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REPORT 1609 Oddmund Oterhals, Bjørn Guvåg, Marte F. Giskeødegård and Jagjit Singh Srani

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# RECIN – REGIONAL CHALLENGES AND INNOVATION IN BUSINESS NETWORKS

Maritime Network Møre and Romsdal





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<b>AUTHORS</b>	Oddmund Oterhals, Bjørn Guvåg, Marte F. Giskeødegård and Jagjit Singh Srail
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## SUMMARY

This report summarises and documents collected information and results of the Møre and Romsdal part of the research project RECIN (REgional Challenges and possibilities – Innovation and value creation in business Networks). The focus in this report is primarily empirical, while the theoretical implications will be further developed in coming papers/articles. We have conducted a study of industrial network structure, evolution, challenges and possibilities for further development of the business network of maritime industries within the county of Møre and Romsdal. The study is informed by a methodology developed at CIM (Centre for International Manufacturing) at Cambridge University for the mapping, documentation and analysis of industrial business networks.

Presented results are based on available literature and qualitative interviews with selected representatives from a variety of stakeholders within this business network and associated governance actors.

Part one of the report contains an overview of actors within this maritime industry, with key figures and development patterns over the last decades. Part two describes a common theoretical platform for mapping of industrial business systems and a guide for survey interviews to be applied for all business networks within the RECIN project. Part three describes the interview guide and the interview panel for the survey.

Derived results are discussed in part four, covering assessed advantages, driving forces, with international, regional and company based perspectives. Innovation topics are particularly treated and future prospects are discussed.

A comparative study of corresponding analysis of the six regional business networks threatened within RECIN is briefly introduced in part five of the report.

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## PREFACE

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As a part of the research project RECIN (REgional Challenges and possibilities – Innovation and value creation in business Networks) we have made a study of development, challenges and possibilities for further development of the business network of maritime industries within the county of Møre and Romsdal. The research work is part of the parent project RECIN comprising similar studies of six Norwegian business networks in different Norwegian regions. The Møre and Romsdal part of the RECIN project is funded by the Norwegian Research Council within the VRI-program (Programme for Regional R&D and Innovation) and the county of Møre and Romsdal. RECIN is a comparative research project that looks into six network initiatives in four regions in Norway to understand how participation in network and clusters contributes to knowledge creation, innovation and value creation for the involved companies. In Møre og Romsdal, the maritime cluster has been the empirical case. The comparative study is concerned with identifying similarities and differences between these networks (WP1), the significance of global impulses (WP2), the emphasis put on the regional level (WP3) and the firm perspective (WP4).

This report summarises a brief analysis of the development path for the maritime industries within Møre and Romsdal and summarises inputs from interviews of a selection of 10 representative respondents from the industry and related actors. The research work has been carried out in close cooperation with the other research communities of RECIN, and within a common defined methodology.

The project team for RECIN in Møre og Romsdal has been *Oddmund Oterhals* (regional project manager/WP responsible for WP1 in RECIN) and *Bjørn Guvåg* from Møreforsking Molde and *Marte Fanneløb Giskeødegård* (responsible for WP2 in RECIN) from Møreforsking Volda AS. In addition, Dr. Jagjit Singh Srail, Head of Centre of International Manufacturing at Cambridge University, has given vital contributions on the theoretical platform and methodological approach concerning the comparative ambition within WP1.

Molde, August 2016

Oddmund Oterhals      Bjørn Guvåg      Marte F. Giskeødegård      Jagjit Singh Srail

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## 1 THE MARITIME CLUSTER IN MØRE AND ROMSDAL

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The maritime industry on the northwest coast of Norway dates back to the Viking age. Significant changes happened around the year 1900. Construction of larger fishing vessels made of wood with working deck and motorized propulsion, started during that period. The first diesel engine was produced locally in 1903 (Finnøy Motor) and anchor winches and hydraulic equipment for drawing of lines and nets were developed. In the period 1900-1960, the district developed economically due to this new fishing vessel generation. This growth was essentially based on occurrences of herring and codfish along the coastline of Norway. During the same time period a variety of workshops for shipbuilding and repair work was developed.

In the 1950s-60s, local shipyards started building ships of welded steel. A new generation of factory trawlers with production on board was developed and gradually more sophisticated merchant ships, tankers and more specialized vessels came into existence. However, during this aforementioned period, the traditional fisheries declined and both industry and fishing vessel owners were forced to seek new international markets.

Exploitation of oil and gas on the Norwegian continental shelf and in the North Sea started in the 1970s, and the first supply and anchor handling vessels were built by local shipyards. Throughout the 1990s, this segment gradually covered as much as 90 % of the capacity of the local shipbuilding industry. As a result of the growth and evolution at the shipyards a strong export-oriented equipment industry developed and local shipping companies invested in offshore service vessels for the petroleum industry.

Møreforsking identified and described this industry in Møre and Romsdal as a good example of a good performing industrial cluster already before 1990. For literature about industrial clusters see for instance (Marshall, 1892), (Porter, 1990), (Porter, 1998) and (Krugman, 1991), among others.

The operators in this industry network were categorized from a disintegration of the value chain consisting of ship design (13), equipment manufacturing and subcontracting (169), shipbuilding (14) and shipping (20) with the 2014 number of companies in parentheses. The industry operates extensive interaction and has a total turnover of 55 billion NOK in 2014 and constitutes 22 000 full time employees (FTEs). These figures are presented in Figure 1.1 – also showing mean profit margins for each group of actors.

## The Møre and Romsdal Maritime Cluster 2014



02.03.2015

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Figure 1.1 Grouping of actors within the maritime industries in Møre and Romsdal

Figure 1.2 illustrates the rapid growth of revenues for this industry network. All actors show growth related to a common competitive reinforcement. Most of the growth in recent years is made in global markets and this industry has become a globally leading industry within the segments of specialized vessels for oil and gas offshore services.

