Cluster Transformation from a Supply Chain Perspective: Theoretical Models and the Case of the Maritime Cluster in Mid-West Norway*

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INTRODUCTION

Through globalization cluster–based firms to a new extent are players in multiple knowledge networks, production networks and value chains on multiple geographical scales (Gereffi, Humphrey, and Sturgeon 2005; Gupta and Subramanian 2008). Some argue that in a global world economy a region or a cluster can hardly contain on its own a sufficient scale of related industries and services (Lilach and David 2003; Gertler and Wolfe 2006). Globalization links economic activity in clusters to more tightly woven and global production networks, market networks and knowledge networks (Porter 1998; Michael 2000; Bathelt, Malmberg, and Maskell 2004; Cooke 2005; Audretsch and Lehmann 2006; De Propris, Menghinello, and Sugden 2008; Hervás-Oliver and Albors-Garrigós 2008; Andersen 2006).

Globalization has triggered several studies of the effect of internationalization on regional clusters (Christopherson and Clark 2007; De Martino, McHardy Reid, and Zygliodopoulos 2006; Phelps 2008; Sammarra and Belussi 2006, 2010). Outsourcing of activity may lead to greatly increased sales and export. This phenomenon is ascribed largely to the maintenance and development of the internal value chain involving high value activity especially related to design, marketing, prototyping and R&D (Belussi 2010). Local hub – and spoke firms have shrunk

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considerably due partly to relocation of production, however, they have concentrated on knowledge intensive operations located in the region. Local – global synergy in fact figures quite prominently in recent studies. External ties are seen as important for the conversion of local knowledge into global knowledge and vice versa, although some notes that globalization may lead to asymmetric structures of knowledge flow in global networks (Semlinger 2008; Andersen and Christensen 2005; Christopherson and Clark 2007; Lorenzen and Manke 2002).

On the other hand, it may seem like clusters follow paths or life cycles that are more or less disconnected from external influences like globalization. For example, clusters may develop in life cycles of emergence, growth, sustainment and decline (Menzel and Fornahl 2010). Others propose cycles like expansion, maturation, and transition (Van Klink and De Langen 2001). Why some clusters decline and some reemerge under duress of globalization still seems to be a puzzle, however, and a lack of longitudinal historical and evolutionary studies is limiting our knowledge of transformative processes in clusters, their cause, effect and direction.

This paper aims at increasing the knowledge concerning the origin, evolution and transformations of clusters. This issue is of particular interest currently, when we witness an increasing globalization of clusters. This development is considered as a challenge to the cluster, where the competitive advantage lies in the local (Porter 1998). According to variants of cluster theory, coordination and development of companies to a large extent takes place through informal interaction between personnel in the cluster, where trust and social capital is of vital importance. In this paper, we draw on institutional theory (North 2009; Scott 2008) to capture the importance of the local way of doing business in the cluster, which is a result of the evolution of the cluster throughout history. Institutions are carriers of history (David 1994), but will also co-evolve with the production system and the actors in the cluster (Belussi and Sedita 2009).

By combining the supply chain perspective with institutional theory, we seek new insight into how clusters evolve. We suggest that by combining the transaction level in the supply chain, and the institutional level, it is possible to improve our understanding of the evolution and transformations of clusters that takes globalization into account. We propose that globalization may alter basic cluster dynamics, so that actors create new and irreversible path dependencies. The benefits may be substantial, but the costs of reemerging historical patterns of governance may also be severe.

The structure of the article is as follows. In the next section, we give a short presentation of the case cluster in this study; the Maritime cluster in Mid-West Norway. In the third section, we elaborate on theories on supply chain governance on transaction cost theory, which is an important building block in this theoretical tradition. We introduce institutional theory into the supply chain perspective, and discuss how we can describe and explain cluster transformation. The empirical last part of the paper is divided into four time periods, chosen to highlight the transformations the cluster has experienced. This part is based on primary and secondary data collected from the case cluster. The cluster has evolved both through long term evolutionary processes, or 'longue durees' in Braudel's terms (Braudel 1979), and through distinct phases or events of extreme challenges posed by technological change, new market situations or in – depth alterations concerning regulations and shifting policies. Accordingly, we analyze the development of this clusters institutional context, and discuss how this has affected agents' choices at the transaction level, and how these choices have fed back on the culture. It is our contention that a relational macroculture can be empirically assessed as evolving from the late 1800s laying the ground for the development of a complete regional cluster during the 1960s. However, this relational governance is put under considerable pressure due to globalization.

THE MARITIME CLUSTER IN MID-WEST NORWAY

The Maritime cluster in Mid-West Norway is located in Sunnmøre, in the county Møre and Romsdal in western Norway (fig. 1). The cluster is part of the offshore service sector of Norway, and includes a group of co-located firms that easily fulfils the criterion of representing a spatial agglomeration of similar and related economic activity. In 2010, the cluster consisted of approximately 200 companies related to the maritime sector, including 17 shipping companies, 14 shipyards, 15 ship design consultants and 155 equipment suppliers (see Table 1). Between 2007 and 2010, the number of companies in the cluster have increased from 178 to 201, whereof 16 equipment suppliers. Turn-over peaked at 50 billion NOK in 2008, reflecting a doubling of the value of market transactions from 2005 (Hervik et al. 2009). The two latest years, the cluster has experienced a reduction in turnover, which was 46 billion NOK in 2010. After the financial crisis, the cluster companies were experiencing a fall in the number of new orders, but there is now optimism in the market and the last year the number of new orders has increased.

