactions have larger impact on *process innovation* than regional STI-mode interactions

In addition to these main hypotheses I will also explore the relationship between collaboration modes with radical product innovation and radical process innovation. Firms having pipelines to the outside world are regarded as a key source for radical innovation, channeling new knowledge and practice (Fitjar & Rodríguez-Pose, 2011).

3. The context

This chapter describes the defined research context; the maritime cluster in Møre and Romsdal. The target population is the maritime suppliers, and is referred to both *equipment suppliers* and *service providers* in this thesis. The study excludes shipping companies, ship yards and fishing fleet, in addition to supportive institutions i.e. financial enterprises, brokers, insurance companies. However, as the cluster is interwoven in a complex network system, all of the cluster actors will be discussed in this chapter to allow a more comprehensive understanding of the suppliers and their innovation dynamics. The suppliers are part of a network of firms that draw productive advantage from their mutual proximity and international connections.

This chapter has been divided into three sections. The first section will treat the overall characteristics, performance, and definition of the maritime cluster in M&R. The second section will briefly treat the development of the innovative maritime suppliers and their economic development. Finally, the M&R cluster dynamics and its challenges will be examined in light of Porters diamond framework. In particular, the maritime suppliers are emphasized as they are the research object of interest. The last paragraph will draw final remarks from the discussion in this chapter. It should be noted that the economic figures obtained in this chapter are mainly from a survey that Møreforskning conducted in 2012[2].

3.1 Characteristics and performance of the maritime M&R industry

As stated in the OECD report (2007) the capability to innovate and to bring successfully innovation to market will be a crucial source of the global competitiveness of nations over the coming decade. Norway is one of the world's leading maritime nations. While other nations mainly have its strengths in one or two maritime areas, the Norwegian environment is among the most comprehensive in the breadth of services, products and expertise. Within Norway, the Møre and Romsdal county is a world leader cluster in the design, construction, equipment, and operation of vessels for the global oil industry (NCE Maritime, 2012). The highly respected maritime cluster in M&R is located on the West coast of Norway and has a total of 36 municipalities. The cluster consists of companies covering all segments of the global value chain of advanced marine operations (NCE Maritime, 2012). In total, the cluster consists of 213 companies, dominated by small and medium sized enterprises (SMEs). These cluster

[2] The population of Møreforskning included firms within the cluster: ship yards, shipping companies, ship consultants and equipment suppliers in the maritime cluster in Møre and Romsdal.

firms are: 19 shipping companies, 15 ship consultants, 14 shipyards and 165 equipment suppliers. As a consequence, the maritime industry is vital for the region as it account for a total turnover close to NOK 50 billion in 2012, and employing around 22.000 skilled workers (NCE Maritime, 2012).

The *service providers* (also referred to as ship consultants) can be defined to be among the largest providers of maritime services. Their services include ship designers, ship- and cargo brokers, marine insurance, financial and legal services, classification, port and logistics services, engineering services, installers of marine equipment and marine dealers (Nærings- og handelsdepartementet, 2012). While the maritime *equipment suppliers* on the other hand, produce and supply equipment for vessels and floating structures. This is for example propulsion systems, cranes, ropes, winches, handling equipment, control equipment, compressors, equipment for dynamic positioning, navigation equipment, fire pumps systems for ventilation and air treatment, ballast systems, telecommunications, electrical installations, lifesaving appliances, kitchen interior, and much more (Nærings- og handelsdepartementet, 2012).

The key economic figures and the relationship between the main actors in M&R cluster is presented in figure 4.

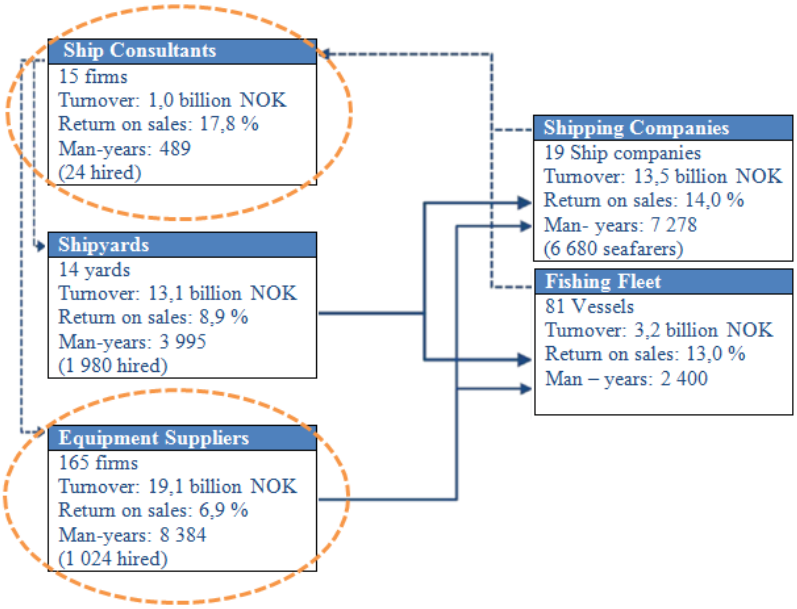


Figure 4: Overview of the maritime cluster in Møre and Romsdal in 2012 (author revision of figure originally published by Hervik et al. 2012, p.13)

The full drawn lines illustrate the financial flows between actors in the cluster. The dashed blue lines illustrate the role of ship consultants in selling their design services to shipping companies and then collect yard capacity and equipment suppliers in a total package (Hervik et al. 2012). The maritime suppliers (both ship consultants and equipment suppliers) are found in the boxes with dashed circles around, representing the focus in this thesis. Service providers and equipment suppliers will often simply be referred to as (maritime) suppliers. In the following paragraph these numbers will be briefly commented on. However the fishing fleet will not be treated.

Total turnover of the 165 *equipment suppliers* in M&R were estimated at NOK 19.1 billion in 2012, an increase in turnover by 16 percent from 2011[3]. Return on sales (ROS) for the suppliers were estimated at 6.9 percent for 2012. Employment represents nearly 8,400 man-years of which approximately 1,000 man-years are associated with hired labor. Employment had an overall increase from 2011 to 2012 by 2.4 percent (Hervik et al. 2012). The 15 *Ship consultants (service providers)* passed NOK 1 billion in turnover in 2012, giving an ROS of 17.8 percent. Employment in 2012 was 490 man-years of which 24 man-years were hired labor. From 2011 to 2012 the turnover to ships consultants had an increase of nearly 14 percent. Overall employment has increased by one percent. An analysis revealed that long term prospects in international markets will have further solid growth in demand for offshore service until 2020 (Hervik et al. 2012). While, the 19 *shipping companies* in M&R turnover reached NOK 13.5 billion in total in 2012, giving a ROS of 14 percent. Overall employment for the shipping companies in 2012 was 7,300 man-years (excluding crew and foreign sailors and administrative staff abroad). From year 2011 to 2012 turnover increased 8.6 percent. Finally, the *shipyards* in 2012 had a turnover at NOK 13.1 billion, an increase of 4.7 percent from the previous year, giving an ROS of 8.9 percent. Employments at these shipyards constitute 4,000 man-years (of which 640 are related to contract labor and 1,340 man-years related to subcontracting) (Hervik et al. 2012).

[3] This survey was conducted in 2012 of suppliers related to maritime activities in Møre and Romsdal. It was based on a population consisting of 165 firms. The survey was primarily targeting the 40 largest companies in the county, as well as a selection among small and medium-sized firms. A total of 55 companies were interviewed and those turnovers accounted for 74% of total turnover in the 165 firms in the population. For the other companies that did not participate in the survey, estimation ratios were calculated based on official figures for 2011 and development of the 55 other companies interviewed (Hervik et al. 2012).

3.2 Brief history and economic development of the suppliers in light of innovation

The past evolution of the M&R region and its present activities has shaped the maritime cluster that is present today. The cluster has been through a transformation from being a pure shipbuilding cluster to take a chance into the offshore industry (Holte & Moen, 2010). Starting with the industrialization period in beginning of the 30's, a substantial number of equipment suppliers was established. The formation of a set of key suppliers and sub-suppliers serving both regional and international markets was a result of diversification in marine equipment (in times of overcapacity in shipbuilding) enabled by competence and strong business networks (Karlsen, 2005). Later, the innovations in the 70's were turned towards the offshore oil and gas market. In close cooperation with suppliers, some yards developed high-level competence for design, construction of ship and ship equipment that was able to handle advanced and extreme off-shore operations (Holte & Moen, 2010). This business development has been and is still fostered by continuous innovations, including improved products and services and diversification to new attractive markets. In the beginning of the 20th century, advanced maritime technologies emerged to support the growing fishing activity (Rialland, 2009). In the last decade the maritime industry has become more competence based, innovation driven and gradually become more offshore related. In figure 5 the key economic figures are presented from year 2005 to 2012, representing the M&R equipment supplier's turnover, earnings before income taxes and return on sales.

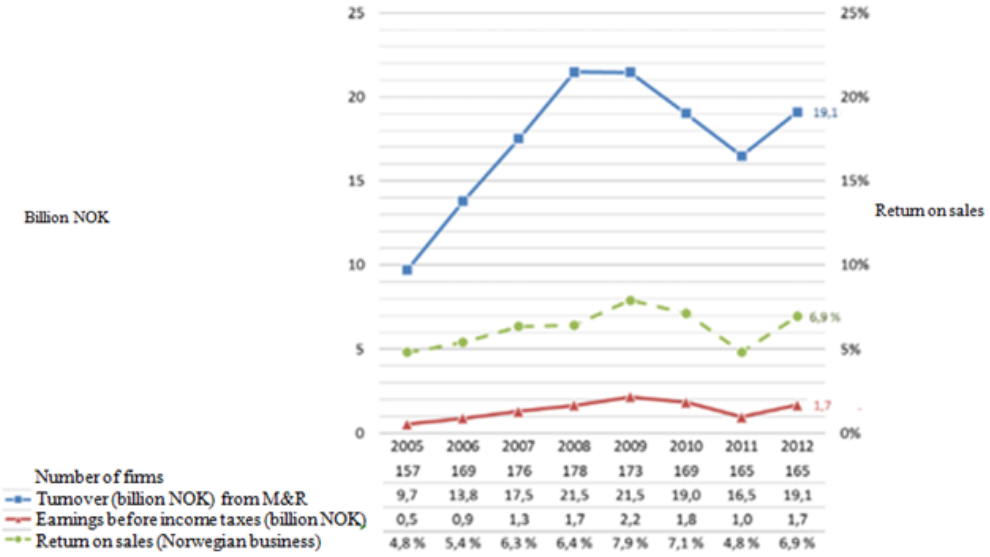
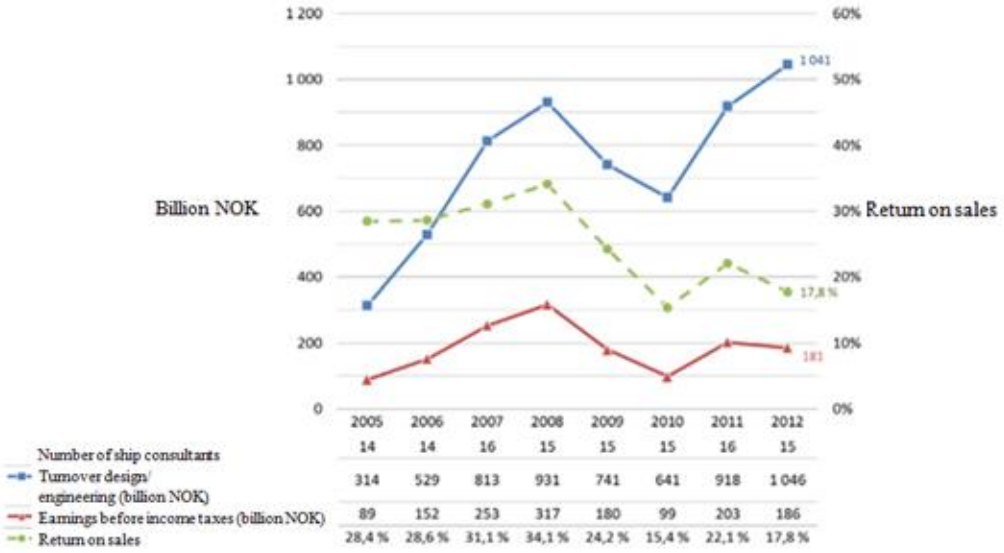


Figure 5: Key economic figures of M&R equipment suppliers (adopted from Hervik et al. 2012, p.15)

As the graphs illustrate, turnover for the equipment suppliers in the maritime cluster had a solid growth in the period 2005-2008 with activity leveling-off in 2009. In 2009, suppliers' turnover reached NOK 21.5 billion, which was more than doubled compared to 2005. The following two years, a solid drop in turnover hit due to the financial crisis. This lasted to 2011 where the turnover had decreased to NOK 16.5 billion. In terms of profit, the suppliers had overall its best year in 2009 with a ROS of 7.9 percent while in year 2012 the ROS was estimated at 6.9 percent (Hervik et al. 2012).