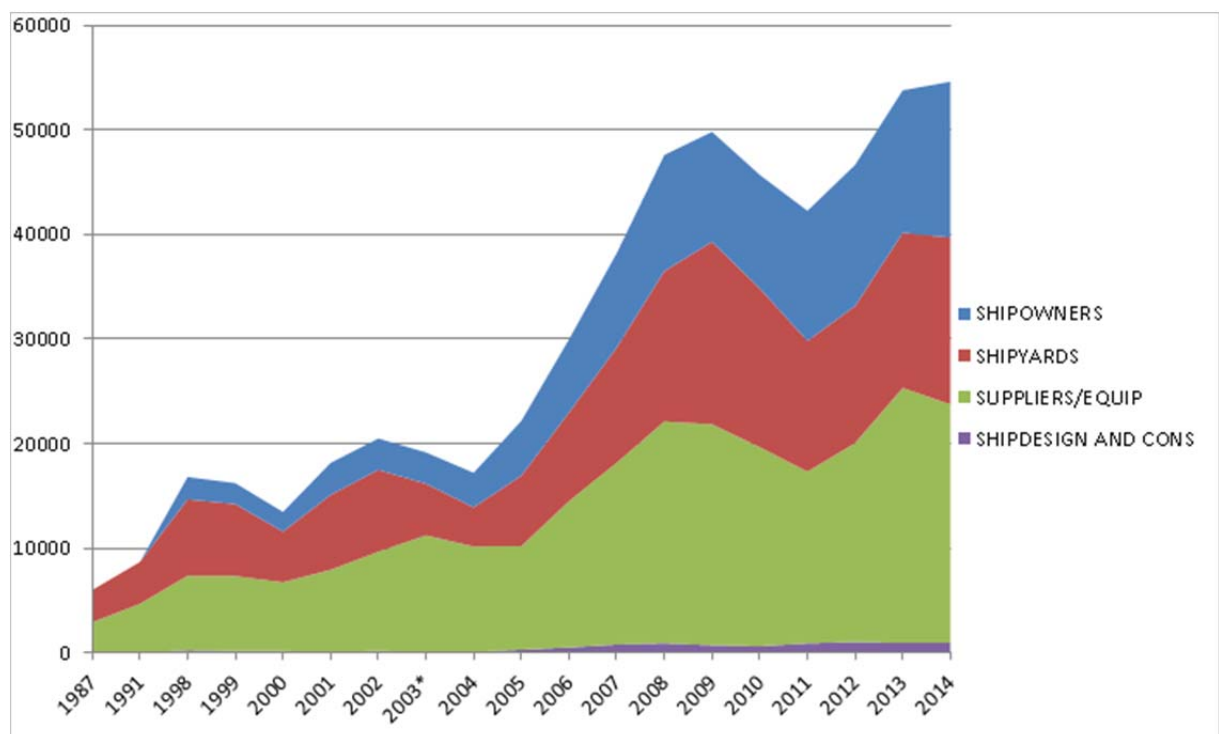


Figure 1.2 Development of revenues for actors of the maritime cluster in Møre and Romsdal

Employment has been stable for many years while turnover has increased vigorously, especially in the past decade (from 17 to 55 billion NOK between 2004 and 2014). Much of the growth is achieved through hiring of foreign labor and outsourcing of labor-intensive production of hulls. This industry has strong brand builders and locomotive companies such as; Rolls-Royce Marine (design and equipment packages, UT-design), Farstad Shipping and shipbuilding group VARD (Fincantieri). These actors together constitute more than 40% of the total revenue of this regional maritime industry. The export share of ship design companies and equipment suppliers in recent years has been from 50 to 75 % and deliveries to offshore service sector makes up 80 % of the overall activity of the maritime cluster in Møre and Romsdal.

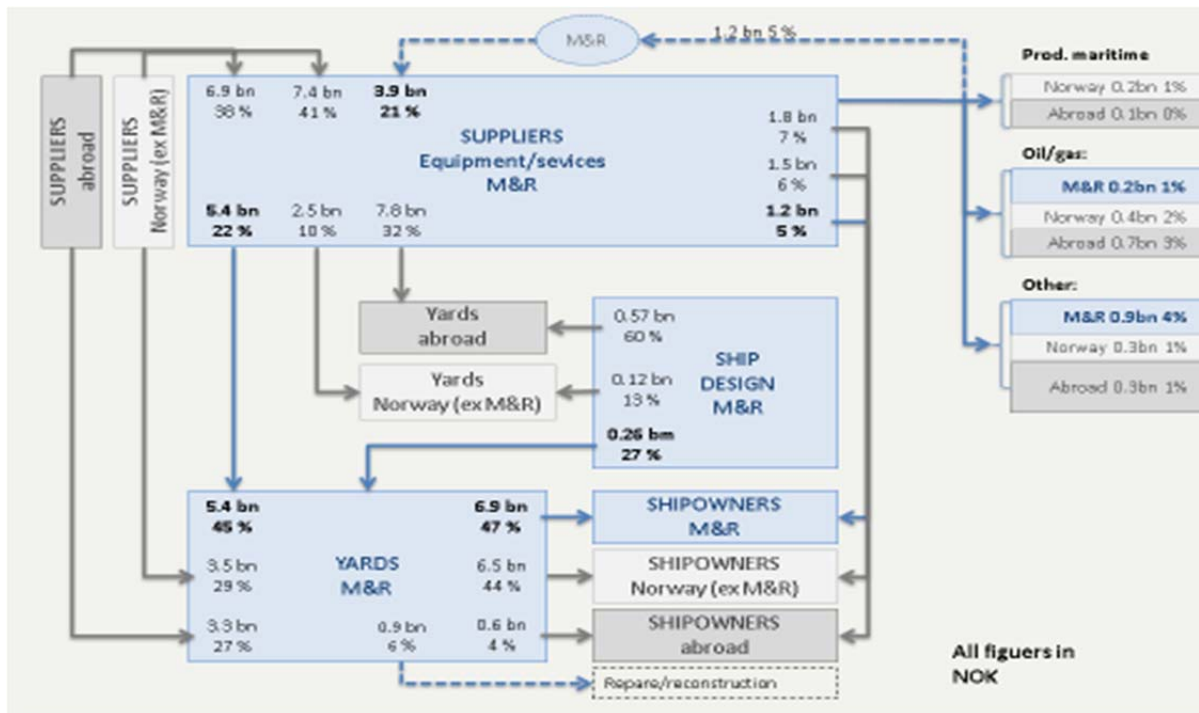


Figure 1.3 The financial transactions within the business network in 2014

To understand the financial interplay between the actors in this industry Møreforsking has studied financial transactions and other relations between the actors. As an example the 2014 financial transactions between parties are shown in Figure 1.3. The results have been obvious: Cooperation between complimentary actors have gained all parties and reinforced the total industry.

In parallel with the maritime industry's growth and internationalization, the region experiences strengthening of expert groups related to financing, quality approval, research, environmental issues, education institutions and other supportive operations for the industry. There has been a continuous introduction of new actors in the cluster and the industry has been attractive to external international players who buy themselves a way into such businesses.



