

Technological change and transformation of clusters
The Møre and Romsdal maritime cluster in Mid–West Norway,
1960s – 2008.

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Introduction¹

Various academic disciplines have noticed that economic activity tends to be concentrated in particular locations. Across different territorial innovation models it is proposed that the major advantage of geographical and social proximity is increased dissemination of knowledge. Clusters accumulate formal and tacit knowledge which no single business can fully contain within its organisation. Accordingly, tacit and formal knowledge is accessed through networking within clusters.

Recent studies question whether or not structural changes and globalisation processes are reducing the importance of local contextual and tacit knowledge and its transfer within old regional clusters, as knowledge accumulation becomes more formalised or even independent of space. On the other hand, in order to become competitive businesses may increasingly be depending on localised interactive learning processes within clusters. Modernization processes may thus promote rather than reduce the importance of location in the organisation of economic life.

However, such studies have focused less on the possibility that technological innovations – directly or indirectly – may alter, disrupt or even have a deteriorating effect on the hitherto institutional prerequisites for regional innovative excellence. This is the main theme of the paper, as we will discuss how technological innovations over time may undermine the institutional conditions that earlier on formed a basis for the very same innovations, thus diminishing the space for new innovations and regional development.

The paper analyse the regional maritime cluster in Møre and Romsdal in Mid–West Norway since the 1960s and to the present in light of national and international regulations, structural changes and internationalisation processes. The cluster is seen as the most complete and comprehensive maritime cluster in Norway as well as globally leading. The institutional role of small skipper owned companies within deep sea fishing has historically been vital for the development in the cluster. The present strength of the maritime cluster in the region cannot be fully understood without considering the technological revolutions in deep sea fishing in the 1960s, with the many regional skipper owned fishing companies in the fore-front.

However: The technological revolutions seem to have affected these institutional settings through two distinct historical phases. Firstly, the new technology fostered a specialisation among ship owners and fishing vessels. Secondly, the new technology was so effective that without public regulation the fishing industry was capable of emptying the sea. These regulations in turn have heavily affected the institutional characteristic of the regions deep sea fishing industry. Both processes, we allege, have altered the potential role of the deep sea fishing in the maritime cluster – and thus – the cluster itself.

¹ The paper builds on extensive statistical, archival and oral sources collected within a larger historical project on the development of deep sea fishing and cluster dynamics since the 1800s and to the present (Døssland and Løseth 2006, Bjarnar, Berge and Melle 2006), financed by regional actors, as well as studies of knowledge flows in regional clusters financed and produced within the framework of The Research Council of Norway (the Programme for Democracy, Governance and Regional Development).

Innovation and fragmentation (or at any rate: transformation) of clusters may thus be interconnected processes. This phenomenon has not been predicted in the cluster literature or in territorial innovation models in general.

Beside this main theme, we also want to demonstrate the advantages (and necessity?) of analyzing clusters historically. The paper also considers the relations between institutional economy, technology and politics.

Technological innovations within institutional and political contexts

Within social science theories of technological and economic development social characteristics attached to geographical concentration of economic activity is seen as an essential prerequisite for and mechanism in innovative dynamics. Businesses competitiveness rests not only on business internal structures and characteristics, but fundamentally on the processes through which businesses build links to a wider community. Firms' external and internal environment is not only shaped within national frameworks, but increasingly in a globalised world within sub-national territorial concentrations and local institutional settings. Economies may, therefore, expose rather different characteristics within a national setting.

This conception is shared within a variety of approaches, like neo-Schumpeterian theories, agglomeration theories within social sciences, regional innovation systems theories, regional cluster approaches, triple-helix models, evolutionary economics and the flexible specialisation literature (Amin and Thrift 1998, Porter 1998, Cooke 1998, Sabel 1994). According to Porter (1998), "Paradoxically, the enduring competitive advantages in a global economy lie increasingly in local things – knowledge, relationships, and motivations distant rivals cannot match".