Similar, figure 6 shows the key economic figures from year 2005 to 2012, representing the M&R service provider's turnover, earnings before income taxes and return on sales.



	2005	2006	2007	2008	2009	2010	2011	2012
Number of ship consultants	14	14	16	15	15	15	16	15
Turnover design/ engineering (billion NOK)	314	529	813	931	741	641	918	1 046
Earnings before income taxes (billion NOK)	89	152	253	317	180	99	203	186
Return on sales	28,4 %	28,6 %	31,1 %	34,1 %	24,2 %	15,4 %	22,1 %	17,8 %

Figure 6: Key economic figures of M&R service providers (adopted from Hervik et al. 2012, p. 19)

Service providers in M&R had a strong increase in turnover related to design and engineering services for the period 2005 to 2008. From year 2005 to 2008, the turnover was tripled compared with in 2005. However, the turnover dropped in the wake of the financial crisis and ended at NOK 641 million in 2010. In 2010 and the following years the ship designers had a significant increase in turnover related to the design and engineering. For 2012, the turnover was record high of 1 billion, an increase of over 60 percent since 2010. In 2011, the total ROS reached 22.1 percent, but in 2012 there is a slightly decrease ending up nearly 18 percent.

3.3 Putting Porter into practice: Challenges for M&R maritime suppliers

3.3.1 Factor conditions

The M&R industry has been acknowledged as highly knowledge and competence driven, where the industry is dependent on innovation to stay globally competitive (Nærings- og handelsdepartementet, 2012). Accordingly access to specialized competence in research, technology and market know-how is critical factors (Benito et al. 2003). Research must be intensified in order for the cluster to become knowledge and innovation driven. The knowledge exchange in the maritime cluster in M&R is enabled by various interaction channels, and by interactive learning. Knowledge transfer goes from ship owners to shipyards, in addition to all other actors in the value-chain. This includes designers, equipment suppliers, marine services and supporting institutions. All this knowledge and capability development contributes to foster the entrepreneurship attitude in the industry. In turn, good collaboration has been developed as a result of proximity to customers and long-term relationships (Rialland, 2009). However, disadvantage of the cluster lies in the difficulty to compete on costs and to get access to highly-skilled work force (Oterhals et al. 2008a). To stay ahead of competition, human resource, education, and physical resources such as well-developed infrastructure with a more robust transport network has been pointed out as critical factors. This may also be beneficial for the industry as attracting a complementary work marked will be easier thanks to shorter commuting time (Rialland, 2009).

3.3.2 Demand conditions

The main customers of the maritime suppliers are the shipping companies and shipyards both from Norway and abroad (Nærings- og handelsdepartementet, 2012). Good collaboration has been developed due to both proximity of customers (local market) and durable relationships which have facilitated the understanding of customers' requirements. This has contributed to the suppliers' development of innovative new solutions to their segments in maritime offshore markets. As a result of a strong and sustained demand, the cluster has developed a competitive advantage owing to the pressure to deliver new products. As a consequence, the cluster has become bigger, stronger, and developed self-reinforcing mechanisms and scale advantages, supported by a strengthened capital base of ship owners (Oterhals et al. 2008a). The cluster must work to keep its leading global position, notably within design and ship equipment as well as quality control of foreign yards (Rialland, 2009). There is a growing demand for more sophisticated and tailor-made offshore vessels for both Norwegian markets and new

international offshore fields. Norwegian Maritime Exporters estimates that about 70 percent of the equipment production is exported. Particularly important markets are the major shipbuilding countries such as China, Korea, Singapore, Brazil, and Japan (Nærings- og handelsdepartementet, 2012).

3.3.3 Competitive conditions

The context of competition in the maritime industry is highly influences by the high cost structure in Norway. With high standard of living, high wages and a high productivity, implies that the maritime industry has to compete on the basis of knowledge, productivity and quality. Therefore the goal for the maritime industry is to become a world-leading maritime nation (Nærings- og handelsdepartementet, 2012). The Norwegian government has developed a strategy that focuses on innovation efforts in the maritime industry in order to stay competitive in the future, called "Stø kurs 2020"[4] (Nærings- og handelsdepartementet, 2012). The common strategies are aimed to give customer value by i.e. innovative new solutions, producing quality products and environmental friendly solutions.

Further, the presence of rivalries in the cluster is assumed to cause pressure for improvements and innovations between the national competitors. Local competitors are continually pushing each other, leading to new knowledge and competence building and continuously reduce costs and improvement of quality, thereby creating new products and processes (Benito et al. 2000). Innovation has also been further stimulated by tough market competition, increasingly from firms in international markets (Rialland, 2009). The economic center of gravity is shifting from the west to the south and east. The BRICS countries (Brazil, Russia, India, China and South Africa) account for approximately a quarter of the total world production. This percentage is said to increase significantly up to year 2060. Additionally, this will influence trade, transport patterns and contribute to the emergence of new markets, but also new competitors. Competition, particularly from manufacturers in large shipbuilding countries, is expected to increase (Nærings- og handelsdepartementet, 2012).

[4] The Norwegian government strategy "Stø kurs 2020" can be uploaded here: http://www.regjeringen.no/upload/NHD/Vedlegg/strategier2013/maritim_strategi.pdf

3.3.4 Related and supported fields

The cluster network of related and supported fields make the cluster itself more flexible enabling the cluster to be more specialized. For the M&R cluster, the proximity between its actors (i.e. the many equipment and service providers, ship builders, ship owners, design companies, as well as, research institutes and universities) has been decisive for networking and stakeholder interaction and valuable providers of cost-effective inputs (Holte & Moen, 2010).

Extensive and adequate R&D activity, are carried out by public and private research centers, consultancies, and universities, facilitating important knowledge in the cluster. This is assumed to increase the likelihood for implementation of new technologies and perceived opportunities for innovations (Holte & Moen, 2010). In addition the cluster was appointed as Norwegian Centers of Expertise (NCE) in 2006 as a governmental measure with the aim to supporting research activities within the region to strengthen innovation and internationalization processes. NCE also contributes as a mean to facilitate relation and secure cooperation between the various cluster actors towards securing both capital and establishment of industry specific research projects (Oterhals et al. 2008a; Rialland & MARINTEK, 2009).

3.3.5 Government and Chance

Governments can have significant role in aiding competitive advantage, especially through public policies which are favorable to investment and profit performance (Monteiro et al. 2013). Further, the role of local authorities is to facilitate the link between the industry and public institutions (Rialland, 2009). Exogenous forces like research universities, venture capital, and social network are all parts of institutions supporting the development and success of the cluster (Feldman et al. 2005). As already mentioned, at the region level, the NCE maritime is established as a mean to strengthen and support the cluster activity and growth. While at the national level, the Norwegian government's white paper for the maritime strategy is also to facilitate for a competitive environment (Nærings- og handelsdepartementet, 2012). *Chance* factors can also have a significantly impact on the maritime cluster and suppliers. There are increased demand and requirements for environmentally friendly and sustainable solutions for extractions. In addition, the industry is easily affected by economic factors like market cycles, exchange rates, energy shortage and

oil price levels (Benito et al. 2003). The oil prices and oil company's investment programs are the main drivers of activity. IEA[5] states in its forecasts for 2020 and further to 2035, that high oil prices is expected to continue high level of investment by oil companies (Hervik et al. 2012).

Concluding from the "diamond" framework and the overall performance of the maritime suppliers, the cluster has gradually positioned itself as a competitive player. High quality of equipment and services has compensated for the lack of cost competitiveness. In appendix B key points from Porters diamond model is summarized (not including government and chance). The analysis demonstrates the importance of continuous innovation as one of the most important factors for future success. In general, the overall key figures for the actors within the cluster revealed solid market position. But, in order to retain its position the cluster should continue to focus on innovation, skill development, environmental solution, product improvement, and smart technology solutions. Despite having positive profitability trend, the turnover has varied the last few years. The maritime industry is cyclical, and dependent on i.e. oil prices, energy shortage and environmental issues. Hence, the suppliers are becoming more dependent on increasing knowledge intensity, to further develop value-creation in the industry. To succeed in an ever increasing international competition the suppliers must continually have the ability to develop new products and services. A well-developed collaboration relationship between sophisticated customers and advanced suppliers are important for both innovation and internationalization (Sasson & Blomgren, 2011). Accordingly this constitutes an interesting framing on clustering, knowledge and innovation and further suggests that innovation is an important explanatory factor for the future success for the maritime supplier firms.

[5] The International Energy Agency: http://www.iea.org/

4. Data and Method

This thesis takes a quantitative approach by conducting a survey to investigate the geographical sources of firm innovation of the maritime suppliers in M&R cluster. The chosen industry is one of the largest and most complete industrial clusters in Norway and covers the entire value-chain (from ship design to ship operations) of the offshore market (NCE Maritime, 2012). The classified target population includes the equipment suppliers and ship consultants (service providers), giving a total population of approximately 170 -180 firms. By using this defined population, the exposure to macroeconomic events that can affect different firms unevenly are limited. Additionally, by using a maritime sample located in close proximity of each other, the results in the analyses will be more consistent as the firms are more homogeneous. As opposed to Fitjar & Rodríguez-Pose (2011, 2013) where they include firms in urban Norway combining a variety of sectors from i.e. mining, manufacturing, construction, wholesale, hotels and resturants, transport, and financial services. Hence, the homogenous target population of the maritime suppliers requires less control variables and sample size. Further, this thesis uses a mixed approach, implying that it is both exploratory and confirmatory as it seeks to explore the causal relationship between the theoretical concepts and also build upon previous research. Additionally, it is also both deductive and inductive. As a deductive research approach uses theory and pre-conceived expectations and seeks to support or reject them (Okasha, 2002). But as the theoretical model is developed both on current theory and empirical findings from the author Fitjar & Rodríguez-Pose (2013) the thesis will also draw upon an inductive approach.

The remainder of the chapter describes the research design applied in the present thesis more thoroughly. First section will start by description of the primary data collection, thereafter validity and reliability of the study, statistical methods that are used in the analyses. Finally, operationalization of the different variables is presented based upon the selected theoretical constructs.

4.1 Quantitative study

The present thesis has made use of questionnaire survey in order to support and efficiently test the proposed hypotheses. Quantitative research is undertaken as this data provides answers that can quantify the incidence of particular behaviors, motivation and attitudes and make inferences about the population under investigation (Wilson, 2012). The data consist of a

survey sent to all classified industry actors. The total population of the maritime suppliers consists of approximately 170-180 firms. A list of the maritime suppliers in Møre and Romsdal from the year 2012 was provided by Møreforskning. The survey that has been used in this thesis was originally developed by the authors Fitjar & Rodríguez-Pose (2011). The authors included indicators from the Community Innovation Survey (CIS), which the authors modified to include data on the location of partners (inside or outside the region) respectively. They also included indicators from values survey (such as the World Values Survey and the Norwegian Monitor survey series), as well as some original questions spesifically tailored to the needs of the analysis.

By adopting the survey of Fitjar & Rodríguez-Pose (2011) the survey sent to the maritime supplier firms included a) the geographical dimension of the sources of innovation and b) the factors behind the propensity to innovate. The purpose of the survey was to complement the sources of data, and gain access to first-hand information regarding each respondent firm's knowledge about product and service development, innovation and collaboration partners. As the observation represents a single point in time, the survey is cross-sectional (Wilson, 2012). The survey consisted of 20 questions, where 10 questions were open-ended and 10 were closed-ended. Some of the open-ended questions related to the firm's foundation year, county, share of ownership and R&D, while the closed-ended questions related to the innovation tendencies. The final survey can be seen in appendix C. Questions that are closed-ended are preferred as they provide a greater uniformity of response, and are more easily processed than open-ended questions. However, few market researchers today argue for one or the other exclusively (Wilson, 2012). There is general agreement that there is room for both - and reason for both.