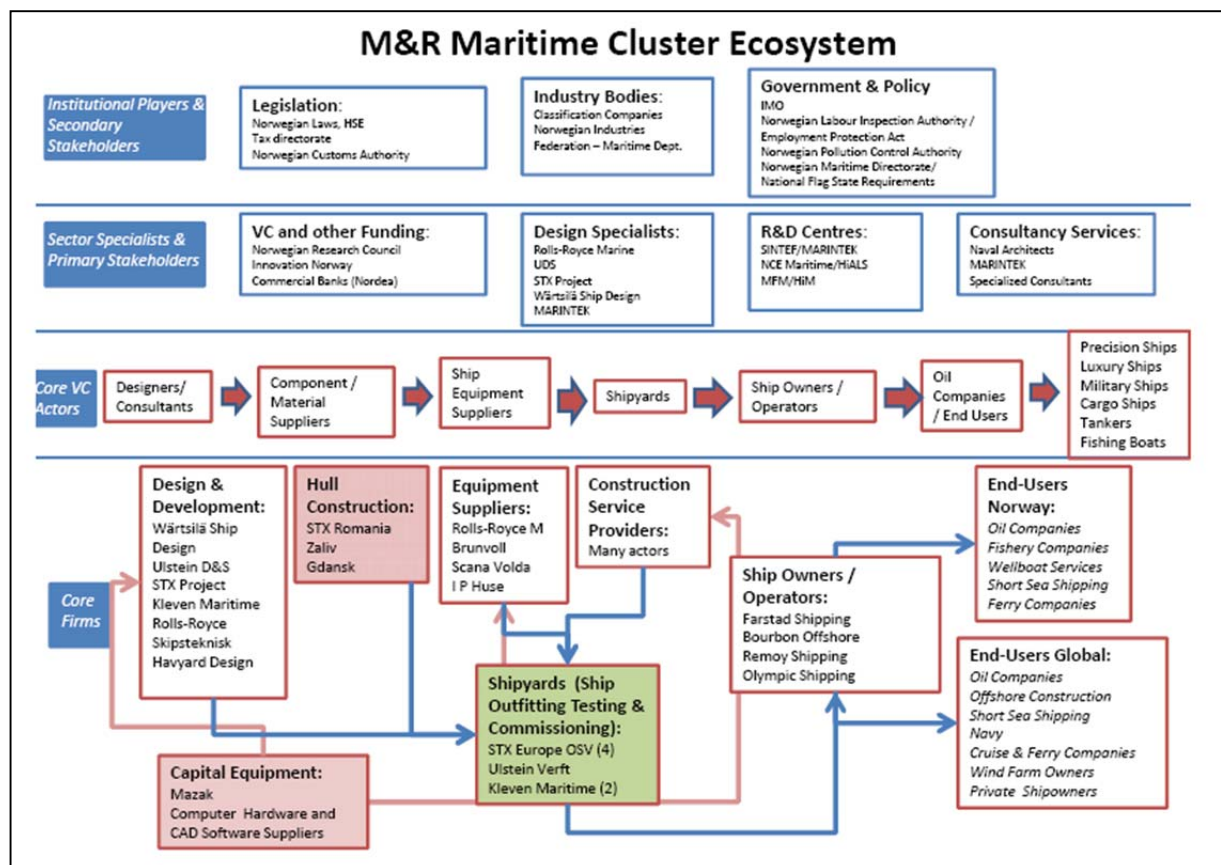


Figure 1.4 Maritime cluster eco system

Finally, the visualization of the maritime cluster eco system in Figure 1.4 describes how the core value chain actors in the middle are affected by governors and sector specialists (above) and the interaction between core firms, technology providers and other supportive actors - illustrated below the supply chain.

## 2 A COMMON THEORETICAL PLATFORM FOR MAPPING OF BUSINESS NETWORKS

A common theoretical platform for mapping of business networks have been adopted in WP 1, called the industrial system mapping approach. As part of this project, all research parties have been introduced to the method, and instructed on how to gather the necessary empirical data to enable the comparison performed in WP 1 of the six network initiatives.

The methodology builds on techniques developed in mapping supply network configurations (Srai and Gregory, 2008), across the manufacturing value chain. The mapping process and their output formats is a culmination of a number of in-depth applications of the generic mapping framework and associated templates covering a diverse set of technology intense sectors (Srai, 2016, Srai et al, 2016).

Here, the supply network configuration has been defined as “that particular arrangement or permutation, of the supply network’s key elements including, the “network structure” of the

various operations within the supply network and their integrating mechanisms, the flow of materials and information between and within key “unit operations” the “role, inter-relationships, and governance” between key network partners, and the “value structure” of the product or service delivered”. Within this definition, the four elements which constitute supply network configuration attributes and dimensions are:

- **Supply network structure**; network tier structure and shape, composition, ownership, levels of vertical and horizontal integration, location, co-ordination, manufacturing processes, optimum sequence, complexity, flexibility, etc
- **Material and Information Flow**; both intra- and inter-key unit operations; value and non-value adding activities, process steps, optimum sequence, levels of flexibility, network dynamics (e.g. replenishment modes), infrastructure, and enabling IT systems
- **Relationships and Governance**; the role, inter-relationships, and governance between key network partners; the nature of these interactions or transactions, number, complexity, partner roles, governance and trust
- **Product/Service value-structure**; product composition and structure (including components, sub-assembly, platforms, modularity), product replenishment mode (e.g. is the product make-to-stock, make-to-order, configure-to-order), SKUs, products as spares, and through-life support and services

These configuration mapping tools were used to capture, in a consistent way, and across the industrial networks of interest, industry system level actors (institutional, industrial support as well as product supply chain actors) and exploring linkages between them. The application of these tools was a key requirement for effective industrial system and cross-case analysis.

The integration of the methods outlined above, resulted in an industrial system level mapping framework (Figure 2.1) which served as a generic template for industrial system mapping, enabling a key goal of the research, a consistent method of analysis to enable subsequent cross-sector comparison.

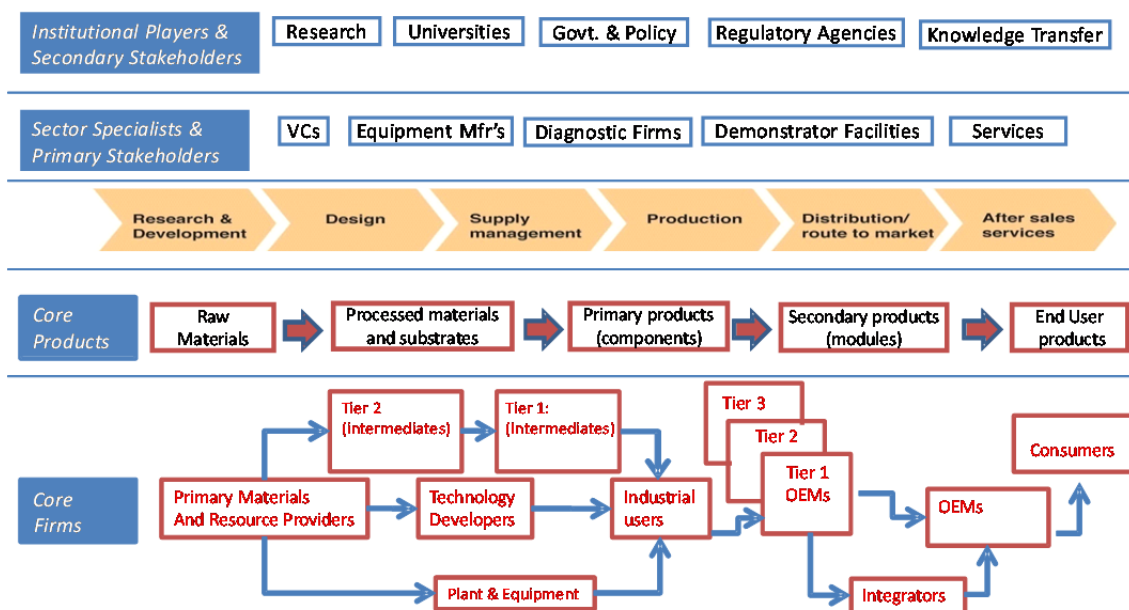


Figure 2.1 Generic Industrial Systems Mapping Framework (Srai, 2016)

The industrial systems mapping framework was used as a common theoretical platform, for:

- capturing industry structure at a broad industrial systems level
- capturing of alternative supply network configurations within a particular industrial system
- the identification of the evolutionary phases of the industrial network, when applied across several time-windows, enabling the identification of stages of evolution (mature industry networks) or emergence (newly formed), primarily from a supply network perspective.