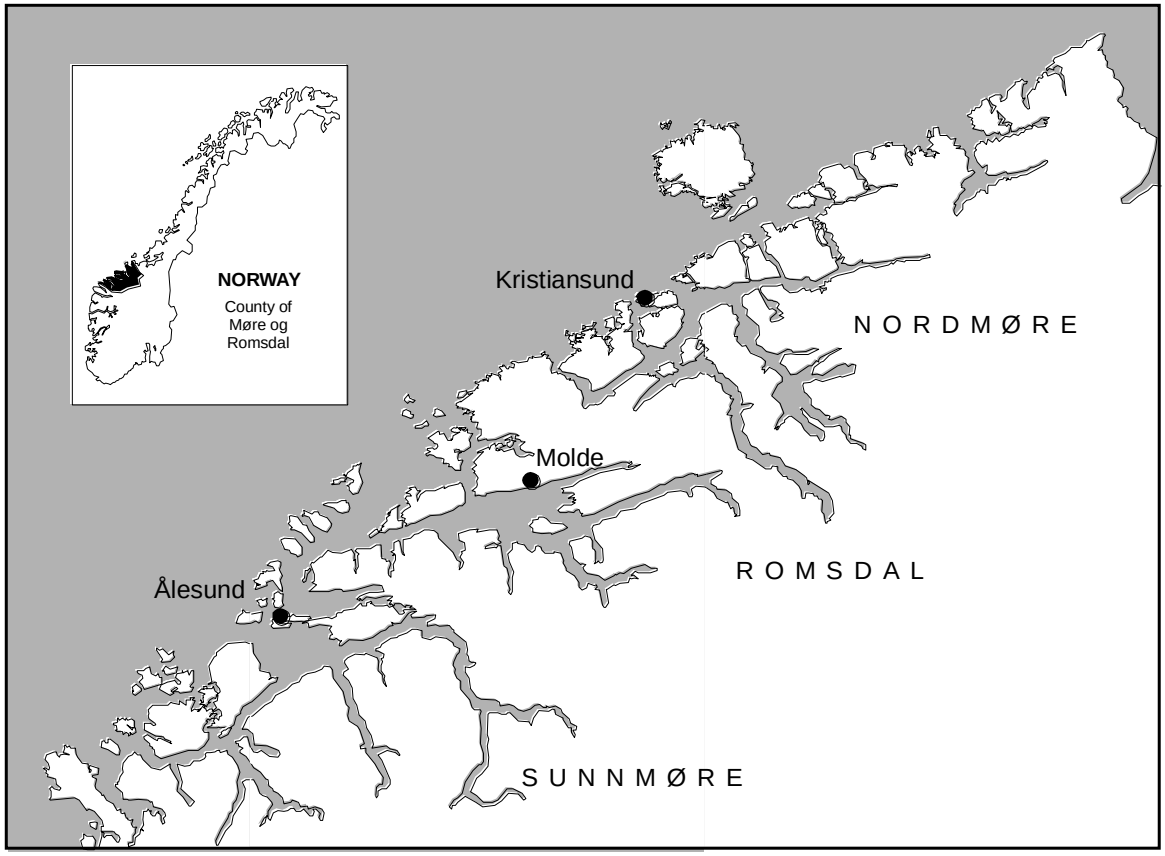

Fig. 1. Map of Møre and Romsdal, Norway

The end products of the cluster are tailor-made highly unique ships mainly for the offshore service market, but also for other market segments as short sea shipping. The cluster also includes companies which export other products related to the maritime sector, as ship design, propulsion systems, deck machinery, and equipment for seismic and subsea applications. Specific demands attached to each ship, makes the production very complex, involving a wide range of components, work operations, suppliers and sub-suppliers. Regional networks have traditionally been vital for the operation of the cluster, and the flow of knowledge within regional scaled networks are still depicted as important and have also been essential for taking advantage of global opportunities (Bjarnar 2010).

Table 1.: Companies in the Maritime cluster in Mid-West Norway 2010

	Number of actors	Turn-over (billion NOK)	Man-years	Result (per cent)
Shipping companies	14	10.9	6234	17.1
Shipyards	17	14.1	3667	5.4
Ship design consultants	15	0.6	571	21.3
Equipment producers	155	20.3	7380	6.3

Source: Hervik et al (2010)

The Maritime cluster in Mid-West Norway has been studied by Norwegian researchers for almost twenty years. Two main lines of research have emerged from this work. The first have been inspired by Porter's cluster model including quantifying the interaction between the cluster companies (Hervik, Nesset, and Opdal 1998, 2000; Hervik 2001; Hervik and Jakobsen 2001; Hervik 2003; Hervik, Aslesen, and Oterhals 2005; Hervik, Bræin, and Oterhals 2005; Hervik, Oterhals, and Bergem 2007; Oterhals et al. 2008; Hervik et al. 2009; Hervik et al. 2010; Benito et al. 2003). The other line of research has been more qualitatively oriented, and has studied cultural and historical aspects of the cluster, as well as innovation and knowledge flow (Bjarnar and Gammelsæter 2003; Bjarnar, Berge, and Melle 2006; Berge and Bjarnar 2008; Bjarnar 2008, 2010; Amdam and Bjarnar 2010). Some of these contributions have studied the historical development of the cluster. This second line of research may be alleged to have highlighted the relational aspects of cluster formation and transformation, drawing attention also to globalization of economic activity. The first line of research only takes into account internationalization in terms of export and foreign operations of ships or some branch offices.

GOVERNANC AND CLUSTER EVOLUTION

The supply chain perspective has proven useful for analyzing the coordination and relations between companies in order to streamline the flow of goods and information along the supply chain. Theory on supply chain management captures the fact that design, production, marketing and coordination involves a chain of activities divided between several companies. The global value chain approach (GVC) focuses on the relationships between companies constituting value

chains that span over larger geographical areas. Lately, this perspective also has been included in the analysis of clusters or industrial districts (Gereffi, Humphrey, and Sturgeon 2005; Bair and Gereffi 2001). While traditional literature on clusters has focused on the internal structure, linkages and dynamics of industrial districts, supply chain theory offers a framework which includes the role of cluster's external linkages (Sammarra and Belussi 2009; Humphrey and Schmitz 2002). This approach is necessary to capture the effects of the increasing globalization of cluster we have witnessed during the last decade. The supply chain perspective provides theories which seek to describe the form and organization among companies in the supply chains. Humphrey and Schmitz recognize that cluster theory earlier mainly have focused on local level cooperation, while literature on supply chain have emphasized links to the external world, leaving the locality weakly theorized. The global supply chain approach allows an investigation of how global value chains interact with local clusters, and in which way they are governed. Specifically, the approach allows for close investigation of agents' choices, and the context in which these choices are made in. This perspective may contribute to the understanding of the existence and evolution of clusters, as well as the cluster knowledge flow (Iammarino and McCann 2006).