The survey was constructed and distributed from an online platform named SurveyMonkey[6]. SurveyMonkey is one of the most popular online survey software and was used due to its uniformity and user friendliness. Respondents selected to receive the survey were part of top management, hence reliable and qualified to answer. Beforehand a pilot test was conducted to ensure quality before the final survey was distributed to the ultimate population. Upon collection of e-mail addresses, the survey was distributed to 167 respondents. In the emails I presented shortly the purpose of the surveys, gratitude for taking the time and effort to participate. In addition the participants were informed that their answers would be

[6] The platform for the survey can be found at: https://no.surveymonkey.com/

confidential (cf. appendix D 1) and 2) for e-mail letter). After one e-mail invitation, three reminder e-mails, thereafter collection of new e-mail addresses within the companies that had not answered the survey and finally manual follow ups by phone calls, gave a total of 88 respondents that carried out the survey (cf. table 2).

Table 2: Sample achieved upon survey collection of maritime suppliers

Target population (Y)	Sample (μ)	Share of firms (μ/ Y)	% of turnover in μ[7]
170 - 180	88	48.9 - 51.8	46.99

4.2 Validity and reliability

Testing for validity and reliability are crucial components of research quality. The generalizability of the findings in this thesis may be assessed through external validity whether results obtained from a small sample group, can be extended to make predictions about the entire population (Wilson, 2012). The potential threats of external validity have been limited by carefully choosing one specific industry in Norway. In the present study the target population is relatively homogenous and hence more likely that those who answered the survey (sample) represent the actual population. Subsequently, the total sample size achieved represent 48.9 – 51.8 percent of the target population (before screening and cleaning). Also total turnover of the sample represent approximately 47.0 percent of the total turnover of the target population that was estimated by Møreforskning in 2012 (cf. table 2). Implying some generalizations can be made about the population as a whole. By investigating one homogenous sample the findings may be more generalizable in similar industries in Norway or even abroad. In particular this applies for the maritime sector or industries that share similar characteristics (i.e. high-tech industries that are highly dependent upon innovation and new knowledge and competencies). However, the context concerned in this thesis has characteristics that may threat the external validity and make it difficult to generalize. Because of the rather small sample size, the generalization of the findings should be taken with caution, especially concerning other industries. Additionally, the maritime industry has specific features that may not be transferable to other sectors (i.e. furniture, hotels,

[7] Sum of total turnover in the achieved sample has been estimated by calculation of official figures for 2012 searched in Proff.no by comparing with total estimated turnover from both ship consultants and equipment suppliers from section 3.1 in figure 4. Giving (9 445 534 000 / 20 100 000 000) x 100 = 46.99 %.

construction and financial service), because each individual cluster has its distinctive characteristics and varies substantially regarding different cluster dynamics and their geographic locations.

Another concern that should be highlighted to ensure research quality is that of construct validity. This refers to whether the operational definition of variables actually reflects the true theoretical meaning of a concept (Wilson, 2012). The theoretical concept of the dependent variable under investigation is firm innovation. The theoretical meaning of innovation is here defined as introduction of something that did not exist before or improvements in a process, product or system that is novel to the institution or market developing the change. Whereas the improvements in products, processes or services are assumed to be shaped by human knowledge that is influenced through interactions and/or web of gossip internally or outside the firm. To adequately assess these theories into actual measures, the question in the survey that were to capture innovation asked the respondents whether the firm had introduced any products or services on the market the last three years that were new for the firm or substantial/significant better compared to existing products. This question is almost identical with the theoretical construct making this an accurate measurement. Whereas the independent variables in the questionnaire where extensive to include seven different partner types asking whether they had collaborated with the particular partner during the last three years or not. In addition, to capture other potential sources of knowledge that may influence innovation developments, the questionnaire included questions such as firm ownership, directorship in other companies, R&D activity etc. Regarding the geographical sources of innovation the firms were asked whether the different partner types where located regionally or abroad. However, the potential bias here would be the manager's knowledge where these partners are located (in Norway or abroad). A second potential threat of the construct validity are that innovation may be confused by R&D, but in order to limit this threat the present thesis controls for R&D local in the regression analyses. Another issue may be that the survey are conducted in one single-point in time, therefore the questions in the questionnaire asks whether these improved products or processes were introduced during the *last three years*. The construct validity will also be highlighted in section 4.4 of operationalization of the variables, where the theoretical constructs will be translated into adequately measurements.

Regarding reliability of the study, research requires dependable measurement. Measurements are reliable to the extent that they are repeatable and that any random influence which tends to

make measurements different from occasion to occasion or circumstance to circumstance is a source of measurement error (Wilson, 2012). In this thesis the dependent variables (product innovation, process innovation, radical product innovation and radical process innovation) is based on a self-reporting questionnaire that may provide potential threat to the reliability of the results. A successful completion of the survey assumes that all respondents are familiar with the different terms used in the survey, and that the respondents possess necessary knowledge to answer the questions (i.e. which partners have been collaborated with the last three years and where these partners were located, if the innovation(s) was new to the firm or market, and the share spent on R&D and whether these activities where located in the region, Norway or abroad, respectively). The results of the questionnaire can also vary depending on the respondent's position within the firm. However it is unlikely that gender and age will create discrepancies. To respond to these possible threats the questionnaire was distributed to top managers. Upon survey collection, respondents conducting the survey consisted of 51 percent CEOs and 38 percent managing positions, while the reminder 11 percent were assistant and academic employees (cf. appendix E).

In order to increase and ensure the reliability and validity in the present thesis, I have used questions that are already widely accepted and been tested before. The self-administrated survey is based on a questionnaire that has been successfully used by Fitjar & Rodríguez-Pose (2011). Where they used indicators from CIS and WVS and thereafter tailored the questions to the need of the analysis. The CIS have extensive experience with surveys that are executed by national statistical offices and the surveys are designed to give information of the innovativeness of different sectors and regions (Eurostat). The WVS on the other hand, is a global research project that explores people's values and beliefs and it is carried out by a worldwide network of social scientists (World Values Survey Association).

4.3 Statistical methods

In order to analyze the data collection and investigate the innovation tendencies in the maritime industry, this thesis use the data software SPSS[8]. The statistical procedures that have been used are descriptive statistics and binary logistic (also referred to as logit) regression analyses to test the presented hypotheses. Because of the small sample Chi-Square test for independence and estimated robust standard errors by bootstrapping technique are also conducted. The basic idea of bootstrapping is that inference about a population from sample

[8] Statistical Package for the Social Sciences (version 21.0).

data can be modeled by *resampling* the sample data and performing inference on (Wilson, 2012). The dependent variables are the different innovation types, namely; product innovation, process innovation and whether they are radical innovations. When the dependent variable in an attrition study is dichotomous (i.e., degree earned vs. not earned), binary logistic regression, as opposed to either multiple regression or discriminant analysis, is particularly appropriate. Logistic regression is chosen over discriminant analysis because discriminant analysis relies on strictly meeting the assumptions of multivariate normality and equal variance-covariance matrices across groups. These strict assumptions are rarely met (Hair et al. 2014).

By the use of logistic regression the assumptions are more robust, making its application appropriate in many situations (Hair et al. 2014). The logistic regression models the natural logarithm of the odds of being in the category of interest as a linear function of the independent variables. Where the independent variables of interest here are based on the six types of partners; suppliers, customers, competitors, consultancies, universities, and research institutes. In the examination of what difference does the geographical proximate make on the innovation, the analysis focus on collaborating with partners outside the conglomerate, as the geographical reach of collaboration within conglomerates will fundamentally be shaped by whether the conglomerate itself is a regional, national or multinational enterprise, rather than by the nature of the knowledge flows (Fitjar & Rodríguez-Pose, 2013, p.135). However, the collabortaion partner with other firms within the conglomerate will be treated in some of the descriptive tables to give a broader view of the collaboration patterns of the supplier firms.

Further, as stated in the theoretical section, these individual partner types will refer to the three categories of partners: STI–mode interaction (with consultants, universities, and research centres) and DUI–mode interaction, distinguishing between DUI-mode interactions within the supply chain (suppliers and customers) or not (with competitors). Within each of these categories a distinction is made between collaboration with partners located in the region (Norway) and outside the region (abroad). These variables (Y) are binary variables, which takes the value 1 if the firm has collaborated with this type of partner within the last three years, and 0 otherwise. In order to prevent the independent variables from being more significant than they should, the models also include the control variables firm size and R&D local.

The population logit model of the binary dependent variable Y with multiple regressors is:

$$\Pr(Y = 1|\ \mathbf{X}) = F\ (\beta_0 + \mathbf{\beta X}),$$

Where *F* is the cumulative standard normal distribution function (Stock & Watson, 2003), and $\mathbf{\beta X} = \beta_1$ (Regional DUI supply chain) + β_2 (Non-regional DUI supply chain) + β_3 (Regional DUI non-supply chain) + β_4 (Regional STI) + β_5 (Non-regional STI) + β_6 (R&D local) + β_7 (Firm size). *Pr* refers to the probability of firm *i* introducing an innovation, with four different logistic regressions being run – one for each of the innovation outcomes (product innovation, process innovation, radical product innovation and radical process innovation).

The coefficients is called logistic, or a logit, and can be interpreted at the estimated change in the logit of a one unit increase in the explanatory variable. The logit is another expression for the log odds that is defined as the ratio of the probability that an event will occur to the probability that it will not. Factors with values greater than one indicate that the odds are increased; and those with values less than one indicate that the odds are decreased (Hair et al. 2014; Pallant, 2010). Two types of logistic coefficient differ in that they reflect the relationship of the independent variable with two forms of the dependent variable, as seen below.

Logistic coefficient	**Reflects changes in….**
Original	Logit (logged odds)
Exponentiated	Odds (e^{logit})

Source: Adopted from Hair et al. (2014 p. 326)

The magnitude of change is thus best measured through the exponentiated coefficients as systematized in the following expression:

Percentage change in odds = (Exponentiated coefficient – 1.0) x 100

The method used to interpret dummy variables is slightly different. Since dummy variables only have two values. The dummy tells whether or not a characteristic is present or absent. In this case the exponentiated coefficient represents the level of the dependent variable for the represented group versus the omitted. The relationship between the two categories can be stated as follows:

$$Odds_{represented\ category} = Exponentiated\ coefficient\ x\ Odds_{reference\ category}$$

Further, the model fit is estimated by Maximum Likelihood (or ML) to find the function that will maximize the ability to predict the probability of the dependent variable *innovation* based on information about the independent variables, *collaborating partners* (Hair et al. 2014). Likelihood simply refers to probability, meaning probability under the specified hypotheses. The hypothesis if no effect will be rejected if the p - value is less or equal to 0.05.

4.4 Operationalization of variables

The variables rather than the concepts have to be recoded into logit-values to empirically test the proposed hypotheses and make statements about the literature.

4.4.1 Dependent variables: Fourfold classification

As a way to test the presented hypotheses, the following dependent variables: product innovation, process innovation, radical product innovation and radical process innovation are dichotomous. The binary variables take the value 1 if the firm has innovated in the last three years, or 0 otherwise. The specifically tailored innovation survey from Fitjar & Rodríguez-Pose (2011) was used in order to provide a reliable measure of innovation. In accordance with the Oslo Manual, SSB defines innovative companies as "new or significantly improved product (goods or services) on the market or introduced within the enterprise a new or significantly improved process during the last three years" (Statistics Norway, 2004, p. 22). Similar to Fitjar & Rodríguez-Pose (2011), use classification of innovation that are the introduction of new products or processes in the firm over last three years, and distinguing between the innovations whether they are product, process, radical ones. This classification of innovation allows for a greater nuance in the explanation of how different forms of firm partnerships may affect different types of innovation.

The operationalization of *product innovation* was based on a question in the survey asking: "Apart from sales of new products from other suppliers: Has your company introduced any goods or services into the market during the past three years that were new to the company or significantly improved compared to your existing products?" while for *process innovation* the question was "Has your company introduced any methods or processes for production or delivery of products during the last three years that were new to the company or significantly improved compared to the company's existing methods?" In order to determine whether the product or process innovations were *radical* or *incremental* innovations, the question in the survey asked: "Were any of these product innovations new to the market/industry, or were

they new to your company?" If the innovations were new to the market and/or industry they were characterized as radical innovations and if they were new to the firm they were characterized as incremental innovations. However, in the statistical analyses only the radical innovations were extracted from the question when asking the firms whether the innovation(s) were radical or incremental ones. Alternatively, the outcomes could also be treated as two trichotomous variables with the values "no innovation", "incremental innovation" or "radical innovation". This would lead to either multinomial logistic or ordinal regression models.

Finally, the firms were also asked about the origins of their innovations, whether they had developed the innovation(s) by the company itself, in cooperation with other companies or organizations, or mainly by other companies or organizations. These questions provide a reliable measure to identify the different innovation types in the surveyed companies.