## **2.1 INDUSTRIAL MAPPING – QUALITATIVE INTERVIEWS**

Industrial system context and structure mapping also involved focal firm investigations with selected ‘institutional, industrial and supply network’ actors from each of the main product categories, with focal-firm selection based upon their central role in the industrial value chain.

Respondents from focal-firms, informed the mapping team by the identification of various actors (Institutional, Industrial and Supply Network (SN)) relevant to the industrial evolution and emergence dimensions presented to them.

In addition they were requested to explore stages of SN evolution within their industrial systems, from a past or nascent product stage, through to their current stage of emergence, and consider potential future stages of industry maturity. This narrative was then tested against the configuration dimensions, in terms of how well they capture (or otherwise) their actual and anticipated SN evolution. These outputs, arising from these complementary methods, were used to generate an understanding of key enablers of industrial evolution/development (in the case of mature industrial clusters) or emergence (in the case of newly formed industrial systems) of each industrial system studied.

The methodology also involved secondary data sources to be identified, followed by primary data collection using semi-structured interviews with recognised expert groups.

Consistent representation has enabled cross-sector comparisons (Srai et al, 2016) – and although individual results are reported elsewhere – each of the maps provide visualization of the outputs that provide the opportunity to identify critical:

- institutional players and secondary stakeholders
- sector specialists and primary stakeholders
- value chain actors and activities
- supply network archetypes that form the supply chain
- firms within the supply network archetypes.

Common structure enables effective cross-sector analysis, (and as reported later in this report) the utility of the mapping process within a particular sector is demonstrated through the reported observations on industry cluster structure, dynamics and characteristics.

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### 3 METHODOLOGICAL APPROACH – DEFINITION OF SURVEY

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#### 3.1 INTERVIEW GUIDE - QUESTIONNAIRE

The research work within the RECIN project has been organised in five related work packages to be applied for the total of six chosen networks in different regions:

**WP 1 Common theoretical framework for network analysis and capability assessment**

**WP 2 External Interaction & Global Influence**

**WP 3 Regional Network Level inclusive Network Construction Programmes**

**WP 4 Firm Level - Interactions and Strategies**

**WP5 Synthesizing and Policy Considerations**

To be able to analyse similarities and peculiarities for development of different chosen networks the project group decided to establish a common interview guide for data collection within the six different networks. The choice of one common guide was a topic of much debate during preparations for the interviews. The weighing of comparative data vs. depth was a real dilemma when working comparatively with four different work packages, gathering data from six different network initiatives spread across four regions, studied by five different research communities – all informed by different theoretical approaches. It was finally decided on a common semi-structured interview guide, where each research community gathered data for each other. This guide structured the conversation with the interview subjects to ensure that key questions were asked within all work packages, but allowed the interviewer to adjust the guide to make sure it was relevant for the interview at hand. While the research group recognized the shortcomings such an approach would create, the potential benefits for the comparative ambition of the project was much larger.

Each interview lasted approximately two hours and had the following main content – adapted to the respondent's position vs the business network:

- On business/enterprise level
  - About the entity you represent
  - Advantages and drivers
  - Designated innovation work
  - About network initiatives
- Global/international perspectives
  - International impacts in local innovation processes
  - Access to international relations/impetus
  - Recruitment of foreign expertise
  - Barriers?
- The regional perspective
  - Role of regional players relative to innovation capabilities
  - Features of well-functioning network initiatives
  - Driving forces for the network
  - Challenges and barriers for further development
- The firm perspective
  - Sources of innovation

- Relation between network investment and firm's achievement
- Critical internal factors
- Future perspectives

Considering the regional focus in RECIN, which also included supportive functions, the interview guide was accommodated to other kinds of respondents, like representatives for authorities, public aids and networking actors.

### 3.2 INTERVIEW PANEL

Table 3.1 describes picked representatives for interviewing.

Category	Respondent	Position/firm/institution	Comment
County authorities	Bergljot Landstad, Anna-Marie Hatlestad	Head of Regional Development and Business	Head of VRI steering committee Møre and Romsdal  Central position for GCE BLU Maritime
Shipbuilding, maritime industries	Kjersti Kleven	Owner/Chair of Kleven Maritime (shipbuilding)  Chair of Federation of Norwegian Industries Maritime	Central business executive in locomotive company with 750 employees
Ship owning company – middle sized	Karsten Sævik	CEO Remøy Shipping with nine subsidiaries	Adm of 15 vessels and 300 sailors
Ship equipment industry	Rune Garen	R&D-director Rolls-Royce Marine (RRM)	Main ship equipment locomotive with 2000 employees and 8,4 MNOK turnover
Ship equipment industry – middle sized	Jan Tore Leikanger	CEO Jets Vacuum	Innovative and rapid growing firm with 100 employees and 380 MNOK turnover
Ship design	Hans Ove Holmøy	CEO Skipsteknisk	Leading independent ship design company with 40 employees and 130 MNOK turnover
Networking actor	Per Erik Dalen	Head of Global Centre of Expertise Blue Maritime	The manager of NCE/GCE for many years
R&D-actors	Øyvind Herse  Arthur Almestad	VRI-coordinator M&R  Head of Norwegian Research Council Regional Office	

Table 3.1 List of interview respondents

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## 4 RESULTS FROM THE EMPIRICAL DATA COLLECTION

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### 4.1 STATUS AND ATTRIBUTES OF THE NETWORK ACTORS

The idea of this initial part of the study is to identify and describe attributes and characteristics of the business network to be analysed. The narrative story and figures in part 1 describes actors and structure of the network that the interview respondents represent.

#### Advantages

This combined shipping and ship building industry has gained strength and growth through decades – mostly based on internationalization and focus on knowledge and technology development while focusing on specialization within demanding markets like ocean fisheries and offshore services for the global oil and gas industry. Actors from each part of a common value network have stimulated business development through an interesting combination of vertical cooperation and horizontal competition.