The mentioned theories are in varying degree approaching local economies' institutional settings, organisational patterns, ownership structures, routines, cultures, motivational structures, traditions, cognitions and knowledge. They offer institutional explanations for observed patterns of economic clustering and activity. Institutional explanations are also invitations to undertake historical analysis. Institutional frameworks grow over time and have their historical origins. Moreover they create certain path dependencies thereby influencing future developments. However, this invitation has to a very limited degree led to such historical analysis within the approaches briefly outlined above (Gertler and Wolfe 2006). This implies that some essential questions are under-researched, like what are the historical conditions for institutional competitive advantages, which institutional changes can be observed over time, and how institutional changes may stimulate a region's competitiveness on the one hand, or may be hampering it on the other (North 1990).

Our paper is thus inspired by historical works that within different conceptual frameworks have addressed such questions. Alexander Gerschenkron (1904-78) and the Norwegian historian Francis Sejersted challenge the view that economic modernisations in each nation-state were unique processes, and confront the traditional linear approach within economics, namely that economic modernisation was identical across nation-states. They thus advocate a certain level of generalisation, however, not in the form of universality independent of specific historical contexts (Amdam, Knutsen and Thue 1998, Gerschenkron

1962, Sejersted 1993). They focus on relations and interactions between technology, socio-economic characteristics and politics. In accordance with such perspectives, Sejersted (1993) characterises the development of the Norwegian “sonderweg” as “democratic capitalism”. Industrial development in Norway was closely dependent on a state that compensated for or substituted lack of big business locomotives and not the least shortage on finance capital. On the other hand it was extremely difficult to launch policies that conflicted with the interests of regional socio-economic and socio-political environments (Sejersted 1993).

While both Sejersted and Gerschenkron viewed modernisation processes within nation-states as territorial units, Sidney Pollard argued that regional peculiarities and differences between regions were just as apparent (Pollard 1990, Wicken 1997). Somewhat paradoxically, though, Pollard used nation-state centred ideal-type models in order to reveal regional patterns, namely the “British” vs. the “French” models of industrial organisation and modernisation. Characterising the “British” model was urbanisation, the creation of the factory as the central organizing unit, hierarchical work control and class cleavage, and in general based on new institutional set-ups which were in conflict with traditional institutions and cultures. The “French” model, on the other hand, promoted industrialisation and modernisation embedded in local or regional milieus. The “work shop” emerged as the key organisational unit employing traditional craft based skills and knowledge, rather simple technology, cheap labour and low degree of class polarisation. The institutional framework built on historical traditions and represented continuity between traditions and modernisation processes. According to Wicken (1995, 1997), the Møre and Romsdal region, which is the focus of our analysis, evolved as a typical example of “French” industrialisation.

Subsequently, alluding to this view, it is implicit in our paper that this form of industrialisation and modernisation has largely influenced later development up to the present. Nevertheless, we have also witnessed important institutional changes. Especially therefore, we target the rather free flow of knowledge and innovations unfolding within the traditional institutional framework, and how subsequent institutional developments may have posed unforeseen limits on knowledge flow and innovation.