4.4.2 Independent variables: Regional and global DUI - mode

The predictors in the logistic regression analyses are the different types of collaboration partners within the DUI and STI-modes of interaction. In order to examine the firms collaborating companies or partners in the DUI-mode, the survey asked which, if any, of the following partners: suppliers, customers and/or competitors, their firm had cooperated with during the past three years. In addition, the respondent firm was asked for each partner, to state whether the partner(s) were located in the region, elsewhere in Norway or abroad. The partners located in the region were summated with the partners located in Norway in the logistic regression analyses, now referred to as *regional partners*. Giving the following independent variables for the DUI-mode:

- Regional DUI – mode non-supply chain: (competitors) within the region
- Global DUI – mode non-supply chain: (competitors) outside the region

- Regional DUI – mode within supply chain: (suppliers + customers) within the region
- Global DUI – mode within supply chain: (suppliers + customers) outside the region

All the DUI-variables are binary variables by nature, taking the value 1 if the firm has collaborated in this mode during the last three years, or 0 otherwise.

4.4.3 Independent variables: Regional and global STI - mode

Similar, to examine the firms collaborating companies or partners in the STI-mode, the survey asked which, if any, of the different types of partners: consultancies, universities, and/or research institute, their firm had cooperated with during the past three years. The firm was also asked to identify whether the partner was located regional, elsewhere in Norway or abroad, respectively. The partners located in the region are summated with the partners located in Norway, now referred to as *regional partners*. Giving the following independent variable for the STI-mode:

- Regional STI-mode: (consultancies + universities + research institutes) within the region
- Global STI-mode: (consultancies + universities + research institutes) outside the region

The STI-mode variable is binary and takes the value 1 if the firm has collaborated with the respective partner(s) in the last three years, or 0 otherwise.

4.4.4 Control variables

A control variable is a variable that is held constant and whose impact is removed in order to analyze the relationship between other variables without interference (Hair et al. 2014). As common in firm-level analyses, the model controls for a set of factors that are related both to innovation and to the use of partners. As the maritime sample is assumed to be homogenous, the analyses require less control variables. Hence, the following variables: *Firm size* and *R&D investment local* have been controlled for in this study.

The operationalization of *firm size* was based on a question in the survey asking the respondent firm how many employees are there at the company you manage. This variable was measured by the log number of employees in the firm. The measure was used because the effect of an additional employee is expected to decline with increasing company size. Prior studies have identified a significantly positive relationship between firm size and innovativeness. This is based on the interpretation that only large firms have the resources to implement the large scale innovation that is required to generate ideas for new products and processes, and to develop these ideas so that they can be implemented commercially (Fitjar & Rodríguez-Pose, 2013). However, empirical evidence for the positive association between company size and the level of innovative activity can reach stagnation or even point in the opposite direction after a firm becomes too large (Lipczynski et al. 2013).

R&D local was measured by a question in the survey asking how many percentages of the firm's research and development activities are carried out locally, other parts in Norway or abroad, respectively. However it should be noted that R&D total have been experimented with in the analyses, as well as, R&D Norway and R&D abroad, but they did not contribute significantly. Therefore the variable R&D local was used as a control variable as it captured more of the variance in the dependent variables. Further, he R&D variable is used as a control variable because it is the most common indicator for measuring innovation, and is often used as a synonym for innovation (Andersson et al. 2004). Firms who invest large amounts in R&D are generally more innovative than those firms that do not (Fitjar & Rodríguez-Pose, 2012). In total, table 3 shows the different variables for the logistic regression analyses.

Table 3: Overview of operationalization of variables

Concept	Operationalization	
Innovation types	Binary dependent variables originating from significantly improved products/service or processes	Dependent
DUI supply chain	Binary variable taking the value 1 if collaborated with DUI supply chain partners and 0 if not, during the last three years	Independent
DUI non-supply chain	Binary variable taking the value 1 if collaborated with DUI non-supply chain and 0 if not, during the last three years	Independent
STI	Binary variable taking the value 1 if collaborated with STI-partners and 0 if not, during the last three years	Independent
Firm size	Log. number of employees in the firm in Norway	Control
R&D local	Percentage of R&D carried out local	Control

5. Results

Despite receiving total 88 questionnaires, the sample of the maritime suppliers is limited to N= 63-71 after screening and cleaning. However, the remaining data is still sufficient in order to provide reliable analyses. With a limited sample size, non-parametric statistics have been conducted to explore the relationship of the variables and to enhance the reliability of the logistic regression models. This chapter will start by presenting descriptive data on all variables that are included in the logistic regression analyses and comment briefly on them. Thereafter the assumptions for the logistic regression are shortly described. Finally, four separate logistic regression models with bootstrapping P-values are presented. The first two models, product innovation and process innovation, are the primary focus of this thesis. The reminding two models that concerns radical product innovation and radical process innovation, are conducted for complementary insight. However, before the finalized logistic regression models were established, Chi-square tests for independence were conducted on all variables in order to reveal which of the independent variables captured most of the explanation in innovation.

5.1 Descriptive statistics of the maritime suppliers

The survey conducted is rather extensive and includes questions that relate to the firms innovative activities: i.e. their knowledge sources of innovation, their use of regional or international partners, R&D investment. All this information is valuable in the investigation of firm innovation sources. Therefore this section use descriptive statistics to examine the characteristics of the data by presenting a wide range of tables to explore the different collaboration trends that are found in the maritime supplier firms. As most of the figures are self-explanatory they are only briefly commented on.

Table 4: Descriptive data of the supplier firms

No. of employees	% of sample	Total % of turnover spent on R&D	% of sample	% of R&D activity local of total R&D	% of sample	% of employees with university degree	% of sample
1 - 49	75.7	0	21.7	0	21.5	0	8.6
50 – 249	22.7	0.2 – 5.0	49.3	1 – 20	3.1	1 – 20	41.4
250 <	2.7	5.1 – 10	15.9	21 – 30	0	21 – 30	10.0
		10.1 – 20	5,8	31 – 40	1.5	31 – 40	2.8
		20.1 – 30	1.4	41 – 50	9.2	41 – 50	8.6
		30.1 – 75	5.8	51 – 80	6.2	51 – 80	14.3
				81 - 100	57.0	81 - 100	14.3
	N = 75		N = 65		N = 65		N = 70

Table 4 shows the descriptive data for the maritime supplier firms in the sample, including firm size, R&D activity total, R&D activity local, and share of employees in supplier firms with university degree. The maritime sample are dominated by small (less than 50 employees) and medium sized firms (50 – 249 employees). Only 2.7 percent firms are large (more than 250 employees). Most of the firms report R&D activity, but the R&D activity differs among the firms. Almost half of the firms invest between 0.2 – 5.0 percent of their turnover on R&D. With approximately 29.0 percent of the firms invest at least 5.0 percent of turnover on R&D. If examine where most of the R&D investment are carried out, the third column shows R&D investment *local* based on firms total share of R&D. Almost 63.2 percent of supplier firms invest between 51 – 100 percent of their R&D local. The last column, displays level of education, showing that 28.6 percent of the supplier firms have more than 50 percent of their employees with a college degree. Further, in figure 7 a sector diagram presents an overview of the surveyed firms in their respected municipalities are illustrated.

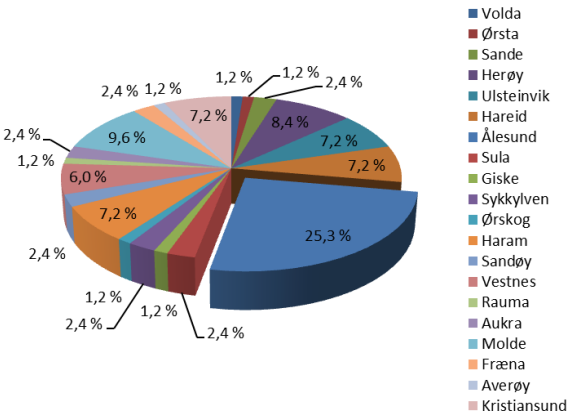


Figure 7: Sector diagram of the represented firms in the municipalities

The sector diagram shows that the supplier firms are located in an array of location around Møre and Romsdal county in different municipalities. With the dominated municipality being Aalesund which accounts for total 25.3 percent of the suppliers included in the sample. This is not surprising as most of the supplier firms are located there. This is followed by Molde which represents 9.6 percent and Herøy representing 8.4 percent. Further, four municipalities equally represents 7.2 percent of the total sample, comprising of Ulsteinvik, Hareid, Kristiansund and Haram, respectively. Vestnes represent 6.0 percent, while the reminding municipalities represent between 2.4 and 1.2 percent. In order to gain a more thorough view where the dominating developments of product and process innovation takes place, table 5 displays an overview.

Table 5: Innovation developed in the last 3 years, % of surveyed companies

	Product innovation	Process innovation
Type of innovation: (% of all companies)	77,10	67.5
N	83	80
Innovations were developed..(% of innovative companies)		
Mainly by our company	64.1	37.0
In cooperation with other companies or organizations	21.9	46.3
Mainly by other companies or organizations	14.1	16.7
N	64	54

The surveyed supplier firms seem to be relatively innovative, with a broad set of knowledge sources gathered from various actors. As the top half of the table indicates a total of 67.5 - 77 percent of the maritime suppliers' report that they have innovated in the last three years. With the majority of the innovation was said to be within product innovation. These product innovations were reported to be mainly developed by the firm itself, while almost 22.0 percent of the suppliers said their product innovations were in cooperation with other organizations, where process innovation were said to be mainly developed in cooperation with other organizations. Table 6 gives a clearer picture of which these innovations were developed with, showing each partner type and their respective shares of firm collaboration.

Table 6: Number and share of firms collaborating with different types of partners

Partner type	Number of firms	% of firms
Other firms within the conglomerate	43	60.6
Suppliers	63	88.7
Customers	61	85.9
Competitors	23	32.4
Consultancies	42	59.1
Universities / Colleges	13	18.3
Research institutes	27	38.0
N	71	71

More specifically, the table displays the share of supplier firms in the M&R cluster that reported cooperation with the seven different partner types during the past three years, without considering the geographical dimension. The most common collaborating partner is found in the DUI-mode within supply chain. Both suppliers and customers are the most frequently used partners, with almost nine of ten firms collaborating with either one. Three of five firms collaborate with other firms within the conglomerate. In regard to scientific partners, the most preferred partners are consultancies where almost three of five collaborate

with consultants. Two out of five firms collaborate with research institutes, followed by one of five firms with universities and/or colleges. The following table 7 displays the various partner types according to the three categories of partners whether they are regional or non-regional.

Table 6: Share of supplier firms in M&R collaborating with partners within and outside the region

Partner type	Regional	Non-regional
DUI non-supply-chain	29.6	9.8
DUI supply chain	91.5	67.6
STI	64.8	18.3
N	71	71

This table presents the collaboration tendencies according to each of the categories that are used in the regression analyses. For each collaboration category, the share of firms that have collaborated with at least one partner in the category are illustrated. It is clear that DUI supply chain is the most preferred cooperation partners both regionally and non-regionally. While the STI mode regionally is the second most popular category for important information sources for firm innovations. The supplier firms have in general a broad set of knowledge sources of relevance for their innovation activity. They are searching for and getting information from a broad set of partners and organizations, also outside the value chains and agglomerations.

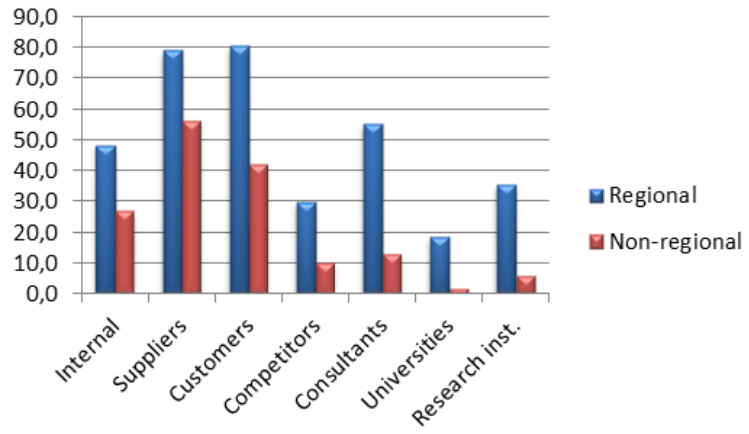


Figure 8: Percentage share of firms which have cooperated with partner type

While table 7 provided an overview of the partners in categories, figure 8 on the other hand illustrates the share of each individually commonly used partners and their geographic location, whether it is regional or abroad. Cooperation with all seven partners within the region is more common than cooperation with partners abroad. When it comes to frequency of

collaboration inside versus outside the region, the majority difference can be found in the STI – mode. The biggest difference in regional vs. non-regional cooperation is for consultancies: 54.9 percent of supplier firms collaborate with consultants in the region whereas 12.7 percent outside the region. Even for universities and research institutes, regional cooperation is most common: 18.3 percent cooperate with universities and 35.2 percent with research institutes within the region, whereas only 1.4 percent cooperates with universities and 5.6 percent with research institute located abroad.