Transaction cost theory is an important building block of the supply chain theory. From its origin, it explains whether activities should be organized inside or outside the firm. According to Coase, transaction costs represents the basis for the existence of the firm (Williamson, Winter, and Coase 1993). In the supply chain perspective, transaction cost theory explains the organization of relationship between companies in the supply chain. This relationship is often described through the term 'governance'. Authors provide different typologies of governance, where the typologies frequently range from arm's length market governance at one end of the scale, to hierarchical governance on the other end, where the supplier either is integrated in the focal firm, or is controlled by the buyer. The supply chain perspective and transaction cost approach provides a consistent method of classifying cluster types (Iammarino and McCann 2006; Gereffi, Humphrey, and Sturgeon 2005), which simplifies the analysis and capture the variation of cluster structure and governance. An important cluster type in these typologies is associated with a 'relational' form of cluster governance. This form of governance is based on mutual dependence, loyalty and trust, which has its basis in a common culture, developed through shared history and experience of the agents. The relational type of cluster emerges when

the information transferred is typically tacit and requires face-to-face contact between actors. Hence, this form of governance may require a geographical proximity between actors in the supply chain. The cluster literature has to a large extent focused on this 'ideal' form of clusters where there are close ties between the companies (Porter 1998), and with shared culture promoting mutual trust. However, work on cluster typologies which is based on transaction cost theory, together with other works (Markusen 1996), has made it clear that clusters differs, both from a structural and a governance point of view. The cluster types which differ from the above describe relational form of governance, exhibits varying degrees of formalization and/or standardization of the relationship between cluster companies. Bell, Tracey and Heide divides between only two forms of governance; relational and hierarchical, where the latter relies on explicit patterns of authority that *'(1) allocate decision rights between transaction partners and (2) specify standard operating procedures'* (Bell, Tracey, and Heide 2009: 626). Typically, the hierarchical rules are deployed by a dominant cluster member (but there is no prerequisite), which means that there is some degree of power asymmetry between the actors. The hierarchical model of governance is not appropriate for transfer of tacit information. It this mode of governance is selected, the information exchanged by the actors must be possible to codify (Gereffi, Humphrey, and Sturgeon 2005), or put in another way, the actors must assume that it is possible to codify the information.

The supply chain and transaction cost framework seem to have limitations when it comes to explaining the behavior of agents in the supply chain. Even though transaction cost theory takes into account bounded rationality (Simon 1997), it still builds on the assumption that the economic agents are rational, that means that they are able to choose the appropriate mode of governance considering the variables frequency, asset specificity and uncertainty. Transaction cost theory does not include the institutional environment in which the transaction takes place, which Williamson left to '*economic historians and sociologists*' (Scott 2008: 112). According to Scott (2008), Williamson and transaction cost theory only emphasize the regulative aspects of institutions, and focuses furthermore on the organization level of analysis. In order to fully understand the actions and choices of actors in the supply chain, we have to study the institutional aspects on higher levels of analysis, and along the normative and cultural-cognitive pillars, not only the regulative as often is the case (Scott 2008). This means that transactions in

the supply chains must be analyzed in light of institutional aspects on cluster, national and at a global level (Boschma and Frenken 2006; Floysand and Jacobsen 2001).

In our view, and in line with North and Scott, institutions also provide a micro context to firms and individuals, affecting their actions and decisions. We argue that in order to analyze and explain this and former transformations of cluster supply chains, we need to take into account the institutional context in which the cluster transactions take place. The institutional context influence how the actors perceive reality, and the possibility space in which they make choices (Battilana, Leca, and Boxenbaum 2009). Thus, in order to analyze the choice of governance in global supply chain, it is essential to include the institutional or cultural aspect in which the actors are part of. By introduction the institutional context into the supply chain perspective, the relevance of history will be captured as well. The challenge of such an approach is that we are working at several levels of analysis; the transaction level, and the institutional context both at a micro and macro level. This approach is suggested in an recent article by Bell, Tracey and Heide (2009), where they introduce the term 'macroculture' into their interorganizational governance model of global supply chains. In their model, they separate between two main types of governance and macroculture; relational and hierarchical. Bell, Tracey and Heide view cluster macroculture as a part of the *institutional environment*, which represents common attributes like general norms, values, and practices. They define the relational and hierarchical macroculture as respectively *'the shared values of forbearance, cooperation, and bilaterism'*, and '*the shared pattern of authority and rules across organizations in a cluster*' (Bell, Tracey, and Heide 2009: 628). In line with Scott (2001), these forms of macrocultures may coexist. This model of culture and transactions provides a framework for analyzing transactions where the cultural or institutional aspect is taken into account. However, the dichotomy of macrocculture can be criticized for being simplistic, and does not capture other aspects which may influence the decisions at transaction level. Moreover, the institutional field is depicted in abstract terms only, which makes it hard to assess how it may change over time, and how globalization in particular alter interactions between the transaction level and macro level that may breach the relational mode of governance. Bell, Tracey and Heide use this model to explain the evolution of cluster, which we will discuss in further detail in the following.

In principle, the supply chain perspective does not appear to offer an appropriate framework for studying the historical evolution of clusters. The focus is on the choice of governance of the present transaction, or transactions in a time frame close to the present. There have however been made previous attempts to describe the evolution of clusters based on cluster typologies (Gereffi, Humphrey, and Sturgeon 2005; Guerrieri and Pietrobelli 2004). Gereffi, Humphrey and Sturgeon suggest that typologies may represent stages in evolutions of clusters (2005). They illustrate this point with several examples from different industries that have experienced transformations between difference types of governance. Their examples indicated that there is no single trajectory that global supply chains evolve along. Similarly, Belussi and Sedita's metastudy showed that Italian industrial districts followed a multiple growth pattern in their development (Belussi and Sedita 2009). However, the above mentioned studies do not provide any analysis of the mechanisms leading to the changes in types of governance. The idea that cluster goes through a set of predefined stages or cycles seems also questionable. These theories may be criticized for being deterministic, as there are no other options than the predescribed typologies.