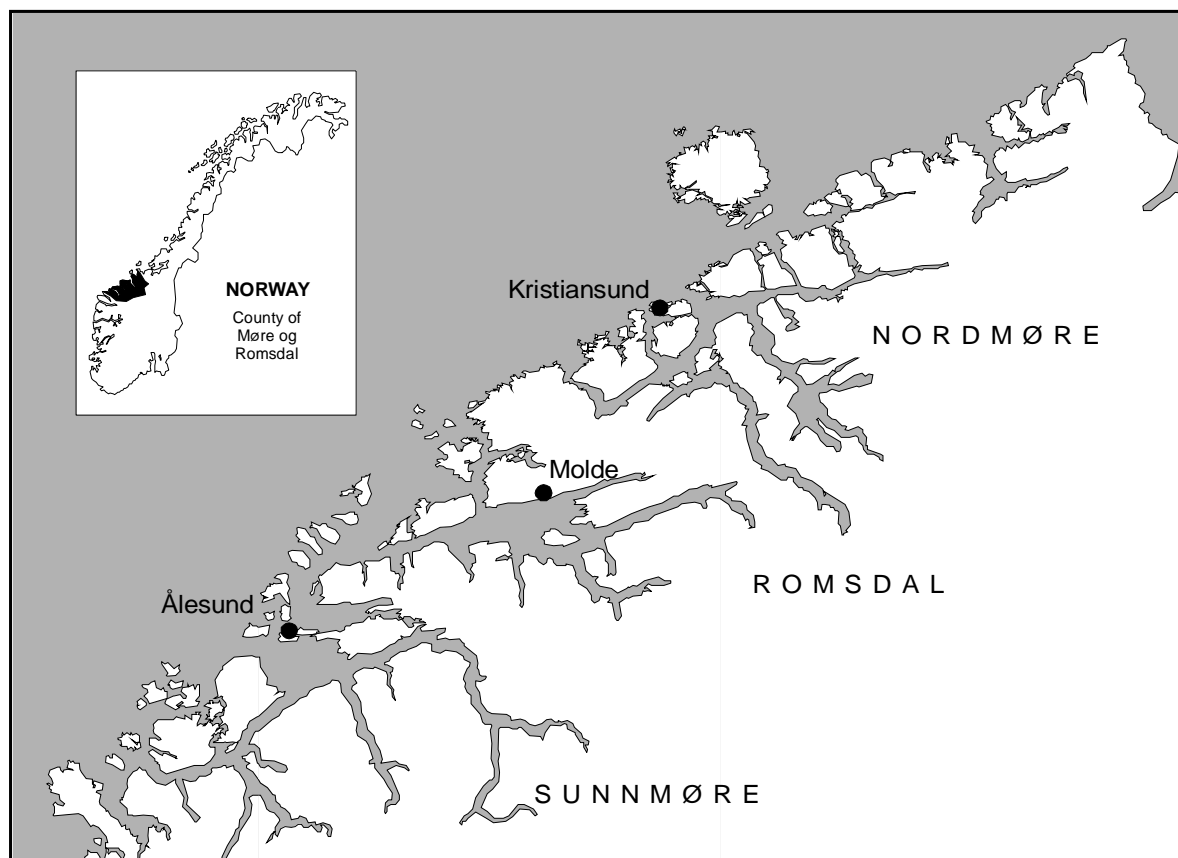
Regionalisation of the national maritime cluster

Andersen (2001) has explored why and how it has been possible for a small nation like Norway to maintain a central role in the international shipping system since the 1850s with rather limited indigenous resources. In the first place, he argues, the answer lies in a tightly interconnected system of supporting institutions, like brokers, certification institutions, insurance companies and finance capital on the one hand, and so called front line organisations like shipyards and ship owners on the other. Moreover, national strength has been maintained through regionalisation of shipping and related activities. “French” industrialisation in Møre and Romsdal promoted a substantial competitive advantage over other Norwegian regions in terms of regionalisation of economic activity within maritime industry.

While South-Norway earlier was the centre for maritime activity and industry (especially concentrated to the town Arendal), the breakthrough for use of steel- and steam-vessels shifted the mainland for maritime economy to the larger cities Western and Eastern Norway. Ship-building was, for example, inspired by a Fordist production mode. From the

early 1970s on, however, maritime activity and industry was concentrated largely to the Møre and Romsdal region. According to Andersen (2001), these regionalisation processes took place due to institutional constraints in the earlier centres much inspired by “British” industrialisation, and much more flexible institutional arrangements within the “French” system in Møre and Romsdal better suited for handling new technological innovations in rapidly changing markets.