5.2 Assumptions for logit analyses

Prior to the logistic regression analyses four assumptions were tested. First, the overall sample size guidelines by Hosmer and Lemeshow, recommending that sample size for each group is 10 observations per estimated parameter. The ratio of cases to independent variables is 9, to 1 which does not satisfy the recommended sample size. In addition, it is recommended a sample size for each group on the dependent variable is 10 observations per estimated parameter. Therefore a caution is added to the findings. In order to respond to this violation, I have performed robustness tests (Chi square of independence and robust Bootstrap p-values) to enhance reliability to the results. Second, non-linearity of the linear predictor: The relationship between the variables must be S-shaped, i.e. non-linear, and linear when described through the logit scale. Inspection of the Hosmer-Lemeshow (H-L) test shows there are significant differences between actual and predicted values, indicating that the model is not S-shaped (Hair et al. 2005). The H-L value and significance level is reported in all four models and are insignificant for all four models. The model therefore satisfies this assumption of logistic regression. Third**,** multicollinearity was inspected through the residuals. None of the independent variables had a standard error larger than 2.0, therefore no numerical problems, such as multicollinearity were detected. Finally, the existence of a relationship between the dependent variable and combination of independent variables is based on the statistical significance of the chi-square for the model that includes all of the independent variables. These are presented under each of the models respectively.

5.3 Chi - square test for independence

Because of the small sample size for logistic regression analyses, non-parametric techniques are especially useful when having categorical variables. Therefore the Chi-square test for independence (χ^2) (with Yates Continuity Correction) have been used to statistical test the categorical variables to evaluate how likely it is that any observed difference between the sets arose by chance (Pallant, 2010). To be significant, the Sig. value needs to be .05 or smaller, if the opposite is true there is no significant association between the variables. The assumptions that are concerned in the Chi-square test is that least 80 percent of the cells should have expected frequencies of 5 or more, if this assumption is violated the Fisher's Exact Probability Test should be considered (Pallant, 2010). Table 8 lists the dependent variables along the horizontal columns and the independent variables in the vertical rows.

Table 7: Pearson Chi-Square test for independence

	Product innovation	Process innovation	Radical product innovation	Radical process innovation
DUI non - supply chain, regional	.05* (0.05*)	.40	.03*	1.00
DUI supply chain, regional	1.00 (1.00)	.87 (.66)	.64 (1.00)	.76 (.59)
DUI supply chain, non-regional	.03*	1.00	1.00	.52
STI, regional	.16	.42	.80	1.00
STI, non - regional	.85 (.73)	.91 (.75)	.22	.34 (.28)
N	71	69	70	70

* P < 0.05 (Asymp.Sig. 2-sided)

Note: The numbers in the parentheses lists the Fisher's Exact Sig. (2-sided)

From the Pearson Chi-square test for independence two of the models (product innovation and radical product innovation) had predictors that reached statistically significance. Thus indicating that there are significant association between the concepts *product* innovation and *DUI non - supply chain regional*, as well as for *product* innovation and *DUI supply chain, non-regional*. There were also found significant association in the third model between *radical product* innovation and *DUI non - supply chain, regional*. The aforementioned will be further inspected in the logit regressions and bootstrap p-values.

5.4 Logistic regressions

Several logistics regression models have been run to investigate the effect of each independent variable on the dependent variable and the models as a whole[9]. In all logistic regression models the dependent and independent variables are dichotomous variables, while the control variables are continuous variables. The following logistic model was applied:

Innovation types (Fourfold classification) = β_0

+ β_1 (regional DUI non-supply chain)

+ β_2 (regional DUI supply chain)

+ β_3 (non-regional DUI supply chain)

+ β_4 (Regional STI)

+ β_5 (Non-regional STI)

+ β_6 (FirmSize)

+ β_7 (R&D local)

In conjunction with the logistic regression analyses, the bootstrap procedure has been performed on all four models to create more robust standard errors for a more accurate view of what is likely to exist in the population. Therefore the Sig. values provided from the logit method was compared with Sig. values from the chi-square tests as well as bootstrap test of 200 samples to reveal whether there were significant consistency among the findings when supporting or rejecting the hypotheses.

9 The logistic regressions have also been run with summated independent variables, as well as different control variables to explore the relationship of the variables before the finalized models was decided upon.

5.4.1 Model 1: Product innovation

Table 9: Result of logit regression for product innovation

Variables	Coefficient	Std. Error	P-value	Robust p-value [b]	Odds ratio
Partner types					
DUI non - supply chain, regional	-1.759	.819	.03*	.01*	.172
DUI supply chain, regional	.661	1.458	.65	.29	1.936
DUI supply chain, non-regional	1.593	.801	.05*	.02*	4.920
STI, regional	.592	.837	.48	.45	1.807
STI, non - regional	1.416	1.167	.22	.16	4.123
Control variables					
Log firm size	.349	.359	.33	.35	1.417
R&D local	.025	.009	.01*	.01*	1.025
N = 65					
Nagelkerke pseudo R^2 = .467					

* P < 0.05 (two-tailed)

[b] Bootstrap based on 200 samples

The full model containing all predictors was statistically significant, χ^2 (7, N = 65) = 23.988, p < .001, indicating that the model was able to distinguish between respondents who reported and did not report having product innovation. The model fit in terms of pseudo-R^2 is between .309 (Cox and Snell R square) and .467 percent (Nagelkerke R squared). This shows a moderately strong relationship between the predictors and the dependent variable. The Hosmer-Lemeshow test is far from significant, indicating that the model fits the logistic curve. The accuracy rate computed by SPSS was 81,5 per cent which was greater than or equal to the proportional by chance accuracy criteria of 80.62[10] percent, therefore the criteria for classification accuracy was satisfied. Table 9 gives information about the contribution or importance of each predictor variables by using the Wald criterion.

The first variable, *DUI non - supply chain regional* has a negative coefficient at -1.759 and is significant at the .05-level in the regression analysis, bootstrap p-value and Chi-square test. Therefore hypothesis 3 that stated regional DUI mode outside the supply chain has a greater impact on product innovation than global DUI mode outside the supply chain is supported. However, collaboration with competitors has a negative impact on product innovation, rather than positive as expected. The odds ratio is .172, thus indicate that by collaborating with DUI non-supply chain regional, the less likely it is that a supplier firm report having product

[10] The proportional by chance accuracy rate was computed by calculating the proportion of cases for each group based on the number of cases in each group in the classification table at Step 0. The proportion in the "yes" group was 15/66 = .0231. The proportion in the "No" group was 50/65 = 0.769. The squared sum of the proportion of cases in each group is the proportional by chance accuracy rate and was 0.645 and the accuracy rate computed by SPSS was 81.5. The following hit ratio was: 1.25 x 64.5 = 80.62 < 81.5

innovation. In other words, for each unit increase in collaboration with competitors, the odds reporting product innovation decrease by a factor of .17 around times, when other variables are being controlled for.

The second predictor, *DUI supply chain regional,* has a positive coefficient and odds ratio. Firms collaborating with DUI supply chain regional are more likely to report yes to total product innovation than firms that do not cooperate with suppliers and customers regionally, but did not reach statistical significance. When examine the third predictor *DUI supply chain non-regional* the coefficient is positive and significant. This was also confirmed both within the bootstrap p-value and chi –square of independence test. As can be seen in the table above the DUI supply chain non-regional has the highest odds ratio of all explanatory variables at 4.920. Implying that a one unit increase in DUI supply chain non-regional increase by a factor of almost 5 times that a surveyed firms have product innovation than firms not collaborating with DUI supply chain non-regional, when other variables are being controlled for. Thus, hypothesis 1 stating that regional DUI supply chain has greater impact on total product innovation than global DUI supply chain is not supported.

The fourth predictor *STI regional* is not significant but, has positive coefficient and odds ratio. Indicating that supplier firms who collaborate with STI mode regional are more likely to report yes to product innovation than those firms not cooperate with STI regional. The final independent variable, *STI non-regional* is not significant either, with both coefficient and odds values being positive. Thus suggest that firms collaborating with STI non-regional will positively influence the dependent variable, product innovation. However, hypothesis 5 that stated global STI have greater effect on product innovation than local STI is not significant hence there is no support for hypothesis 5.

The control variable, *firm size,* is not statistically significant and do not make any contribution of the model. But the second control variable *R&D local* reached statistical significance, with the value of odds ratio being 1.025 implying that a one unit increase in R&D local increases the odds that surveyed firms have product innovation by 2.5[11] percent.

[11] (1.025 – 1.0) x 100 = 2.5%

5.4.2 Model 2: Process innovation

By performing logistic regression on the dependent variable *process innovation*, the sample size decreased to N=63. Therefore the model was simplified to *exclude* the independent variables that were least significant: DUI supply chain non-regional and STI non-regional to respond to the sample size shortage.

Table 10: Result of logit regression for process innovation

Variables	Coefficient	Std.Error	P-value	Robust p-value [b]	Odds ratio
Partner types					
DUI non - supply chain, regional	-.376	.638	.56	.64	.687
DUI supply chain, regional	-.573	1.240	.64	.32	.564
STI, regional	-1.179	.706	.09	.08	.308
Control variables					
Log firm size	.259	.262	.32	.33	1.295
R&D local	.022	.008	.01*	.01*	1.022
N = 63					
Nagelkerke pseudo R^2 = .265					

* P < .05 (two-tailed)

[b] Bootstrap based on 200 samples

The second model containing *process innovation* as dependent variable with all the predictors, was statistically significant, χ^2 (5, N = 63) = 13.443, p < .001. Hence, the model was able to distinguish between respondents who reported and did not report having process innovation. By using the Cox and Snell R square and Nagelkerke R Square, the overall model fit in terms of pseudo-R^2 is between .192 and .265 percent, and correctly classified 73.0 percent. The Hosmer-Lemeshow test is also far from significant. The criteria for classification accuracy are satisfied as the hit ratio was greater than or equal to the proportional by chance accuracy criteria of 68.2[12] percent.

From the above table, the results show that only the control variable, *R&D local* is significant and has a positive impact on the dependent variable process innovation. This was also supported by the bootstrap p-value. Thus, indicating that a one unit increase in R&D local increases the odds that surveyed firms have process innovation with 2.2[13] percent, all other factors being equal.

[12] Hit ratio: 1.25 x 54.6 = 68.2 < 73.0

[13] (1.022 – 1) x 100 = 2.2 %

All three predictors in the model, *DUI outside the supply chain regional*, *DUI supply chain regional* and *STI regional* have negative impact on the dependent variable process innovation, as the odds ratios are below 1.0. Indicating that by collaborating in one these modes, the less likely it is that surveyed firms will report having process innovation. The STI regional was not far from reaching significance. However, hypotheses 2, 4, and 6 did not find support as none of the p - values were significant. Therefore the predictors did not make any contribution to the prediction of process innovation. Although the overall model is significant, it has low explanatory power.

5.4.3 Model 3: Radical product innovation

The third model containing *radical product innovation* as the dependent variable, the sample size decreased to N=64. Therefore the model was simplified to *exclude* the independent variables that were least significant: DUI supply chain regional and DUI supply chain non-regional. This was also inspected in the chi –square test of independence to make sufficient support.

Table 8: Result of logit regression for radical product innovation

Variables	Coefficient	Std.Error	P-value	Robust p-value [b]	Odds ratio
Partner types					
DUI non - supply chain, regional	-1.532	.669	.02*	.01*	.216
STI, regional	.189	.597	.75	.76	1.208
STI, non-regional	1.311	.800	.10	.11	3.710
Control variables					
Log firm size	-.160	.246	.51	.46	.852
R&D local	.018	.008	.02*	.02*	1.018
N = 64					
Nagelkerke pseudo R^2 = .259					

* P < .05 (two-tailed)

[b] Bootstrap based on 200 samples

The third model containing, *radical product innovation*, as dependent variable with all the predictors was statistically significant, χ^2 (5, N = 64) = 13.796, p < .001, indicating that the model was able to distinguish between respondents who reported and did not report radical product innovation. By using the Cox and Snell R square and Nagelkerke R Square the model fit in terms of pseudo-R^2 was between .194 and .259 percent and correctly classified 71.9 percent. The Hosmer-Lemeshow test was also far from significant. The criteria for

classification accuracy were satisfied as the hit ratio was greater than or equal to the proportional by chance accuracy criteria of 62.5[14] percent.