An evolutionary approach does not point at a specific next stadium or state, but predicts certain evolutionary direction(s). An equivalent approach has previously been chosen by North (2009), who argues that transactions cost actually leads to evolution of economy, as zero transaction cost represent the most effective solution and will therefore not create divergent paths. According to North, the formation of institutions is a result of transaction cost. Institutions are considered as constraints that shape human action, and these constraints may be divided into formal and informal constraints. He argues that the transaction cost framework offers promise of exploring informal constraints, as the change in measurable transaction costs may give an indication of change in informal constraints. North uses his theoretical framework to analyze evolution on macro level, where he explains the difference between economical performance of countries and regions, and the historical paths of institutional change. The foundation of his theory lies however at a lower level, at the transaction level. Elements from this framework may therefore be used in order to analyze historical development of clusters.

It can be argued that this is analogous to the approach Bell, Tracey and Heide (2009) have used in their model of changes in governance of transactions. A change from relational to hierarchical governance implies an increase in transaction cost, and dependent of the 'match' with the macroculture, this has implications for the efficiency of the transaction. A hierarchical mode of

governance in a relational macroculture will not be efficient. Bell, Tracey and Heide further argue that this transformation of mode of governance may be path-dependent, as it will be difficult to reverse from hierarchical to relational governance. However, the model does not explain why changes happened. What triggers change from relational to hierarchical governance? Given that the macroculture and governance of transaction 'matches', there will be no change according to this model. Furthermore, the decision of governance mode is portrayed as a decision which alone shapes the path. The model does not capture the fact that the change in governance structure will feed back on the macroculture, or the institutional context which actors are part of. In their article, the macroculture is represented as something immutable, independent of the change in governance structure.

We argue that mode of governance is a result of a decision taken previously, i.e. it is path-dependent (David 1985; Martin and Sunley 2006; Sydow and Schreyogg 2010). According to Martin and Sunley (2006) there is a strong element of path-decencies that can be traced back to the emergence and growth phases of a cluster. The evolution of relational value chain governance may thus be expected to have a profound long–term effect on clustering processes. There is a wide literature on path dependency models, however in this paper the scope is narrowed to denote path dependency as development constrained within a limited range of options, defined also by institutional rules and practices. Fagerberg et al. (2009: 4) says that: 'At any point in time many new ideas emerge, but only those that (at the time) are sufficiently well adapted to the selection environment are likely to be applied and form the basis of continuing adaptation and improvement'. The focus on value chain governance here will include both endogenous and exogenous factors by using a dynamic evolutionary perspective (Boschma 2005; Onsager et al. 2007).

The theoretical passages briefly laid out above leads us to a certain set of questions; can we actually assess an evolution of a relational mode of governance as predominant in the cluster? Has it prevailed or even been a success factor in distinct technological leaps and other major transformations? Has the relational governance been attached in particular to specific value chain structures? Is the relational mode of governance now challenged, how and at what possible costs? To answer these questions, we have explored the evolution of the maritime cluster through different historical transitions.

PHASE 1 (1880s – 1960s) CLUSTER ORIGIN

Following Max Weber (1930), the shaping of economic activity in different places can be understood as the product of the religious values and world views that dominated the community and places. Following seminal historical works, the southern area of Møre and Romsdal in particular can be said to have developed a combination of strong work ethics, reinvesting economic practices, layman and equality orientated Christianity and a puritanical self control (Løseth 1996; Bukve, Løseth, and Gammelsæter 2004). The egalitarian Christianity had a much stronger position than in the northern sub-regions of the county, and the people in this region were also more open to new impulses. This meant that people in this region were allowed to, and also felt obliged to, perform well in economic matters. They were 'industrious'. But at the same time they felt a strong obligation to invest in the future of the local communities. As Christians they were not expected to maximize business opportunities purely for their self-interest but to care for their neighbors as well. This 'worldview' also had strong influence on those who did not regard themselves as active Christians. This 'industrious' way of thinking was however subordinated other values, which was illustrated by the support to the temperance movement in the beginning of the 1900s, which was founded in a strong religious sentiment (Nilsson 1975).

In mid-1700s, the southern part of Møre and Romsdal, land workers, cotters or crofters were free, and farmers had to make contracts with them in order to request their labor. This was opposite from other parts of the county, where hierarchical structures were developed between cotters and farmers, and where cotters where compelled and legally bound to work most of their time for the farmer. This implied that the social distance was much smaller in the southern part of the county (Sunnmøre and southern part of Romsdal) compared to the northern sub-regions. At the end of the 1880s, the cotter-system dissolved. However, the class cleavages were maintained in the northern part in contrast to the southern part, where the social distances remained smaller. In the southern part, the ownership also was more widely dispersed than in the North (Bjarnar and Gammelsæter 2003). A correspondent structure could be observed within the fisheries, were collective and dispersed ownership of boats and ships was widespread in southern parts of the county.

The region developed a rich tradition for shipbuilding, fishery services and coastal transport (Bjarnar, Berge, and Melle 2006). The development of the shipping and fishery sector in the

region, laid the foundation for what we today name the maritime cluster in Mid-West Norway. In Sunnmøre and also other parts of Western Norway, the shipping, fishery and shipbuilding industry was surrounded by related production and service industries with strong cooperative links to fishermen and local communities as well as local financial institutions. Within a dynamic maritime culture this led to a constant upgrading and modernization towards industrialized fishery, as well as maintaining much of the coastal fishery. Historians like Wicken (Wicken 1995, 1997, 1998) and With Andersen (2001) both see the highly successful development within fisheries and the maritime complex (shipping, mechanized industry, shipyards, electronics industry and a web of related industries and services) in Møre and Romsdal as a result of regional configurations of socio-economic, socio–technological and cultural factors. According to With Andersen (2001), smaller businesses were working in a kind of 'federation' within the maritime complex.