For the leading actors there is a strategic balancing challenge between niche market segment specialisation and diversification to reduce risk.

The naval architect companies have become world leaders (with up to 75 % export share) within specialized vessels in close cooperation with demanding local ship owners. They take part in development of regional networks and institutions for education and research – from which they recruit and develop their own workforce.

Today the ship equipment suppliers constitute the biggest part of this maritime industry (40 %) measured both in number of employees and revenues. Their export share has become 60 % as an average, with some dominating locomotive actors.

Proximity to practise, coupling and balance between personal experiences and formal knowledge are vital factors. There has been developed a climate for entrepreneurship and newcomers that understand the importance of being members of a larger business system. Focus on high level education has increased and share of employees with education at university level has increased 60 % over the last five years (with reference to a study made for the iKuben-network last year). Leading actors, like RRM, are also being more conscious about internal graduate schemes, building more systematic *learning-by-doing*-practices with capturing of knowledge from external sources. This industry has an open communication internally and externally, based on the Norwegian egalitarian society model. This is claimed to be a vital advantage.

Regional shipyards have developed competition strength globally by *engineer-to-order*-production of *tailor-made and highly specialised vessels* for fisheries, ocean research and

*The local buzz has always been important for knowledge development and sharing, regionally.*

Bergljot Landstad, Head of Regional Development and Business

*The attitude towards formal knowledge and education changed sometime around the millennium-shift.*

Rune Garen, R&D-director Rolls-Royce Marine (RRM)

eventually advanced vessels for the offshore oil and gas-industry. Specialized vessels for the offshore oil and gas industry has amounted a share of up to 90 % of the total deliveries from shipyards in this region over the last 15 years. This market segment is characterized as a *high-end-market* where customers are willing to pay for the best quality. Characterized by a high degree of modifications during the contract period and integration of sophisticated top-side equipment this industry has taken a position beside of the competition from the traditional shipbuilding industries globally that are more based on manufacturing of more standardised commodity vessels. Norwegian shipbuilders appear as flexible and adaptive contract partners adapted to niche-market with *willingness-to-pay*. This highly specialised Norwegian shipbuilding industry – including all actors throughout the value chain – has gained a label as world leading provider of specialized vessels in certain global market segment. This label has paced the way and made it easier to penetrate international markets for all member actors.

As demonstrated in Figure 1.2 the ship owners have increased their share of this regional business network during the last 15 years – closely related to the continuous growth (boom) within offshore oil and gas exploitation during the same period of time.

Oil companies and offshore contractors have shown great confidence to Norwegian offshore service providers in demanding offshore operations. Based on gained experiences from fisheries and offshore services in harsh environments the regional network has gained a position as global leader.

*Establishment of Norwegian Centre of Expertise Maritime and NMK (Norsk Maritimt Kompetansesenter) were main events for this region.*

Bergljot Landstad

When asking representatives from regional authorities, networking actors and R&D-administrators about advantages for the regional maritime industry they point out much of the same factors as the industry respondents. A strong local cluster attracts both capital investments and recruitment of skilled labour from

external actors. When asked about beneficial actions from authorities they point out the importance of supporting locomotive actors that will both be able to succeed globally and attract global actors from abroad to take part in the local industry.

Authorities and networking actors like NCE Maritime have been facilitators that have provided policies and arenas for the industry actors more that providing direct contributions to the separate actors.

They stress the informal relations between actors that make it easy to build consortiums and share knowledge and technological applications without rigid formal contracts. They also point out the social culture of *risk-taking* that has allowed innovative solutions to be developed and tried out in full-scale operations.

### **Driving forces**

Many of the driving forces for the regional maritime industry are listed among the description of advantages above. By being an innovative provider of new solutions for demanding and dynamic maritime markets this industry has to be extremely adaptive and innovative. By joining efforts in dynamic changing consortiums the actors

*Coopetition: We cooperate when possible and compete when necessary.*

Common saying within the regional maritime industry



will always be in front of knowledge and technology development within their area of work. The biggest actors in the industry play the role as driving forces for the smaller ones and together they constitute a more or less complete value network. Market demand for flexibility and adaption is also a driving force for continuous development and supplementation of labour skills.

Besides the traditional kinds of demand from markets with willingness-to-pay there is also a *legislation-driven* development force based on the demand for *safer and greener* vessel solutions based on new legislation for reduction of factors such as health and safety risks and greenhouse gas emissions.

This industry has been developed based on proximity to practice and sharing of tacit knowledge between networking actors. During the last years there has been a change towards more formalised knowledge building with strengthening of education and research regionally. The actors expect this increased interaction between academia and work experience to become a central driving force for further development of the maritime industry.

During the last year the industry has been increasingly challenged by a demand for more *cost-effective solutions*, especially related to the price-fall for oil and gas. This is expected to be a main driver in the years to come.

Eventually - after a period of time driven by the demands from the offshore oil and gas exploitation industry the actors expect business possibilities from other kinds of exploitation of *ocean space possibilities* to become drivers for the future.

## 4.2 THE GLOBAL/INTERNATIONAL PERSPECTIVES

The maritime industry is a global industry as these local companies have both international customers and international competition. In the global/international perspective, we want to investigate how participants in the cluster is working to gain access to international impulses and to what extent the local innovation processes are affected by these relationships. Central issues will be the type of impulses that are retrieved home and what importance such impulses have on internal innovation processes. The topic has at least two sides. One is international and global impulses onto the regional community, and the other is this regional community's focus outwards.

### Local strength – global power

To address the latter first, internationalization has always been an important characteristic of the cluster. As illustrated when one of the company representatives talked of historical drivers of this cluster, he emphasized the fact that influential local business owners like Idar Ulstein (maritime sector) and Jens

It is important to have local locomotives in the cluster to grow internationally and to develop international business.

Petter Ekornes (furniture) very early on invested heavily internationally. These activities in the mid 70-ties brought the world close to them. Two elements of this reflection are worth noticing to understand how international relations are key to the cluster: First, the fact that the influential examples are not just within the maritime sectors, and second, the indication of a regional community that draws impulses from each other. The local community will be a subject for other parts of the report, but it is crucial to recognize the emphasis put on the community for positioning internationally. Several of the company representatives we interviewed similarly



describe a regional fellowship in regards to internationalization. Being part of a cluster with local locomotives enabled companies to develop international business, where examples given included larger companies bringing with them smaller companies internationally or even situations where one of the smaller companies had borrowed the international office of another local company when they just started developing their business in that country. In addition, it had been able to use the larger local company as a sparring partner – discussing experiences operating within the country.