DUI non - supply chain regional has a negative coefficient, showing the direction of the variable. Since the variable is coded 0 – no collaboration and 1 – collaboration, it is clear a firms collaborating with competitors decreases the chance for radical product innovation. The variable is significant with an odds-ratio of .206. Implying that a one unit increase collaboration with competitors regionally decrease the odds by approximately by a factor of .206 times that a survey firm have not *radical product innovation* than supplier firms that do not cooperate with competitors regionally, all other variables being controlled for.

The remaining predictors in the model, *STI regional* and *STI non-regional* have positive coefficients, with the odds ratios larger than 1.0. Meaning that cooperation with research institutes, consultants and/or universities are more likely to report radical product innovation than firms that do not collaborate within the STI-mode. However, the variables have Sig. values larger than .05 and did not make a significant contribution to the model.

The control variable, *R&D local* is also significant with positive b values in this model. Implying, increased R&D activity was associated with an increase likelihood of having radical product innovation. A one unit increase in R&D local increases the odds that survey respondents have radical product innovation with 1.8[15] percent, all other factors being equal. The relationship between, *firm size* and radical product innovation is negative. By increasing number of employees within the firm are more likely have an adverse effect on the dependent variable.

5.4.4 Model 4: Radical process innovation

By performing logistic regression on the dependent variable, *radical process innovation*, the sample size decreased to N=64. Therefore the model was simplified to *exclude* the independent variables that were least significant: DUI non-supply chain, regional, DUI supply chain regional and DUI supply chain non-regional.

[14] Hit ratio: 1.25 x 50.0 = 62.5 < 71.9
[15] (1.018 – 1.0) x 100 = 1.8 %

Table 9: Result of logit regression for radical process innovation

Variables	Coefficient	Std.Error	P-value	Robust p-value [b]	Odds ratio
Partner types					
STI, regional	-.682	.675	.31	.34	.506
STI, non-regional	.981	.785	.21	.21	2.666
Control variables					
Log firm size	.021	.285	.94	.95	1.021
R&D local	.029	.012	.02*	.00*	1.029
N = 64					
Nagelkerke pseudo R^2 = .22					

* P < .05 (two-tailed)

[b] Bootstrap based on 200 samples

The fourth model containing, radical process innovation, as dependent variable with all the predictors was statistically significant, χ^2 (4, N = 64) = 10.104, p < .001, indicating that the model was able to distinguish between respondents who reported and did not report process innovation. The model fit in terms of pseudo-R^2 is between .146 and .220 percent and correctly classified 76.6 percent. The Hosmer-Lemeshow test was also far from significant. However, the criteria for classification accuracy were not satisfied as the hit ratio was not greater than or equal to the proportional by chance accuracy criteria of 79.9[16] percent. Therefore the model was also tested by deleting two outliers, but did not provide any significant different results other than a limited increase in classification accuracy. The presented model was retained as the outliers were inspected without finding any errors and is therefore still a genuine value as they are observation of the segment and should be retained to ensure generalizability to the entire population.

Neither *STI regional* nor *STI non-regional* was significantly affecting radical process innovation. The result showed that STI regional was negative correlated with the dependent variable indicating that firm cooperation with STI mode regionally are less likely to report having radical process innovation. While the opposite is true for the *STI non-regional* variable, by cooperation with STI partners abroad, supplier firms are more likely to report radical process innovation. Hence, none of the independent variables reached significance. Finally, the control variable *R&D local* made a significantly contribution to the predictive ability of the model with the value of odds ratio being 1.029 implying that a one unit increase

[16] Hit ratio: 1.25 x 63.9 = 79.8 > 76.6

in R&D local increases the odds that surveyed firms have radical process innovation by 2.9[17] percent.

In total, the results indicate that there are different explanatory factors affects respectively *product innovation*, *process innovation* and *radical product innovation* and *radical process innovation*. The main significant contributions are found in product innovation and radical product innovation. Table 13 displays a summary of the findings from the four logistic regression analyses.

Table 10: Summary of main results

Variables	Model 1	Model 2	Model 3	Model 4
Partner types				
DUI non - supply chain, regional	Significant and negative	Insignificant and negative	Significant and negative	
DUI supply chain, regional	Insignificant and positive	Insignificant and negative		
DUI supply chain, non-regional	Significant and positive			
STI, regional	Insignificant and positive	Insignificant and negative	Insignificant and positive	Insignificant and negative
STI, non - regional	Insignificant and positive		Insignificant and positive	Insignificant and positive
Control variables				
Log firm size	Insignificant and positive	Insignificant and positive	Insignificant and negative	Insignificant and positive
R&D local	Significant and positive	Significant and positive	Significant and positive	Significant and positive

To build more confidence in the presented results, several analyses have been undertaken in order to test the robustness of the models. As a mean to increase the reliability and validity in the hypotheses and findings all predictors in the logistic regression that made a unique statistically significant contribution to the models were also examined with the chi-square tests of independence and the robust standard errors by bootstrap technique. Even though the logistic regression analyses had a rather small sample, from 63 to 71 firms, the models captured between 35.0 – 40.1 percent of the total target population of the maritime M&R supplier firms.

[17] (1.029 – 1.0) x 100 = 2.9%

6. Discussion

The purpose of the present thesis has been to investigate whether geographical sources of interaction are linked to STI or DUI-modes of innovation within the maritime suppliers in M&R cluster. By examine whether collaboration with different partners improves the likelihood of innovating and whether regional partnerships are more important than global partnership when it comes to firm innovation.

The most surprising and interesting results are found in the model of product innovation, where hypothesis 1 stated that regional DUI-mode supply chain interaction has a larger impact on product innovation than global DUI-mode supply chain interaction was rejected as the global linkages had significant impact on product innovation. Contradictory to expectations, the findings revealed that collaborating with *non-regional suppliers and customers* are significantly associated with product innovation. Global collaboration increases the likelihood of product innovation by a factor of almost 5 times, than those firms not cooperate with suppliers and customers located abroad. On the other hand, the predictor *DUI-supply chain within the region* was positively related to product innovation but it did not make a significant contribution to the model. Rather than being more effective regionally, interaction with suppliers and customers regional does not significantly affect the likelihood of innovation at all. This is consistently in all four logit models. These findings contradict a wide stream of the traditional innovation literature; that geographic proximity, or "local buzz", is a fundamental driver for innovation. These findings conflicts somewhat that of Isaksen (2009). He analyzes the innovation dynamics in six competitive regional clusters that have been appointed as NCE (including the present context, M&R cluster) where he stress the importance of national innovation system in underpinning the innovation dynamics of the clusters. Even though the significantly effect of extra–local linkages on product innovation were unexpected, these findings are in line with other researches that questions that local interactions are the main source of innovation (Bathelt et al. 2004; Owen-Smith & Powell, 2004; Bramwell et al. 2008; Fitjar & Rodríguez-Pose, 2011, 2013; Wolfe & Gertler, 2004).

A reason for the limited innovation effect of cooperation with *DUI-mode supply chain regionally* may be a result of the knowledge circulation in the cluster is neither novel nor varied and may restrict the level of innovation (Gertler, 2003). The benefits of face-to-face interaction, which is more likely to be frequent among regional partners, may be outweighed by gains from seeking extra-local international partners that possess the knowledge needed by

the firm in order to innovate (Fitjar & Rodríguez-Pose, 2011). Thus, an explanation may be the notion of "related variety" as inflow of extra-local knowledge that is similar to existing competences in the region may particularly improve interactive learning, and thus innovation (Asheim et al. 2011). The majority of the supplier firms in M&R cluster may depend on new knowledge as they are engaged in production of non-standardized products and solutions, and therefore require complementary set of highly specialized knowledge. The maritime cluster is international by nature and with organizations and partners spanning all over the globe. Accordingly it may be assumed that the maritime suppliers enjoy characteristics that of global specialized knowledge that facilitate the M&R knowledge intensive industry. Because of the benefits of participating in "global pipelines" they may seek the best possible partners who provide knowledge exchange that is highly targeted towards pre-defined goals (Bathelt et al. 2004; Fitjar & Rodríguez-Pose, 2011).

The results regarding whether regional partnerships or global partnership are more important when it comes to innovation yields interesting results. In three of the innovation outcomes (product, radical product and radical process innovation) the predictors *DUI supply chain non-region* and *STI non-region* had constantly positive and larger effect than any form of regional collaboration. In hypothesis 5 that stated global STI-mode interactions have larger impact on *product innovation* than local STI-mode interaction was rejected, but global STI – mode had larger effect than local STI on product and radical innovations. Interpreting these results, it seems that external markets provide new impulses and ideas, bringing new variety into the maritime supplier firms. In this respect, spatial lock-in may be avoided through the establishment of connections with other organizations outside the region (Boschma, 2005). Why this is the case might be that repeated interactions with other actors in high cognitive, social and high trust environment may not yield the same returns. It may end up to developing a relative homogenous environment in which new knowledge find it difficult to take hold and diffuse (Fitjar & Rodríguez-Pose, 2011). These arguments reflect a recent study comparing performance of family-owned firms within a cluster and outside cluster. They found no causalities between those belonging to a cluster or not, and those firms not part of the cluster had slightly better performance (Bøhren et al. forthcoming). Interestingly, geography proximity was not deemed primary.

Another effect of the clustered maritime supplier firms is collaboration with DUI-mode with competitors. According to the Porterian-view of clustering, competition is considered a self-reinforcing driver for innovation, continually pushing the industry to innovate. High competitive arena, combined with co-operation, through formal and informal channels, facilitates the flow of knowledge among agents, keeping firms on their toes and making them more innovative (Porter, 2008; Fitjar & Rodríguez-Pose, 2011). In contrast, hypothesis 3 that stated regional DUI-mode interactions outside the supply chain has a larger impact on *product innovation* than global DUI-mode interactions outside supply chain was supported but showed a negative effect on product innovation. This was also found to be significant and negative for radical product innovation. Similar to hypothesis 4 that stated regional DUI-mode interaction outside the supply chain has a larger impact on *process innovation* than global DUI-mode interaction outside supply chain was rejected but was also likely to have a negative impact on process innovation. Thus indicating that supplier firms who collaborate with competitors regionally tends to have a detrimental effect on innovation. Collaboration with competitors within the region is associated with lower likelihood of innovation and was found to reduce likelihood of product innovation by a factor of .172 times. While for a respondent firm that does collaborate with competitors regionally has .206 times lower odds for having radical product innovation than supplier firms that do not cooperate with competitors. However, these finding are also in line with Fitjar & Rodríguez-Pose (2013). The likelihood of decreased innovation could be taken as tacit knowledge is not conducive to firm innovation regionally, at least not through competing firms. Supplier firms at maritime M&R cluster have strong rivals inside the cluster (Isaksen, 2009). Therefore, as argued in the theoretical section, too much proximity may result in having negative impacts on innovation, especially in highly specialized industries. The reason for this may be the fact that maritime supplier firms are rather homogenous therefore the necessary heterogeneity is not present to generate new knowledge (Srholec & Verspagen, 2008). It is evident that the fact that geography proximity to industry partners is not alone enough to have a positive explanation effect on innovation outcomes.

In the model for process innovation, hypothesis 2 stating that regional DUI-mode supply chain interaction has a larger impact on *process innovation* than global DUI-mode supply chain interactions, and hypothesis 6 that global STI-mode interactions have larger impact on *process innovation* than regional STI-mode interactions were rejected. However, both STI regional and DUI supply chain regional had negative odds ratios, showing that regional

partnership are not likely to result in process innovations within the cluster. Additionally hypothesis 5 that global STI-mode interactions have larger impact on *product innovation* than regional STI-mode interactions was rejected. But cooperation with non-regional research centres, universities, and consultants had larger positive associations on all innovation outcomes than regional STI-mode. Although I did not find significant support for the importance of the STI–mode, the control variable *R&D local* was significant and positive in all innovation outcomes. Implying that for each unit increase the supplier firms invest in R&D local, the likelihood for product innovation increase with 2.5 percentage points. The likelihood for process innovation is 2.2 percent higher, and radical product innovation 1.8 percent higher. The likelihood of radical process innovation is the highest among the four models, where the likelihood of innovation is 2.9 percentage points for each unit increase in R&D local. Thus, suggesting that firms that carry out their R&D activities local are more likely to have innovations than those not investing in R&D local. In the theoretical section, R&D activities and collaboration with universities, consultants and research institutes are stated as indicators of the STI-mode. This might be taken that some of the STI-mode interaction effects are captured in research and development activity local, as the DUI type innovation is generally not R&D intensive (Fitjar & Rodríguez-Pose, 2012). Hence, supplier firms may carry out parts of their innovations through R&D units locally either in-house or in collaboration with outside scientific sources. According to Statistics Norway, Norwegian firms are buying more R&D services performed by other actors which in 2012 were estimated NOK 5.9 billion in 2012.Where, NOK 1.2 billion of the expenditures were hired services from research institutes, universities and colleges in Norway[18]. These might include scientific partners stimulating firms' product and process innovations (Statistics Norway, 2014).