In general coastal societies in Norway were reluctant to adopt industrialized fisheries based on British models, which was concentrated in larger industrialized cities with a proletarian class of fishermen with no ownership to boats or equipment. These fisheries were based on larger trawlers operating on the deep seas in different parts of the world and with few relations to coast-based fisheries. The Norwegian coast and seasonal fishery using the wood and sail technology could not be competitive in the long run. However, due to close cooperation between shipbuilders and fishermen, the technological development evolved in an incremental manner, where small motors were fitted into smaller wooden boats and modified according to the fishermen's needs. This 'wood and motor' technology represented a pillar in a gradual modernization of the fisheries, which led to a gradual development of larger boats with larger machinery and technology, eventually adapted for deep-see fishing (Amdam and Bjarnar 2010).
As Karlsen notes (2005), offensive strategies directed at shipbuilding instead of maintenance, indicates a strong local entrepreneurial capacity in this region. Karlsen claims that the investment in shipbuilding, represented a break from the institutional context where the focus was on maintenance of boats (Karlsen 2005). The entrepreneurial spirit in this region was also expressed in the early diversification into marine equipment (Karlsen 2005; Grytten, Opdahl, and Eide 1992).

An important part of the modernization, however, was not knitted to the wood – motor concept, but to a steamboat concept, in fact both wooden as well as steel vessels. As within the wood – motor system, close interdependence and also cooperation characterized this line of modernization. Although the city trade bourgeoisie in Ålesund played a vital role in setting up this fleet of costly vessels, the dispersed and collective ownership structure enabled fishermen families in scattered coastal communities to acquire larger vessels and handle substantial mortgages. Skippers and fishermen also often cooperated with the traders in Ålesund. Since the share system (lott) penetrated the regions coastal as well as deep sea fishing, repeated trust based interactions represented a transaction system prior to the formation of a genuine regional value chain system of a cluster. This is underpinned by the empirical fact that a majority of these vessels were not built in the region, but in more northern and southern parts of Norway. It was not at regional territorial system. In other words, transactions were embedded in specific social structures, and not in agglomeration effects. However, the dispersed ownership structure as well as the share system interacted with the religious macro culture, forming a system preceding the cluster and forming its basis.

When new technology revolutionized the fisheries in the 1960s, it was this 'operative' system that enabled local communities to carry trough the vast modernization process. Contrary to Karlsen (2005) who sees strategies at firm level as late as around 1990 as the cause of clustering, these strategies were adopted in a certain opportunity framework and linked to specific generic resources. Hence, it would be more appropriate to stress that long term historical processes represented a specific opportunity that made these choices feasible. Karlsen (2005) also dates this choice, or performance of agency, to the 1960s. Historical facts, moreover, show that a quite substantial part of the steamers, even steel boats, and also larger wooden motor vessels were built by shipyards in the region, however mainly in the towns, Ålesund and Molde. Diversification took place, therefore, between 1903 and 1920, although, as Karlsen points out, maintenance and shipbuilding in this phase were complementary functions. We suggest, therefore, a rewriting of this history, by claiming that preceding the cluster was a specific mode of interaction between the transaction level and the macro culture, moreover, this also evolved prior to mature territorially anchored value chains.

Contrary to Bell et al (2009), however, this operative system did not represent a specific cluster typology of interaction, as it clearly evolved prior to the cluster. Probably no state of art cluster framework catches this subtle transformative system hence a broader institutional framework would prove superior to cluster theories. We here support Karlsen (Karlsen 2005: 317) that within the industrial district literature cultural properties of successful regions are usually taken for granted and cultural properties are not interpreted from agency, so that few explanations of how culture and economy interact are offered. Likewise, listing factors in the Porter tradition, like related industries, local rivalry and collaboration, specialized factors and demanding customers, proximity and knowledge spill–over and innovation pressure does actually not specify the formation of industrial clusters, and the reinforcing upgrading mechanisms tends to be a tautology (Karlsen 2005: 317).

To summarize the description of this cluster phase, the cluster culture in this period was characterized by short social distances and a spirit of entrepreneurship and business, which was based on people's economical independence and egalitarian Christianity. At the transaction level, strong cooperative links developed between shipping companies, fishery, shipbuilding industry, fishermen and local communities as well as local financial institutions. These close ties facilitated an incremental evolution from the dominating 'wood and motor' costal fishery towards industrialized fishery.

PHASE 2 (1960s–1980s) –TECHNOLOGICAL DEVEOPMENT

This time period is characterized by major technological innovations within the maritime sector. The cluster came strengthened out of these major changes, and exerted a unique ability to adapt. The first major technological breakthrough was the transition from wooden hulls to steel hulls in the 1960s. This transition was accompanied by innovations in electronic instruments for fish detecting (sonar/asdic), combined use of ring nets and trawlers, power blocks and development of side propellers. This totally revolutionized the sector in terms of geographical range, catch and output (Bjarnar, Berge, and Melle 2006).

Analyzing this transformation contains many challenges. In the first place it is a puzzle how the small local communities managed this revolution and the huge investments needed to carry it through. The modern fisheries growing up during the 1960s not only was characterized by a

transition to a very specialized fishery in distinct segments, in the pelagic as well as white fish sector, specialization was, moreover, geographic. Different areas specialized in different fisheries and technology, so that economic agency and diversification went hand in hand (Bjarnar, Berge, and Melle 2006). There was no specific reason why these scattered and distinct adaptations should amount to cluster dynamics. And it would also be a puzzle why, as Karlsen (2005) proposes, diversification strategies in the shipyards should drive a clustering process. A more appropriate answer would be that in sum the fishery revolution posed enormous challenges on the shipyards as well as mechanized industries and equipment production (Bjarnar, Berge, and Melle 2006). Nevertheless, we argue that the cluster was formed in this break through period. We argue that the most vital clustering mechanism was the development of complete value chains within a focal territory.

Accordingly, we once again fall back on a specific interaction between macro culture and transaction level or economic agency. The operative system constituted by the share system and dispersed ownership stroke back on culture and institutions, as well as the other way around. Hence small environments managed complex and costly modernizations. But why did they not remain scattered and divided coastal milieus along the specific technologies?