Wicken (1994, 1997, 1998), Andersen (2001) and Bjarnar, Berge and Melle (2006) see the highly successful development within fisheries and the maritime complex (shipping, mechanised industry, shipyards, electronics industry and a web of related industries and services) in Møre and Romsdal during the 1900s as a result of regional configurations of socio-economic, socio-technological and cultural factors. Some figures illustrate patterns of modernisation of these coastal societies: From 1960 until 1965 the employment in the shipbuilding industry (including related industries as suppliers) grew with a rate at 54 percent. In 1966, the regions share of the total employment in bulding of ships over 100 gross tons in Norway amounted to 9 percent, soaring to 39 percent in 1988 (Bjarnar, Berge and Melle 2006). The region’s share of employment in related industries and services grew from 37 percent in 1980 to 54 percent in 1987 (Andersen 2001). Smogeli (1986), who studied the development in 76 yards and related mechanised industries between 1970 and 1980, found that these enterprises increased their employment by 42 percent in this decade. This pattern of expansion took place within businesses with dispersed ownership structures and with stronghold in local milieus and societies. According to Andersen (2001) and Berge, Bjarnar and Melle (2006); smaller businesses were working in a kind of “federation” within the maritime complex. Historically, during the 1800s and 1900s the region developed a rich



tradition for shipbuilding, fishery services and coastal transport. Small yards worked closely with shippers and ship owners to satisfy the need for specially designed boats and equipment fitted to operate under different, often local circumstances regarding sea and weather conditions, as well as the patterns of the season-based fisheries. The dispersed and local ownership of ships and yards implied that many fishermen owned parts of their boat together with neighbours and relatives. In fact, this pattern has largely prevailed up to the present. Even today the maritime complex consists of many small shipping companies operating only a few ships each.

The maritime complex has been strongly regionalised especially since the 1960s. Modernisation processes developed in a gradual or evolutionary manner through user–producer linkages that produced many radical innovations within hydraulics, anchor handling, steering and stabilisation, equipment and deck machinery. The region also developed joint sales, marketing and financial institutions, which enabled smaller companies to take advantage of large building projects through cooperative measures (Andersen 2001, Bjarnar, Berge and Melle 2006). This kind of networking was in fact widespread in the region since the 1930s in several industries (Amdam and Bjarnar 1997, 1998, 2000, Bjarnar et al. 2001). As the offshore and oil sector developed rapidly during the 1970s and 1980s, the strong user–producer linkages and cooperative culture enabled this rather small-scale industry to take advantage of new markets, especially supply ships, other shipping and mechanised services to the oil industry.

Supply ships are rather small boats that need to operate in very similar conditions to fishing vessels, and in fact the local shipyards applied the experiences from the fishing fleet more or less directly to the new industry. There has been a long–standing tradition in the coastal communities and within the maritime complex to adopt a diversified business strategy, deliberately designed as to counteract shocks emanating from oscillating markets (With Andersen 2001). Hence, the actors also carefully avoided adopting a “fordist” mass production model, and maintained instead a largely craft–based industry characterised by flexible specialisation. In many ways this can be seen as a *life-form* reflecting local and even regional cultural traits (Wicken 1994).

In general coastal societies in Norway were reluctant to adopt industrialised fisheries based on British models from the late 1800s. The British system was a “steel and steam” system, concentrated in larger industrialised cities with a proletarian class of fishermen with no ownership to boats or equipment. 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. Obviously, the Norwegian coast and seasonal fishery carried out by using the “wood and sail” system could not be competitive in the long run. However, by introducing small motors that could be fitted into smaller wooden boats and modified to operate under different season-determined fisheries, this “wood and motor” system evolved as a pillar in a gradual modernisation of the fisheries. It included a gradual development of larger boats with larger machinery and deck technology, eventually fitted for deep–sea fishing.