Finally, the control variable, *firm size* had little impact on the likelihood for innovation. This might be due to the small sample included in the analyses, however firm size had consistently positive effects on all innovation outcomes, except for radical product innovation where it was negative. Overall, it does not seem that the form of tacit knowledge generated in geographic proximity increase the likelihood for innovation in the maritime supplier firms. But, rather the more formal interaction type of codified knowledge. The early cluster theory stating that innovation primarily relies on local conditions "limited" to people in the cluster does not seem to apply for the supplier firms. As Bathelt et al. (2004) argue the more firms of

[18] Based on Norwegian firms with at least 5 employees.

a cluster engage in the buildup of extra-local pipelines the more information and news about markets and technologies are ‘pumped’ into internal networks and the more dynamic the buzz from which local actors benefits. Accordingly, as stated in the theoretical section about the Norwegian paradox, many innovative firms spend little on R&D and yet they are able to successfully innovate by drawing on knowledge and expertise from wide range of external sources. Hence, it may be asserted that the suppliers in Møre and Romsdal maritime industry require more pipelines than local buzz.

7. Implications

This chapter provides governmental and managerial implications from the results and discussion from SMEs maritime suppliers in Møre and Romsdal cluster. In order to consider the generalizability of the presented results, this thesis was conducted on one industry (maritime) in one region (Møre and Romsdal), by investigating one rather homogenous sample (maritime suppliers). The contributions and implications of this thesis may serve purposes for policy and practice regarding the role of geographical sources for innovation performance.

From the discussion, it is obvious that modes of innovation are a complex interaction system that is interwoven with cluster policy. In this regard, to work efficiently it has to work on multiple levels. If the regional, national or international institutions are not efficient, the regional institutions will most likely suffer, and that will impact the result of the innovative capacity of firms. It should be emphasized that, ultimately, innovations are created through interactions among individuals, not by the clusters, firms and organizations as such. Thereby innovation has to be regarded as a social process by individuals, but also a cumulative process. One of the prime objectives of innovation policies and cluster policies may thereby be to facilitate interactions.

7.1 Governmental implications

In line with the discussion described in the context of M&R, this industry is one of the world's leading offshore clusters. The maritime industry is of great importance to value creation in the region and contributes to approximately 30 percent of total industry value creation. This figure would even been higher if including the ripple effects it creates. M&R is the region in Norway where the maritime industry means most for industrial development (Jakobsen et al. 2014). Thus, it is clear that the government must present stable framework conditions for the industry to continue its growth, and ultimately benefit the society as a whole. As established from the findings, it is evident that those firms already engaged in a global collaboration are more likely to have product innovation than those firms not having partnership with suppliers and customers abroad. As this is assumed to be positively influenced by global knowledge that are similar or complementary to existing competences in the region and thus innovation. It is therefore recommended that policy should be aimed to promote and invest in knowledge sharing and facilitate extra-local cooperation with national and international projects for

industry research, cooperation and discussion. To mention some of the already established such projects nationally and regionally are: "Steady as she goes", MAROFF[19], NCE, while "Horizon 2020"[20] is global cooperation project. Projects should focus on increasing global interaction linkages both at the regional, national and global level. Policies should support the development of external networks and the connection of maritime firms inside the region and outside world with respect to customers, suppliers, markets and other resources. These projects are also facilitators regarding the R&D development within the region. The development of such wider (global) networks and collaborations could help maritime firms as well as the industry as a whole, to overcome barriers to innovation related to resources and capabilities, and complement regionally available expertise.

Further, the significant effect of R&D activity that is performed locally indicates that increasing investment in research and development within the region are important. As established from the descriptives total 57 percent of the sample carries out between 81 to 100 percent of their R&D activity in Møre and Romsdal. Policy aim may be directed towards increasing network cooperation between firms R&D activities, and the region's research centres, consultants and universities within M&R industry. These activities may also give tax benefits (skatteFUNN). All Norwegian companies with research and/or development projects or planning to start such projects may apply for approval so that the company can use its right to tax credits. Firms obtain 18 percent (large enterprises) or 20 percent (small and medium enterprises) tax credit of approved expenses for R&D work (Nærings- og handelsdepartementet, 2012). This policy may be important to motivate maritime firms to carry out and increase investments in R&D.

7.2 Managerial implications

In line with the discussion part of the detrimental effect of firm collaboration with competitors, managers should be aware of the effect that too much interaction of the informal kind with regional competitors may lead to "lock in" and even hamper innovation. Heterogeneity matter for innovation and is more common in geographic distance than in close proximity. Even though the competitors regionally in the analyses includes competitor from Norway, the maritime suppliers are rather homogenous which may hinder both product innovations and radical product innovations. Additionally, when partners are direct

[19] For more information about "MAROFF", see http://www.forskningsradet.no/prognett-maroff/
[20] For more information about "Horizon 2020", see http://ec.europa.eu/programmes/horizon2020/

competitor where both firms seek to maximize their learning process, these goals may conflict directly, and may impact the innovation outcome (Hamel et al. 1989). Therefore it may be recommended for the maritime suppliers to be careful when choosing which competitor to collaborate with.

Secondly, partners in the DUI-mode outside the region are shown to be important for product innovation. As a result, managers should facilitate global pipelines for exchanging valuable knowledge. Policies should be aimed at strengthen linkages to sources of codified knowledge to facilitate for extra-local collaboration. At the same time, employees should be aware of their knowledge policies: the protection of strategic knowledge and promoting the absorption and diffusion of knowledge. However, it should also be noted that interaction through global pipelines is costlier than interaction in regional environments. The conscious act, time and efforts involved in establishing connections with the outside world also imply that not all firms have equal accessibility to engage in such pipelines. The processes behind the establishment and maintenance of global pipelines must be predesigned and planned in advance, and they require specific investments. This involves a complex and costly process (Bathelt et al. 2004).

Third, in order to turn new knowledge from global interactions to be successfully translated into innovation outcomes, the supplier firms rest on their absorptive capacity. The ability to exploit external knowledge is a critical component that is depends very much on the internal organization of the firm. To evaluate and utilize outside knowledge is largely a function of the level of prior related knowledge. For the supplier firms, this may include openness to external knowledge sources and awareness of where useful complementary expertise resides within and outside the organization. It is likely that communication systems, in-house training, and knowledge enhancing activities will facilitate knowledge creation and in turn may be translated into innovation.

Finally, managers should promote R&D investments local if not already pursuing it. Efforts such as strengthening the link between universities or increasing the formal qualifications of engineers and scientists may be useful. This does not imply that firms should focus almost exclusively on strategies promoting science-based learning, but balancing the two modes of learning (DUI and STI) to acquire necessary knowledge. R&D alone cannot be expected to constitute a strong innovation system.

8. Limitations and future research

Factors that relate to innovation are many and varied, and can change over time. The aim of this thesis was not to present an exhaustive model of the determinants of innovation but instead to test the importance of extra-local over regional interactions that relate to firms capabilities to innovate. The present thesis may contribute to policy and practice; however the reader should be aware it is not without limitations.

I acknowledge that the estimates in this study may suffer small samples. As a consequence the findings should be taken with caution. A caution is added to the findings because of the inclusion of the ordinal level of the dependent and independent variables. To respond to these issues I have sought to minimize the impact of the limited sample size by testing different measurements and test the robustness of the statistical significance (cf. robustness test section 5.3 and 5.4) and thus increase the reliability and/or validity. Nevertheless, I was able to explain between 35.0 – 40.1 percent of the total target population, as well as, the sample represent approximately 47.0 percent of the total turnover of the maritime supplier firms. In the view of the small sample, the findings from this thesis may only serve as indications of possibly broader directions. But the fact that clear patterns emerged from the robust p-values, logit regressions as well as similar findings of Fitjar & Rodríguez-Pose (2013), may suggest that the results have some wider implications concerning generalizability.

Finally, due to the limited time of the study, I was not able to investigate which activities that the maritime sample undertake in their R&D investments. Therefore the implications provided for R&D should be understood more at the general level. It would have been interesting to examine which activities that are dominated in these investments, whether it is mostly in-house or in cooperation with various actors. Additionally, the findings in the present thesis generate my curiosity regarding the role of knowledge flow over local and non-local interactions. Thus, for future study it would be highly interesting to conduct a quantitative study outside the cluster to examine whether differences or similarities exist on geographical sources of firm innovation tendencies. Likewise, to gain complementary insight, in-depth qualitative research may also contribute in understanding the complex innovation mechanisms. These questions would help to gain a clearer picture of the complex interwoven network system of firm innovation.

9. Conclusions

The future of the maritime industry at Møre and Romsdal lies in the hands of the firm's ability to innovate. It is becoming increasingly important to develop new products and processes acquired from existing or new knowledge to be globally competitive. However, the global environment for the maritime industry is rapidly changing. International regulations, technological progress and global competition are the main contributors in shaping these challenges. In order to meet these challenges it is necessary to be a front-runner in the innovation race. The M&R industry is particularly ideal as it is one of the most knowledge-intensive of all maritime industries in today's economy. As a consequence, this thesis has investigated whether geographic collaboration between three categories of partners creates advantages for firm innovation. These three categories are based on the science-based STI and the experience-based DUI-modes of innovation. To advance the understanding of innovation process, this thesis has put forward Fitjar & Rodríguez-Pose (2011, 2013) research as point of departure.

The empirical findings demonstrate that: (1) the maritime suppliers are intensively engaged in developing innovations. (2) Firms engaging in extra-regional DUI within the supply chain tend to be more conducive to product innovation. (3) Investment in R&D activities locally increases the likelihood of product, process and radical innovations. (4) Collaborating with competitors regionally has a detrimental effect for product and radical product innovations. Finally, (5) the supplier firms have most of their collaboration partners inside Norway, applying for both within the DUI and STI-modes. Surprisingly the findings showed that global partnership may be more important than regional partnerships for firm innovation. Regional collaboration did not make impact on the likelihood of successful innovations. Interestingly, collaboration with suppliers and customers in extra-local distance made a significant contribution to product innovation. The maritime industry in Møre and Romsdal seem to be more dependent on non-regional linkages than previously expected. These findings also correspond to those of Fitjar & Rodríguez-Pose (2013). Thus, challenge the assertion that innovation takes place in thick environment of local buzz. Therefore future policy should aim at keeping a stable and competitive environment and facilitate knowledge sharing through cross-border cooperation. Further, as proven in this thesis the sources of innovation can rarely be developed entirely within a cluster. So national innovation systems, regional innovation systems and clusters are nested phenomena and need to be treated as such for innovation policy to be successful. A natural extension of the study should focus on investigating

whether significant differences exist between a similar sample of firms outside the cluster. Nevertheless, despite the importance of ‘‘the local’’, it is clear from the analyses that strong linkages to foreign markets, collaborators, and sources of knowledge remain crucial for enabling product innovation in M&R supplier firms. Successful clusters are those that are effective at building and managing a variety of channels for accessing relevant knowledge from around the globe (Bathelt et al. 2004).