The expansion of the maritime industry took place with the same dispersed ownership as earlier and with a strong foundation in the local society. The dispersed ownership was an important institutional arrangement which was crucial for the maritime cluster's position. Another important factor was a business culture that promoted sharing of knowledge and innovation. This flow of knowledge actually knitted the local communities together, by diffusing knowledge and technological experiments they both counteracted too great risks and single entrepreneurs benefitted from growth of a larger environment. This again promoted interaction in value chains that emerged as more and more regional and not the least because they were relationally governed.

The institutional context and the type of interaction between actors in this area has been reconstructed through diverse studies by Bjarnar and Gammelsæter (2003), Bukve, Løseth and Gammelsæter (2004), Bjarnar, Berge and Melle (2006), and Døssland and Løseth (2006), building on a substantial array of written and oral sources. Informants from the southern and coastal areas in Møre and Romsdal (notably Sunnmøre but including the uttermost coastal areas

of Romsdal) saw themselves as economic and social actors operating within a widespread cooperative and collective business culture. Informants in the other sub-regions (Romsdal and Nordmøre) ascribed similar characteristics to the southern sub-region. Managers, who had worked all over the region, strongly stressed the cultural differences between a 'cooperative business culture' in Sunnmøre and along the coast and a much more 'enterprise focused' culture in Romsdal and Nordmøre (cf. map). Bjarnar and Gammesæter (2003) found that the prominent rule of action in the maritime cluster was a '*widespread combination of competition and at the same time strong collaborative practice between economic actors'.* Many informants expressed that this combination eased the flow of knowledge within wider arenas and geographical areas, at the same time as the actors saw themselves as competitors. The interaction and knowledge exchange between actors in the cluster took place in informal arenas, which by the respondents were seen upon as more important than the formalized networks. The informants in this study underlined the egalitarian aspects of the macro culture and the cooperative and mutual respect between capital and labor. In fact, this relational macro–culture proved itself superior in vast transformation of maritime industries during the 1960s and 1970s. Not only was the region evolving as the focal Norwegian fishing area, also a large part of the maritime sector in Norway was regionalized to this region. Perhaps, even more so than in phase 1, this break–through hinged on relational value chain governance.

As in the previous period, the technological development took place in an incremental manner through user-producer linkages. Many radical innovations were born during this period, within hydraulics, anchor handling, steering and stabilization, equipment and deck machinery. Joint sales, marketing and financial institutions were developed as well, which gave opportunities to smaller companies in large building projects through cooperative measures (Andersen 1997; Bjarnar, Berge, and Melle 2006). The development of an independent equipment industry stems back from the 1930s, also yards diversified into equipment production, however, this sector expanded greatly during the 1960s, and was more closely linked to the regional production environment and fisheries (Berge 2006). Thus, we can see that a vast technological modernization was subsumed under a cluster like formation around value chains that grew more complete within the focal territory.

Parallel to the major technological and market changes, this period was also characterized by a strong growth in the maritime sector: From 1960 until 1965 the employment in the shipbuilding industry grew with a rate at 54 percent. From 1966 until 1988 the region's share of the total employment in building of ships over 100 gross tons in Norway, increased from 9 percent to 39 percent (Bjarnar, Berge, and Melle 2006). The increase continued in the 1980s, when the region's share of employment in related industries and services grew from to 54 percent in 1987 (Andersen 2001).

Hence, in the period from 1960 to 1980 the cluster in North-West Norway transformed from a maritime milieu to a full blown cluster. This transformation took place in an institutional context which was characterized by close relational ties between the actors in the supply chains with a high degree of informal coordination. Actors were embedded in a regional business culture that promoted sharing of knowledge and innovation. This culture had its origin in dispersed ownership which led to short social distances in this community. The mode of governance in this period was mainly relational, but we can identify elements that are associated with hierarchical governance. Actors also saw themselves as individualists and competitors, but this did not hamper the knowledge exchange. The cultural collective aspect seemed to play the most important role, governing actor's choices. It can be argued that this relational macroculture have represented the most important factor for the establishment and development of the cluster in Mid-West Norway, through turbulent times with major technological breakthroughs and turbulent market conditions. Success in this turbulent period was not bestowed with all regions in the western part of the world.

PHASE 3 (1980s – 1990s) - CLUSTERING AROUND OFFSHORE SERVICES

Through the 1970s the demand for new fishing vessels declined substantially, which was a result of diminishing species and national and international regulations to prevent overfishing. In the same period new market opportunities emerged, as oil was discovered in the North Sea in the late 1960s. The maritime cluster was able to take advantage of this market opportunity, and specialized on supply vessels for offshore oil platforms. Supply vessels were originally rather small, and operated under relatively similar conditions as fishing boats. This meant that the experience this industry had gained from building fishing boats could be utilized more or less

directly in building new Offshore Supply Vessels (OSVs). Still, building of fishing boats remained an important element of the cluster activity for many years. The cluster developed a successful concept of small and very compact factory trawlers, and in the period 1985-1990 almost one hundred per cent of the regional capacity for shipbuilding was engaged in building these types of vessels (Amdam and Bjarnar 2010). This counteracted severe crises in the OSV segment.

It is fair to say that yards, in this case Ulstein Yard in Ulstein, Sunnmøre, pioneered the transition to supply activity by building ships for Danish customers based on foreign design. However, Ulstein developed a path breaking design, the UT–704, in 1975, which was subsequently developed during the following years and became a great international success. Statistics show that in 2005 one third of the global fleet of supply ships is built on design developed by Ulstein (Berge 2006). Not only had the yard generated a lot of competence from experiences from deep sea fishing in the North Sea, they also built on knowledge about steering operations generated from factory trawlers, and stabilization systems developed for fishing boats and ferries (Berge 2006: 422). Initially, the yards had built OSVs based on American design, which proved unsuitable for Norwegian conditions and the North Sea. The equipment producers followed the shipping companies and the yards into the OSV sector, and companies like Hydraulic Brattvaag (now owned by Rollc Royce) pioneered innovations within hydraulic and synchronizing systems for complex handling of wire systems. Due to downturns in the deep sea fishing, skipper–owners entered the offshore market in the early 1980s. Especially in Herøy, a centre for deep sea fishing, entrepreneurs converted trawlers acquired in Nordmøre and England into OSVs, and also ordered new vessels from local yards. Other coastal communities followed up. However, they faced severe shocks in the market both in 1983 and 1986, leading to a number of bankruptcies. The owners survived since they still had a foot in the fishing sector.