Within this socio–technological paradigm distinct regional innovation systems evolved. In Møre and Romsdal and also other parts of Western Norway, the shipping, fishery and shipbuilding industry was surrounded by related mechanised and service industries with

strong co-operative links to fishermen and local communities as well as local financial institutions. Within a dynamic maritime culture this led to a constant upgrading and modernisation towards industrialised fishery, as well as maintaining much of the coastal fishery. In other words, modernisation was embedded in the existing maritime culture and complex.²

A basic organisational form, namely small shipping companies within deep sea fishing, where the active skipper was owner or partner and controlled strategic decisions, has been particularly important in promoting an extensive flow of knowledge within the maritime cluster. These companies have as mentioned above intersected experience based specialised knowledge with more formal and technological knowledge as the skipper-owners have interacted closely with shipyards, mechanical industry and producers of electronic equipment and hydraulic devices. This flow of knowledge placed the regional cluster in the international forefront. The region became leading in the many technological revolutions in fishing since the 1960s, as in the adaptation of thrusters to fishing boats, use of power-bloc, electronic fish-finding technology and auto line systems. Since the 1970s, moreover, a substantial flow of knowledge and innovations to new blooming industries was facilitated, as many of the skipper-owners pioneered businesses within offshore supply services, fish farming and – to some extent - marine industry (Bjarnar, Berge and Melle 2006).

Implicit in much of the literature outlined above is the view that regions are characterized by rather stable and enduring institutional frameworks that offer different potentials for innovation and modernisation. They are to a varying degree adaptable to environmental pressures (markets, technologies, policies). On the one hand regions may have institutional settings that over time lead regions into lock-in situations. On the other hand regions may have settings that promote flow of knowledge and innovations within a flexible and adaptable milieu. This literature, therefore, tends to advocate a rather static perspective on institutions and institutional settings. In this paper we argue for a more dynamic historical approach that reveal how technological development mediated through socio-economic or political processes may alter and – directly or indirectly – disrupt or even have a deteriorating effect on the hitherto institutional prerequisites for regional innovative excellence. In other words, we will discuss how technological innovations over time may undermine the institutional conditions that earlier on formed a basis for the very same innovations, thus diminishing the space for new innovations and regional development. This dynamic approach seems to be largely under-communicated in the above outlined literature. Our aim is,

² This general picture, however, covers great sub-regional variations. The development within the clip fish cluster is illustrating. Until the 1960s, Kristiansund in the north sub-region was the dominating producer and shipping town in the clip fish market. In the 1950s, 70-80 percent of the total Norwegian clip fish export was shipped from producers in Kristiansund. The town was also successfully engaged in the huge herring fisheries in the 1950s and 1960s. Large and prosperous firms exporting clip fish, but also salted fish, herring, frozen fish, fish oil, canned fish etc. were localized here. In the course of only ten years, however, between 1960 and 1970, almost all of this industry was pulled down, and the core of the industry moved to Ålesund in the southern sub-region. By 1977, 82 percent of the Norwegian clip fish export was shipped from Ålesund. A major economic transformation had taken place within the region. Later, Kristiansund's fleet of trawlers and the production of supply boats also moved to the southern sub-region.

subsequently, to address the complex dynamic relationship between technology, socio-economic factors, institutions and politics.

Two path-breaking set of “events” form our point of departure, namely a set of technological break-troughs in the fisheries in the 1960s, and subsequently the long term effects of these innovations as they were mediated through a very comprehensive and detailed political regulation of the fisheries developed since the mid-1970s. The long term development of the skipper-owner institution is discussed against different structural and political developments, like regional specialisation and concentration of capital and know-how, changing patterns of co-operation and competition among maritime actors, the interplay between fisheries and maritime industry, and the interaction with political regulations. We will demonstrate that important institutional set-ups once favourable for regional innovation are no longer in place, while others are profoundly challenged.

Technological leaps

Several radical innovations made a huge impact on the development of deep sea fishing nationally, but not the least in the actual region, during the 1960s. The innovations affected all sectors of deep sea fishing. However, the different sectors grew based on rather sector-specific innovations.