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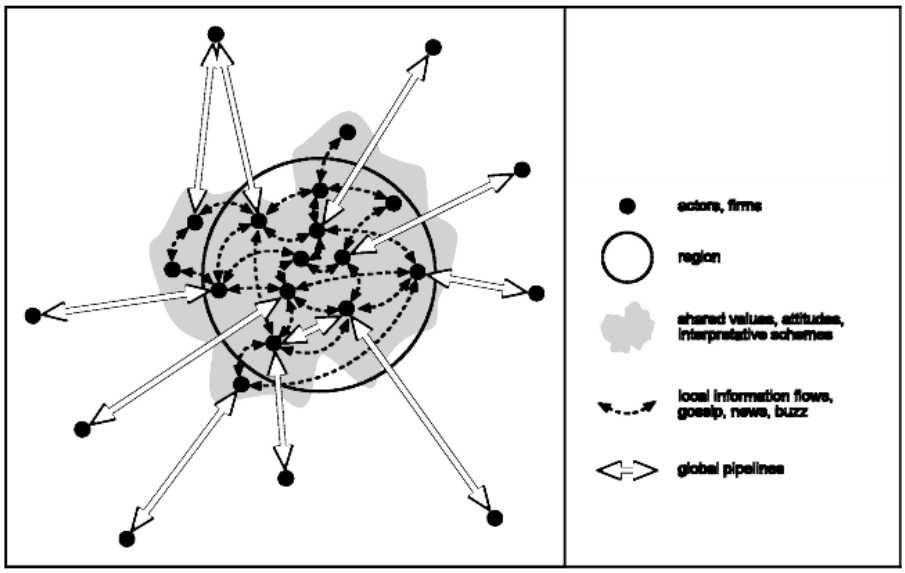
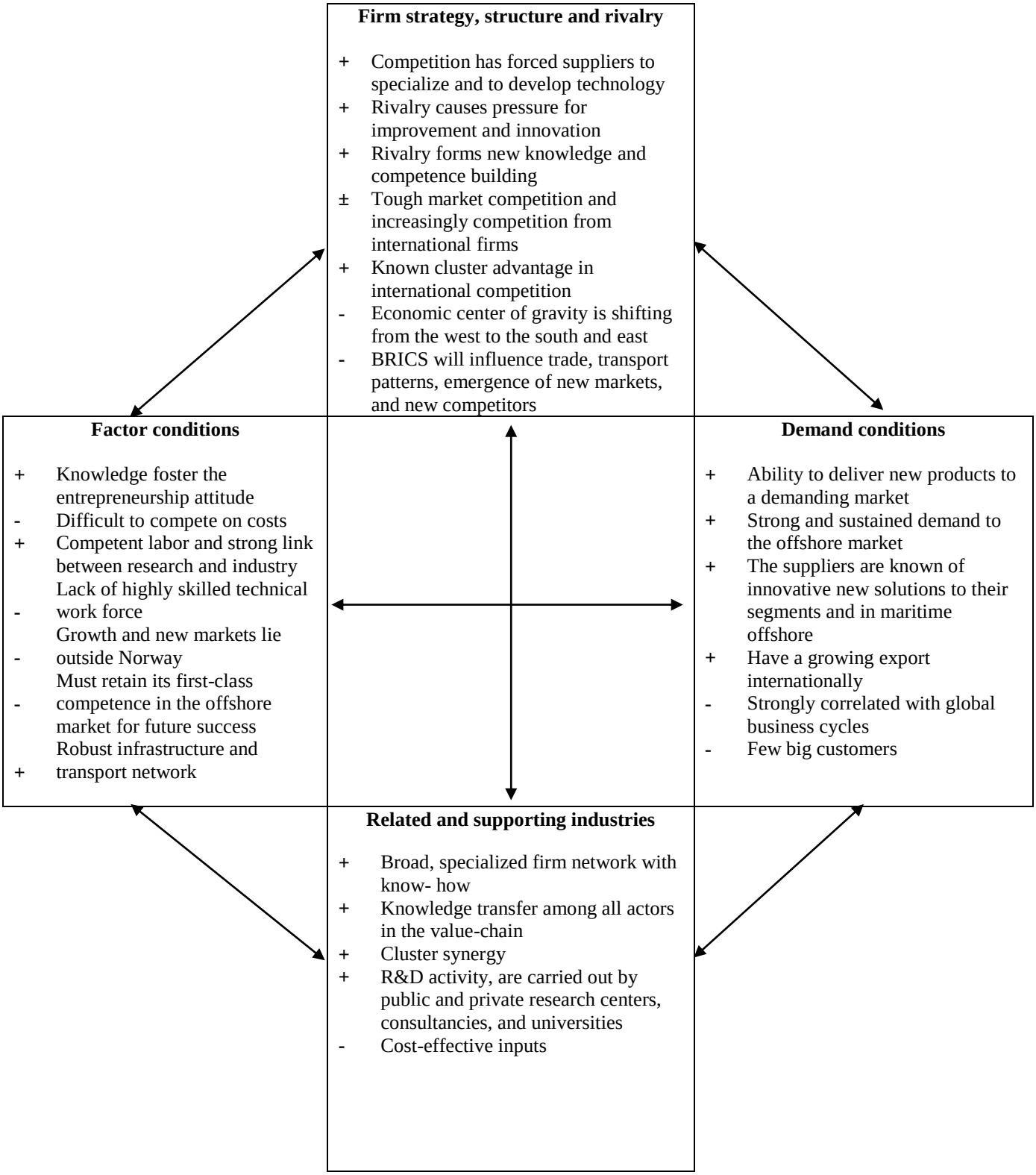
Appendix A: Illustration of the dynamics of local buzz and global pipelines



Source: (Bathelt et al. 2004, p. 46).

Appendix B: Summary of competiveness factors of suppliers



Appendix C: Questionnaire

Innovasjon og Verdiskapning i den Maritime Klyngen

1. **Hvilke kommune hører firmaet til?**

2. **Bedriftens stiftelsesår?**

3. **Er selskapet del av et større foretak, og i så fall som mor- eller datterselskap?**
   - Ja, som morselskap ☐
   - Ja, som datterselskap ☐
   - Nei ☐

4. **Hva er din stilling i selskapet?**
   - Daglig leder / adm.dir ☐
   - Annen lederstilling ☐
   - Faglig ansatt ☐
   - Assistent / administrasjon ☐

5. **Hvor mange styreverv har du i andre selskaper?**

6. Hvis vi ser bort fra videresalg av nye varer fra andre leverandører: Har ditt firma lansert noen varer eller tjenester på markedet i løpet av de tre siste årene som var nye for firmaet ditt, eller betydelig forbedrede i forhold til deres eksisterende produkter?

- ☐ Ja
- ☐ Nei
- ☐ Vet ikke

7. Ble disse produktene utviklet hovedsakelig av ditt firma eller hovedsakelig av andre firmaer eller organisasjoner, eller samarbeidet dere med andre om utviklingen?

- ☐ Av ditt firma
- ☐ Av andre firmaer eller organisasjoner
- ☐ I samarbeid med andre firmaer eller organisasjoner
- ☐ Vet ikke

8. Var noen av disse produktinnovasjonene nye i markedet, eller var de bare nye for firmaet?

- ☐ De var nye i markedet
- ☐ De var bare nye for firmaet
- ☐ Vet ikke

9. Har ditt firma tatt i bruk noen metoder eller prosesser for produksjon eller leveranse av produkter i løpet av de tre siste årene som var nye for firmaet, eller betydelig forbedrede i forhold til firmaets eksisterende metoder?

- ☐ Ja
- ☐ Nei
- ☐ Vet ikke

10. Ble disse metodene eller prosessene utviklet i hovedsakelig av ditt firma eller hovedsakelig av andre firma eller organisasjoner, eller samarbeidet dere med andre om utviklingen?

- ☐ Av ditt firma
- ☐ Av andre firmaer eller organisasjoner
- ☐ I samarbeid med andre firmaer eller organisasjoner
- ☐ Vet ikke

11. Var noen av disse metode- eller prosessinnovasjonene nye for bransjen, eller var de kun nye for firmaet ditt?

- ☐ De var nye for bransjen
- ☐ De var kun nye for ditt firma
- ☐ Vet ikke

12. Har firmaet i de siste tre årene samarbeidet med noen av de partnertypene som er beskrevet under?
Oppgi for hver type om dere har brukt partnere lokalisert lokalt eller regionalt, andre steder i Norge og/eller i utlandet.

Flere svar er mulige per rad.

	Lokalt eller regionalt	Andre steder i Norge	I utlandet
Andre bedrifter i samme konsern	☐	☐	☐
Leverandører	☐	☐	☐
Kunder	☐	☐	☐
Konkurrenter	☐	☐	☐
Konsulenter	☐	☐	☐
Universiteter eller høyskoler	☐	☐	☐
Forskningsinstitutter	☐	☐	☐

13. Om lag hvor stor prosentandel av bedriften du leder eies av personer eller selskaper som er lokalisert i henholdsvis lokalt eller regionalt, andre steder i Norge, i Norden for øvrig, i Europa utenfor Norden og i verden for øvrig?
Fyll inn tall i prosent. Alle rader skal fylles inn. Gyldige verdier: 0 – 100.
NB! Skal summere seg til 100
Den nederste raden viser total.

Lokalt eller regionalt?	
Andre steder i Norge?	
I Norden for øvrig?	
I Europa utenfor Norden?	
I verden for øvrig?	

14. Hva er bedriftens årlige omsetning i millioner norske kroner eksklusiv mva?
Fyll inn hele beløpet i millioner NOK.
NB! Det er tillat med inntil 2 desimaler.

Årlig omsetning i millioner kr: ☐

15. Om lag hvor stor prosentandel av bedriftens omsetning kommer fra salg utenfor Norge?
Svar oppgis i prosent
Det er tillatt med 1 desimal

Prosent av omsetning: ☐

16. Har bedriften ansatte som arbeider utenfor Norge?

Ja ☐
Nei ☐
Vet ikke ☐

17. Om lag hvor stor prosentandel av bedriftens omsetning brukes på forskning og utvikling?
Svar oppgis i prosent
Det er tillatt med 1 desimal

Prosent av omsetning: ☐

18. Om lag hvor stor prosentandel av bedriftens FoU-aktiviteter utføres henholdsvis lokalt eller regionalt, i andre deler av Norge og i utlandet?
Fyll inn tall i prosent.
Gyldige verdier: 0 – 100.
NB! Summen av alle svar skal enten være 100 eller 0.
Hvis vet ikke, la det stå ubesvart i alle radene.

Lokalt eller regionalt ☐

I andre deler av Norge ☐

I utlandet ☐

19. Om lag hvor mange ansatte er det i bedriften du leder?
Her tenker vi på ansatte i virksomheten lokalt

Fyll inn antall ansatte:

20. Om lag hvor stor prosentandel av bedriftens ansatte er utdannet ved universiteter eller høyskoler?
Svar oppgis i prosent

Prosent av ansatte

-Tusen takk for at du tok deg tid til å delta i undersøkelsen!-

Appendix D 1) E-mail sent to all classified supplier firms

Til: Daglig leder eller bedrifts leder
Fra: Maria Kvalsvik Frøystad

Hei,

Jeg er student ved Høgskolen i Ålesund hvor jeg tar mastergrad i Internasjonal Business og Markedsføring. I forbindelse med masteravhandlingen gjennomføres det en undersøkelse om innovasjon og verdiskapning i den maritime klyngen i Møre og Romsdal. Spørreskjemaet tar omlag 8 - 10 minutter og dine svar vil selvsagt håndteres konfidensielt. Din besvarelse er viktig vedrørende bedre forståelse av den regionale verdiskapningen og næringsutviklingen i fylket. Det settes stor pris på om du tar deg tid til å delta.

Her er en link til undersøkelsen:
Link:

Om du har noen spørsmål om spørreskjemaet, ta gjerne kontakt med meg på telefon:
915 49 129 eller e-mail: maria.froeystad@gmail.com

På forhånd, takk for at du deltar!

Obs! Hvis du ikke ønsker å motta påminnelse e-poster, kan du klikke linken nedenfor. Da fjernes du automatisk fra adresselisten.
Link:

Appendix D 2) Reminder e-mail

Til: Daglig leder eller bedrifts leder
Fra: Masterstudent, Maria Kvalsvik Frøystad

Hei,

Din deltakelse er svært viktig for å kartlegge verdiskapningen i Møre og Romsdal. Dette er en påminnelses e-mail, og det blir satt stor pris på om du kan ta deg tid til å utføre denne spørreundersøkelsen som tar om lag 8 – 10 minutter.

Jeg er student ved Høgskolen i Ålesund hvor jeg tar mastergrad i International Business and Marketing. I forbindelse med masteravhandlingen gjennomføres det en undersøkelse om innovasjon og verdiskapning i den maritime klyngen i Møre og Romsdal. Ved høy svarrate kan dette bidra til en bedre forståelse av den regionale verdiskapningen og næringsutviklingen i fylket.

Her er en link til undersøkelsen:
Link:

Tusen takk for ditt bidrag!

Obs! Hvis du ikke ønsker å motta flere e-poster, kan du klikke linken nedenfor. Da fjernes du automatisk fra adresselisten.
Link:

Appendix E: Position in the company of the surveyed respondents