The financial system diverged from the dispersed and collective structure characterizing the fishing sector. Moreover, the relation to the customers differed, in the OSV sector the customers exercised much more power and the skipper–owners say they met a new and harsher kind of business culture (Berge 2006: 426). Nevertheless, pioneered by entrepreneurs like Stig Remøy and Per Sævik, the OSV segment grew rapidly during the 1990s. Also, a number of vessels were sold to global actors entering the cluster, like Trico Marine and Bourbon. The OSV companies

were also listed on the stock exchange, Oslo Børs. All in all, the transaction level changed substantially in relation to customers, while the 'internal' transaction system and interplay between regional actors probably remained intact. However, the OSV companies were strongly concentrated to a few, especially to four municipalities, all located in a smaller part of Sunnmøre. Since the 1980s also the deep sea fishing contracted and became much more geographically concentrated.

In some respects, the relational form of interaction and knowledge exchange is still important. Much of the innovative process is built on already established 'conceptual innovations'. Innovations within the OSV segment have to a considerable extent grown around a basic concept, 'the supply vessel', developed already in the 1970s. Likewise, innovations within deep sea fishing have been prototypes that have enjoyed enormous international success and have thus been of great importance to regional growth. Our informants express that such groundbreaking innovations also in the future may be depending extensively on the flow of tacit knowledge within the cluster environment. This corresponds well with the model of Bell, Tracey and Heide (2009), where the relational form of governance is the most suitable when it comes to exchange of tacit knowledge. Strong norms for knowledge sharing still play a vital part, and illustrate a prevailing relational macroculture (Bjarnar 2010).

However, the picture is now more blurred. As much of the cluster has moved into supply, not only the transaction level has changed. The basic social institutions like the share system and the dispersed ownership structure hardly play the same role as in previous transformations due to the diminishing role of the fisheries. Moreover, much of the knowledge attached to project management and financial operations has now moved out of the region, and is concentrated around the capital Oslo. Some of our informants claim that there is no longer a regional cluster, but a national cluster (Bjarnar 2010). Although we cannot at this stage of our research assess the impact of such changes on the interaction between the transaction level and the macro cultural level, it is fair to ask whether globalization will represent a furthering of hierarchical relations and formalization introduced through the OSV segment.

PHASE 4 (1990 TO THE PRESENT) – GLOBALIZATION

This period has most of all been characterized by a gradually globalization of the cluster. The cluster have been international at the downstream side of the supply chain for many years, but in this period the internationalization of the upstream side was accelerated. High internal costs and high wage levels in the region made it difficult to maintain complete production in Norway. During this period most of the construction of hulls have been outsources to low-cost locations, like Poland and Romania (Amdam and Bjarnar 2010; Bjarnar 2010). Shipyards and regional equipment suppliers have established branch offices and production units abroad. For example, have Ulstein group, which is a shipbuilding company with a long history in the cluster, subsidiaries in Brazil, Slovakia, Poland, Netherlands, Turkey and China. In general, ship-building is increasingly outsourced to partner yards in Poland, Ukraine, Dubai, Brazil and China. This process has been a success financially. Offshore ship owners in the region doubled their revenues from 2002-2006, almost exclusively coming from markets outside the North Sea (Oterhals et al. 2008). Cost saving has been an important argument for outsourcing production to other counties. Parallel to this globalization, shipyards also have made substantial investments in modern production facilities, and companies in the clusters have focused of developing new technological solutions in the offshore segment. An argument for keeping a part of ship production local, is that it is as way of retaining shipbuilding knowledge inside the cluster in order to be able to develop new technological solutions for existing and new market segments. Some shipping companies also prefer to have vessels build locally in the cluster.

Outsourcing is one side to low-cost countries is one side of the globalization process. Another is the increasing presence of large international companies in the cluster. At the end of the 1990s, the non shipbuilding parts of Ulstein Group were sold to international actors, which are now owned by Rolls Royce Marine. Rolls Royce has increased its presence in the cluster through the acquisition of Odim ASA in 2010, a producer of services and equipment to offshore service vessels. In 2007 Aker Yards was sold to STX Europe, which now own shipyards in France, Romania, Ukraine and Vietnam. Other global actors are Aries, Trieste, Bourbon and ABB.

The institutional context or macroculture under duress of globalization has recently been studied by Bjarnar (2010). The interviewees, ten upper echelon regional managers, altogether stress that the cluster has traditionally been characterized by widespread formal and informal contact

between actors. Coordination and knowledge flow takes place in day to day practical work inside and between companies, and also through many social networks. Problems related to work are discussed and solved in other social settings than the workplace, and the interaction is frequently relational without any form of formalization. Conferences and other forums are also important facilitators of knowledge flow. Networks to some larger and global companies in the region and the design milieu is seen as very important, especially many businesses have been helped to develop customer–tailored products. Communication and sharing of knowledge within local micro networks is extensive (all informants). The informants in this study attach a special value to low social distance between management and workers, which facilitate the emergence and diffusion of new ideas. Strong norms for knowledge sharing play a vital part, and illustrate the relational macroculture which still seems to be predominant in the cluster (Bjarnar 2010). However, this study reveals that relations, in particular connected to knowledge sharing is changing in many subtle and problematic ways. Major players in the cluster have developed own design and building programs, and there is a growing tendency that internal resources count more in product development than before. There seem to be an increased concern for protection of knowledge and ideas, than has hitherto been the tradition. Innovation processes are furthermore more 'structured' and project oriented than they used to be, and with a shorter time horizon. The emergence of global value chains also implies an increased formalization also in terms of negotiating procedures and contractual processes. There is a growing tension between standardization pressures to be efficient, and flexible specialization to be innovative. From the above we can assert that there has been a development from tacit practice based collective knowledge, to formalized transfer of knowledge in-house or between global companies.