The question then is whether companies with international owners have the same priorities concerning commitment to the local community or the regional cluster that they belong to. When we asked such questions, several of the respondents reminded us that these international owners are attracted to the region precisely to get a footing in the “local buzz” (Bathelt et. Al, 2004). Moreover, several pointed to the fact that there were examples from the cluster where the international owner had changed three times, while the local management stayed the same. This local management was also a point in itself, because they were part of the same informal environment. However, it was also commented that in large companies a branch office often has to use a lot of energy to work within the system for their own cases – which left less capability to engage in activity outside of the company. The commitment to regional matters was also easier to get an understanding for when the numbers were positive. We were told that in regards to the involvement in the region (particularly in matters that required commitment), it was absolutely essential that the international regional units were governed from the region.

First and foremost, the statements referred to above indicate a cluster that has a global outlook. One of the respondents also commented that a cluster strength was that the companies here have been good at following their customers out into the world, together with the ship owners (identified as leads in the cluster). The respondents tell that early emphasis on internal language training (mostly but not only English) has been important for building international relations. This was also how the first interest organizations came to life, according to one of the business leaders that we talked to. Already in the late 60-ties their customers were international, and the business leaders saw that they had a need for competence development on areas where it made more sense to join forces than seek it within each individual company – like marketing, legal and English. This was the start of a formalized network, now called MAFOSS, which was said to start out as a very competence driven network, but quickly also focused towards business politics and transport politics. Thus, the international focus has been important also to foster local cooperation.

Today, not just the companies, but also the GCE also has some role in respect to facilitating this business network internationally, particularly for small SMB's.<sup>1</sup> GCE Blue Maritime functions in many ways as the cluster's overall *brand*. In the period the interviews were conducted, there was a very recent example of this where the GCE had taken with them Norwegian equipment supplier to shipyards in Turkey. The leader of the GCE, stressed the importance of a strong local

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<sup>1</sup>The GCE leader differentiate between commercial networks and research networks, where they find their role associated primarily with the former, while the latter take form initiated by the research institutions and the companies themselves. There are some uncertainties concerning the future of such activities as a result of the change from NCE to GCE, as the GCE leader said their mandate now was more oriented towards the industry as a whole in a way that meant reduced, or a new, focus on the region.

milieu to do so. The key position the cluster had globally, allowed his organization to work as a gate opener for local companies outside of Norway, as they could help gain access to central local people. This was particularly for SMB's in new markets, and he mentioned a case from Istanbul as an example.

Although, initiatives like bringing the Norwegian ship equipment suppliers to Turkish yards are also a potential source of conflict within the cluster, as other company representatives were somewhat skeptical to such initiatives seen up against loyalty towards the local competitors of the Turkish yards. The network leader identified this conflict as a *regional dilemma* trying to balance the needs of a cluster making up a complete value chain. In addition to network building, the GCE, in their own perception, also took a role in international competence development, as the GCE had invited companies to talks introducing foreign markets, one example was a market seminar on the Americas. This was open for all, but not all the business leaders we interviewed valued such initiatives as relevant to attend for their own company.

### **International impulses and innovation**

It is clear that the respondents truly see their cluster as a globally significant hub within their industry, an impression they also have got recognition for internationally, manifested among other things in the GCE status of the regional cluster organization. The perception of local strength has significant implications for the issue of where the business leaders focus their attention to get impulses for innovation. The leader of the GCE said that this global recognition was one of the clusters true strengths, but he was at the same time somewhat worried about the cluster's reputation. To explain, he referred to a survey that had been conducted with respondents from 18 countries, where these respondents, independent of each other, had described the cluster as expensive and arrogant, even if they all recognized the local cluster as world leaders within their field.

Yet, it was conspicuous that as the respondents were asked about global impulses, they seemed most concerned with the importance of the local community – and also, the regional cluster's significant influence globally.

For example, one of the respondents commented that the designers' closeness to the active fisheries has led to attention from Island, Shetland, Canada and so forth. The Norwegian climate has been vital in how the design of fishing vessels had developed and these countries have similar conditions. The interest in Norwegian solutions had come from a mix of requests from other countries to leading Norwegian consultants, and that Norwegian ship owners have built their vessels outside Norway. According to this respondent, the Norwegian influence was significant within the development of standards, technology and equipment as well. Hence, in the internationalization process, *Norwegian offshore quality* is by several of the respondents said to be a leading *brand*, which has given international assignments. As an example, knowledge about and experiences with the Kongsberg DYNPOS-

*Proximity and access to the users (i.e. vessels crew) challenges and experiences are the main sources of innovation.*

Karsten Sævik, CEO Remøy Shipping

In a development context, the shipyard highlights the importance of the triangular cooperation between shipyards, ship-owners and design companies.

system for dynamic positioning of vessels, has given market opening towards mining on the seabed. Thus, in terms of innovation impulses, many focus on how outside actors look to the regional milieu rather than the other way around. The innovation work is characterized as experience-based innovation with the bases of knowledge coming from fisheries, offshore service, aquaculture, etc. One of the managers underscored the importance of engineers with both *know how* and *know why* knowledge of the industry, with a trial and error mentality (a mentality this manager perceived easier to come by in Norway than in other countries they operated in). The local environment, particularly feedback from the industry and the market, were identified as essential for innovation.

Respondents argue that ideas of development and innovation happened more through daily operations than through defined R & D projects. Close dialogue and short communication paths provide rich access to problems and innovations – like for example feedback from the crew onboard the vessels. In terms of internationalization, it is worth mentioning that in recent years companies have increased the number of foreign crew members, which might potentially change some of this dynamic. In a development context, the importance of the triangular cooperation between shipyards, ship-owners and design companies is highlighted.

Even if most companies emphasized the experience-based local interaction and business environment as key to their innovation processes, international impulses were recognized. Of course, the relevance and the importance of the questions of global impulses varies depending on where the players are located in the industrial ecosystem - whether they are among the core players in the value chain and their location in the value chain. In addition, the way these companies gather outside impulses, vary greatly depending on size, ownership situation and type of business. As shown, the respondents range from small locally owned companies, to division of large global players. Yet, common to all of them is that their business is not limited to Norway or Norwegian customers. All of them seem to find customer demands as innovation drivers, and many of these customers are international. International regulations the actors have to comply can also be a potential source of international impulses that require adjustment. Moreover, there were cases where a company used agents/contractors for their business internationally, but prioritized that local staff got to know them, to facilitate ideas and innovation. Some respondents also seek international impulses through attendance in relevant conferences (local and international) in key areas like financing and market outlook- one such arena mentioned was an international oil conference.

In the production process, the yards have been conscious to recoup impulses and expertise in areas where skills are weak at home. Automation and robotics in the production lines are good examples. With regard to the innovation work the yards has found it necessary and important to seek expertise outside the traditional GCE Maritime habitat and apply *best practice*, regardless of the industry e.g. at Raufoss (automation). In at least one of the significant research project mention through the course of the interview, the yard had gotten their contacts in a research environment in Europe through a supplier they used locally.

One of companies we talked to, RRM, is a major global player with 34 locations worldwide, which through acquisitions and development has acquired a dominant position among the suppliers in the maritime cluster. This company now has 85 % export and the maritime division accounts for approximately 40 % of the total turnover of the supplier part of this industry. The share size and complexity of companies like RRM is an important for the topic of global impulses.