Recent findings suggest that central companies in the cluster have chosen a 'market-oriented' way of organizing relationships with suppliers, instead of the relational mode of governance with was prominent earlier. This implies a stronger emphasize on price when contracts with suppliers are negotiated, which to some degree has substituted long-lasting relationships based on trust. This market-oriented tendency has led to a bias towards short term profit and production that can satisfy this drive. The global actors seem to be less willing to join open membership in the cluster, and close themselves in.

The above described development is supported by surveys performed by Møreforsking in the period 2001-2009. These surveys show that the cluster company's assessment of the strength of the relations between them, was predominately decreasing in the period 2001-2009 (Hervik 2001; Hervik et al. 2009). From 2006 and 2009, cluster companies assessed the importance of having local suppliers and proximity to customers, were reduced (Hervik et al. 2009). One exception was equipment suppliers' relations to shipyards and shipping companies. This development illustrate that globalization have affected the tight relations between companies in the cluster.

Nevertheless, respondents also stress the need to uphold the regional realm, as it is recognized by some actors that innovation capacity is knitted to the local production environment. The knowledge required to construct complex ships is based on tacit knowledge and a relational form of cooperation between actors in the supply chain, and is not easily outsourced to other countries. Recent findings indicate that some cluster companies now are considering back-sourcing of activities. Another argument for not flagging out core production is that it in the long run, globalization will lead to worker's demanding similar social and economic benefits as within the home cluster. Some of the actors have also become aware of the transaction costs associated with coordination production over large geographical distances. On the other hand, some of the respondents look upon globalization as an opportunity to further growth, and to develop new competencies through a global workforce. In order to meet challenges associated with global production networks, actors increasingly focus on building and maintaining a growing complex international competence network (Bjarnar 2010). A possible development path will be outsourcing most of shipbuilding and design, and keeping some core functions in the cluster.

The globalization process taking place the last decades have been a combination of global outsourcing reasoned in cost savings, and global actors establishing themselves as major players within the cluster. These global actors act as institutional players, and express a desire to contribute positively to competence building in the region (Oterhals 2008). Nevertheless, the cluster is challenged. There are indications of reduced strength of the relationships between cluster companies, and a development from relational to hierarchical governance of cluster supply chains. This is in particular expressed through closing mechanism in knowledge flow and some actors choosing a market oriented strategy towards suppliers. In parallel with this

development, actors in the cluster still talk positively about the traditional way of working in the cluster, which has been characterized by informal contact and knowledge flow through collective problem solving. This may indicate a growing tension between the transactional level and the institutional or cultural level. All in all, the macro culture appears to have grown more ambiguous, and cannot at present be represented in terms of a relational culture. From our interviews we see that central actors are becoming more inward looking and global at the same time (Bjarnar 2010). The cluster is embarking on a new evolutionary path of stronger hierarchy and formalization of relations. If this is representing a continuous movement, it can be predicted that this path will structure business relations for a long future, and that in a certain period structure will determine strategies, or more precisely, the role of strategic management will be diminished.

DISCUSSION AND CONCLUSION

Based on primary and secondary data concerning the Maritime cluster in Mid-West Norway, we find that from the origin of the cluster, a relational macroculture have been prominent. The first two phases described in this analysis, the relational mode of governance has characterized the relations between actors in the cluster supply chains. The relational mode of governance has been resistant to exogenous forces as major technological breakthroughs and changing market conditions. The success the cluster has experienced during its life may also be explained by this strong relational macroculture and 'match' with mode of governance at the transaction level. Strong relational ties between actors in the cluster, which has its roots in a egalitarian cluster culture with dispersed ownership, have facilitated knowledge exchange and innovation, and supported adoption to new technology and entry in new market segments such as the offshore service business. Recent data suggest that globalization of value chains leads to a pressure towards hierarchical governance of value chains. This is not surprising, as globalization implies actors operating in different cultural contexts have to coordinate actions along the global value chains. This represents a need for an increased degree of formalization, as the actors cannot rely on the coordinating mechanisms of the macroculture. However, the hierarchization of the relations between local companies in the cluster has not come as a result of coordination difficulties due to different institutional contexts. The actors in the cluster are mainly the same as before, even with the introduction of multinational companies in the cluster. The shift from

relational to hierarchical governance may come as a result of actors in the cluster have acquired knowledge from outside the cluster, which have influenced their world view and consequently their decisions (North 2009). This knowledge has been introduced to the cluster through the establishment of global companies in the cluster, and cluster companies outsourcing activities globally. Another exogenous factor may also be the latest financial crisis, which facilitated a market-oriented way of handling transactions, as a response to possible way out of the crisis. This illustrate how international events and market changes affect how the actors in the clusters perceive the world, that is the institutional context, and shapes the cognitive space in which these actors make decisions.

In this view this shift to hierarchical mode of governance represents a break from the traditional mode of relational governance, and may constitute a new evolutionary path with emphasize on formal contracting and market-oriented relations between actors in the cluster. Weather the cluster will evolve along a new path will depend on how resistant the institutional context or macroculture is to the changes of governance at the transaction level. The data collected also shows that the recent development to hierarchical governance represents challenges for the cluster actors, because of the mismatch between the historical relational macroculture, and the new mode of governance at the transaction level. Some respondents have indicated that major cluster companies now are changed their strategy, and focuses on long term relational relationships to other cluster companies, and some are also considering back-sourcing of key activities. One possible interpretation of this development is that the mode of governance which historically has been dominant is quite resilient, even when the cluster is exposed to major events that draw the cluster in new directions. This is in line with authors that claim that institution changes slowly (Nelson and Winter 1982; North 2009). From this case study, it is too early to predict the cluster's future evolutionary path, as the cluster seems to be in the middle of a transformation process. Further longitudinal studies of this case should be performed in order to follow this development,

The strength of the theoretical framework presented in this article, is that it highlights the tension that may exist between the institutional cluster level and the transaction level (Scott 2008). The findings in this case study, indicates that changes in mode of governance at transaction level may take place in a relatively short time frame, while changes in the institutional context is more resilient. According to institutional theory (North 2009), changes in transaction level will feed

back to the macroculture, shaping a new evolutionary path. It remains to be seen how the recent development in governance at transaction level, will affect the institutional context at cluster level, and shape the future evolution of the cluster.

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