Such companies with international owners, are recognized by the other cluster members as a vital source of international impulses in themselves.

The question of global impulses is different all together when asked to a company with a vast global organization, including 30 different university centers (UTC) spread around the global, where RRM linked R & D activity up to leading research environments around the world. As a comment on this internal complexity, Rune Garen said that in a way RRM is a cluster in itself. Obviously, RRM had a completely different point of departure when it comes to R & D resources internally. Interestingly enough, in Garen's opinion these UTC were more important in regards to patents and recruitment, than innovation. He argued that most innovations happened internally, where the UTC takes part, but the company itself establishes the framework for this innovation.

Another important source of global impulses is foreign staff. The number of foreign employees vary greatly among the companies asked. It is worth noting that while there is foreign staff within most of these companies, these employees are in several of the companies found in production, sales and marketing, and not in product development.

The regional county authorities are very concerned with keeping a vibrant local community. At the same time, the representative for the county comments that the global arena is not in Møre and Romsdal and the relations of the cluster needs to be to the best. For that reason, she stressed how important it is that the companies here are connected to the leading milieus around the world. She is concerned with increasing the awareness of the global scale. From the regional county's perspective, it is a criteria of success that companies that are globally leading within their field are part of the cluster.

The institutional actors (MR County, VRI / FR and GCE Blue Maritime) play different roles in the efforts to help companies in their internationalization- and innovation processes.

The Research Council seeks to convert and translate international research trends and international research programs into regional and local research programs. The VRI program, which aims to stimulate regional research especially within SMEs, is a part of this. The aim is to develop a more research-based development in companies. Meanwhile, it is asserted that they are aware of and are working more, both

*The aim is to develop a more research-based development in companies.*

*Øyvind Herse, Arthur Almestad, regional representatives from the Norwegian Research Council*

geographically and across industries, knowledge crossover. Møre and Romsdal county is keen to facilitate the design and financing of an instrument that stimulates both internationalization and increased R&D work. The county claims that they are concerned that the public support systems are adapted to regional needs but also that they are accessible by links to the international environment and other industrial clusters (crossover). The county has put much effort and resources in getting to a stronger interaction between the industry and Academia.

The GCE is not recognized, neither by the companies nor by the network initiative itself, as playing a role in the development of international research networks. Such networks primarily take form through the local University College or through the companies themselves.

This industry is a major user of national research funding, with access to research program dedicated to this industry. Involvement in such projects vary greatly among different companies. Yet, when asked about innovation it is striking that many of the respondents highlight continual

improvement in their day – to – day activity rather than research and development, when talking of innovation impulses.

### 4.3 THE REGIONAL PERSPECTIVES

At the top of figure 1.4 sector specialists, primary stakeholders, institutional stakeholders and secondary stakeholders are made visible, as part of a total maritime cluster ecosystem. These actors have no primary economic interests in the ecosystem as we have shown is the case for the primary players in the value chain or value network in Fig. 1.4. However, sector specialists and the institutional actors are all playing different and important roles in the ecosystem, and in a well-functioning eco-system it is believed that the interaction between the institutional and sector specialist actors and between sector specialists and the institutional actors and players in the primary value chain is functioning well. Through our interviews, we have tried to uncover how these actors consider their role and how participants in the primary value chain value them. We have not interviewed all the players in the above-mentioned categories but limited ourselves to Møre and Romsdal County (The Regional and Industry department), the Regional Research Council and VRI (Programme for Regional R&D and Innovation) and the networking organization GCE Blue Maritime.

*The aim has been to formalize the informal networks.*

Bergljot Landstad

The county sees its primary task to be the mediator and facilitator. In their time, they brought influences from Finland once when the NCE was established, as a test or a pilot project, and believe themselves to have had a significant role in the creation of NCE Maritime (National Centre of Expertise). It is pointed

One praises the companies for having stimulated the development of R&D communities regionally and locally. The private sector has gone ahead and pushed academic initiatives.

out that there were actors outside the companies who once initiated the network initiative and not the companies themselves. The aim has been to formalize the informal networks. The construction has made it easier to reach out to industry - both in terms of addressing problems and their solutions and thus to formulate policies and policy instruments. Through formal meeting places, it has been easier to adapt policy instruments to the regional economy's needs. One praises the companies for having stimulated the development of R&D communities regionally and locally. In this region the private sector has gone ahead and dragged academia after. They believe this has developed the R&D communities and given them a stronger position. Allocation of SFI (Centre for Research-based Innovation) is an example of this. They think that it is important for the academic society to gradually take a leading role. The County also believes to have played an important role in relation to national authorities both in initiatives related to the industry and in the design of instruments to the industry. In addition to the importance of developing good regional research communities, the County believes that they have played a link role in relation to other regions, such as the formalized Western Norway Cooperation Network.

Although most of the instruments are aimed at the SMEs, we also experience that the larger enterprises benefit from the many strong SMEs in the cluster.

NRC M&R (Regional branch of the Norwegian Research Council) and VRI are seen as key mobilization tools for human resource development in both the business and R&D environment. When talking about foreign business owners, the representatives believe that local decision making and local decision makers are essential.

It is not always easy to distinguish between the cluster and the network initiative (GCE). GCE is an important meeting ground and has by the County's opinion succeeded in establishing cluster-to-cluster cooperation. Mentioned here, among others, is the commitment to the Ocean-space initiative where the link between maritime industry and marine industry is central. Respondents from the County believe it is important for GCE to have a clear focus and be more targeted in its focus. It is for sure important to be closely linked to the cluster.

Respondents from FR and VRI point out that RFF has an important role in disseminating the content in the advertised Research Council programs. Simultaneously the RFF play local issues into the national forums and into new research programs. VRI coordinates are member of the national network and is close to the issues in the country. Network organizations, such as the GCE, are becoming increasingly important. GCE is, in their opinion, dedicated to building cooperation and development between companies and R&D communities. Especially for the SMEs this is important. GCE must have focus and an active role in the mobilization of new research. NCE / GCE have in their opinion had more focus on the entrepreneurship/incubator role than the R&D initiatives. Most respondents stressed that the informal networks are more important than membership and formal organisation of networks.

The NMK-building located at the NTNU University Campus in Ålesund is regarded as an important instrument, also for the cluster. Both the NRC and VRI highlights the importance of the work GCE does to build brand, to build reputation and attractiveness. In their opinion, GCE also has a lobby function by virtue of being the mouthpiece for such a large participant group. It is also noted that it is not always easy to keep track of where the rumblings coming from when there are so many players who go about each other within 'GCE wings'.

The head of GCE sees as one of his main tasks to make the region more attractive, - be a host. They are trying to push common public infrastructure projects, research and education and try to include the entire competence community locally. They themselves find it difficult to distinguish between the different expertise communities and the different roles the expertise communities have. The boundaries between GCE, NTNU Ålesund, ÅKP and funding agencies are unclear and overlapping. For the sake of the GCE, it is important to connect and communicate well with the top leaders in the cluster and some of the large enterprises/locomotives are more important than others. Although most of the instruments are aimed at the SMEs, they also experience that the large enterprises benefit from the many strong SMEs in the cluster.

Although geographical location is less important for member companies, it is important that the core or the hub in the cluster is local. In their opinion, a strong maritime cluster could pave the way for future and new cluster formation. The commitment to the Ocean Space Initiative is a result of GCE's thinking. GCE's role is to encourage and finance efforts in the enterprises and in the R&D communities and not to implement them themselves. One of the key success criteria for a network initiative is said to be the ability to communicate with senior managers in the cluster.

*This industry constituted an industrial cluster long before there was such a cluster concept defined in literature. The first important network actor was the MAFOSS organization.*  
Kjersti Kleven

Companies surveyed emphasizes that they are members of many networks and GCE is just one of these. They point to the fact that they were part of a cluster long before there was such a cluster concept or the concept was defined. The first important network actor was MAFOSS (The MAritime FOrum for Southern Sunnmøre), which was established in 1969 with three members. The original task was common training in vocational, language, law, etc. Eventually MAFOSS also became a mouthpiece into the industry policy and transport. Several of the participants pointed to the importance it has had to take advantage of the local locomotives, especially in the internationalization of business. Jets, which has evolved from being a small business with only a maritime market into being an international company with several market areas, claims to have benefited greatly from the funding agencies (IN, VRI, SkatteFunn, etc.), while Kleven and RR have been major users of the national research programs. Skipsteknisk have only used SkatteFunn. All the respondents point at the positive and important role GCE has in promoting the industry in common, in building pride and identity - branding. In addition, smaller actors have benefited from being perceived as part of a bigger industry. The annual cluster study performed by Møreforsking Molde and others, where economic development and the internal financial transactions in the value chain are analyzed, has been regarded as helpful for strategic planning and policy making. MAFOSS, ÅKP and NCE, now GCE, has contributed to a unifying community in the region. There has been competition but also cooperation. GCE has played an important role in relation to authorities and politicians and has been useful for entrepreneurs. Survey respondents claim that GCE has legitimacy, but is perceived more as a forum for networking and exchange of ideas than as a member organization. In addition, GCE is regarded as useful and well visible and has a capable management. Some actors claim, as previously mentioned, that they are part of many networks, both formal and informal. It seems in some cases to be too many networks, which partially overlap.

Tacit skills development often happens outside the formal networks. Furthermore, it is important for the GCE to retain their anchorage although it is desirable that the GCE takes a major national role. Although the GCE today have legitimacy, it becomes important that the GCE in future have access to expertise, networks and communities that are relevant while legitimacy is maintained.

#### **4.4 THE FIRM PERSPECTIVE**

##### **Sources of innovation**

The traditional way of innovation work practices has been *incremental and project-related* with close cooperation between project partners at all levels. There has been very little independent and academic based research activity regionally. This is changing now as the industry becomes more and more based on formal knowledge development. However, we find no actors with in-house research departments.

New vessel concepts are normally derived from cooperation between ship owners and naval architects on a *no cure no pay*-basis. As long as many of the new builds from regional shipyards are *one-of-a-kind* vessels they also will be prototypes with a certain degree of innovations implemented in each vessel. This phenomenon might of course lead to *high-cost* production. That is one reason why the industry pays more and more attention also to improvement of project execution and production processes.

The biggest shipbuilding and ship equipment suppliers gradually take part in more formalised research based development – also internationally – but input through suppliers is still the most common way of *fertilization*. In recent years focus has been gradually increased on both *product and process development*, more and more based on research and globally available knowledge and technologies. The respondents point out the importance of external and international relations on all company levels as sources of new ideas and innovations.

Authorities and networking actors play the role as facilitators that arrange arenas for exchange of knowledge and experiences. Over years these arenas has become vital sources for innovation input – especially for smaller companies with limited resources. Regional authorities and networking actors also play a vital role by adjusting governmental aids for stimulation of innovation skills. They also play a role by bringing different industries together for mutually sharing of knowledge (*cross-over effects*) between different industry areas.

### **Future prospects**

By being closely related to a complete cluster of actors belonging to the same business network there is a close dependency between *network success* and *company success*. The market end of this business network is the ship owner's customers. During the last 15 years this industry has become more and more dependent of the oil and gas offshore service customers. As the investment levels in these market areas decreases globally the industry suffers. That is why attention is more and more moved to other market possibilities within a wider *ocean space* consideration. Lessons learned from the demanding oil and gas market might be utilised in new market areas at sea.

There is also a need for paying more attention to the move against the *internet society* by adding new *internet based services* to existing products. A company that traditionally has acted as a product provider has to become a service provider with greater concern about after sales market and monitoring of product operations. This means a combination of new challenges and new business possibilities. Several actors of this industrial network take part in a new Norwegian R&D-initiative named *Manufacturing Network 4.0*, covering these issues.

This business network is characterised by a diversified mix of separate SME-companies (small and medium sized) that constitutes a common eco system. This pattern might be considered as a strength when the industry is forced to change. By utilising all achieved skills from history the respondents' express great confidence in future success, but for the time being they have to cope with a challenging business re-orientation.

However - this business is regarded as a cyclic business with ups and downs that has occurred several times in the past. The actors within this business network have always showed a competitive attitude as part of their culture and a driving force. This attitude will also be required in future.



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## 5 FURTHER WORK – COMPARATIVE ANALYSES OF REGIONAL NETWORKS

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Within the RECIN project several cooperating research communities have been carrying out parallel studies of six Norwegian industrial networks:

- The maritime cluster of Møre and Romsdal
- The maritime cluster of Sogn and Fjordane
- The maritime cluster of the Haugalandet region of Rogaland/Hordaland
- The network associated with NCE Smart Energy Markets
- The network associated with NCE Culinology, Rogaland
- The emerging network Welfare Technology, Rogaland

Five of these networking programs have achieved funding from the Norwegian Innovation Clusters-program. The exception is the maritime cluster of Sogn and Fjordane.

All networks have been mapped and documented according to the guidelines given in Chapter 2 of this report. Forthcoming academic papers will discuss structure, content, attributes and capabilities across these six networks. The purpose of this kind of comparison work will be to achieve knowledge about maturity, capabilities and survival ability of clusters and to identify capabilities that contribute to innovation and growth. This kind of work might give new insights in abilities of innovation and adaption to external changes and then also abilities to gain resilience against external or internal changes like market changes or technological shifts.

The theoretical platform of this work will be theories about business networks and industrial clusters, resource-based theories of comparative advantages focusing dynamic capabilities and social capital theories.

The business networks being investigated represent a great variety both in size, structure and content, with interesting observations of similarities and peculiarities.

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