A generic technological development in the region was characterised by a wide transition from hulls made of wood to steel hulls. Steel hulls were introduced in the region in the late 1800s, combined with steam driven vessels. The diffusion of the steel-steam system was rather limited. The basic technological system since the beginning of the 1900s was wooden vessels driven by smaller motors. The 1960s marked the end of the wood-motor era, as the use of steel hulls saw a break-through in this decade. Transition to steel vessels was accompanied by innovations in electronic instruments for fish detecting (sonar/asdic). Although the combination of technologies in the first place led to a soaring catch and output in the herring sector, the technologies had a distinct generic character and affected all deep sea fishing (Bjarner, Berge and Melle 2006).

Within pelagic sector, the use of new ring nets, power-blocks and development of new propulsion systems (side-propellers) totally revolutionised the sector in terms of geographical range, catch and output. Transition to steel hulls was an essential basis for this revolution. Another break-through was represented by the development of the combined ring net and trawler vessel in the late 1970s which led to much greater range and flexibility. A specific innovation laid the ground for this combined technology, namely construction of sterns as lateral axis.

Within the white fish sector, the development of automatic driven long lines largely rationalised two of the most demanding operations, in terms of crew needed and in terms of work load during fishing, the baiting of the lines and the hauling up operation. Another prerequisite for using new forms of sterns and automatic hauling was the construction of sheltered decks. Within the white fish sector, moreover, entrepreneurs within the regional milieu developed a compact factory trawler concept. All the above mentioned technological combined solutions represent “conceptual” innovations that have enjoyed a tremendous international success (Bjarnar, Berge and Melle 2006). It is fair to say, that although some of

these technologies were built on imitation and refinement of ideas generated outside the region, the diffusion of new technology in the region was unmatched by any other area. Thus, the region evolved as a national maritime centre of gravity.

Four interacting institutional arrangements laid the basis for the region's maritime position. First, as mentioned the dispersed ownership structure that allowed a substantial number of fishermen to own parts of boats or the technological equipment and have parts of the catch. Second, actors were embedded in a regional business culture that promoted sharing of knowledge and innovation (Bjarnar and Gammelsæter 2003). Third, the tight interplay with maritime industry (like ship-yards, mechanical work-shops and fish industry) furthered flow of knowledge and innovation. Fourth, as mentioned above, the entrepreneurs benefited from a well developed infrastructure of supporting knowledge-producing institutions (financial institutions, consultancies, co-operative associations etc.). This infrastructure enabled the skipper-owners to undertake expensive and risky modernisation projects. It was also an important asset in handling the very complex regulation regime established since the mid-1970s. Negotiations over quotas and concessions within national and international frameworks further demanded a rapid development of organisational capabilities in terms of common associations and special interest organizations (as The Norwegian Fishing Vessel Owners Association and Norwegian Fishermen's Association). In turn, this furthered competence building and also political influence (Bjarnar, Berge and Melle 2006).

Together, historical traditions, culture, institutional set-ups and the dispersed ownership structure made it possible for the active fishermen to manage and control the new and very capital demanding fishing. The skipper-owner institution largely explains why small local communities emerged as centres in the modernisation process, while the more hierarchical management structures and complex ownership structures hindered the larger shipping companies situated in the towns from expanding. In fact, few of them survived the technological and socio-economic development in the 1960s.

The skipper-owner institution had a great innovative potential. Skippers or other central officers on board developed experienced based knowledge from handling technologies and operations, and from witnessing successes and failures of other skippers. These companies had the capacity to intersect experience based specialised knowledge with more formal and technological knowledge as the skipper-owners interacted closely with shipyards, mechanical industry and producers of electronic equipment and hydraulic devices. The skippers' ownership position rendered them, moreover, a considerable decision power.

By following the history of each of the more ground-breaking innovations – and imitations – within deep sea fishing, we see that the skipper-owners played a paramount role, be it within propulsion technology and thrusters, within construction of hydraulic devices, within automatic long line fishing, the construction of compact factory trawlers, the refinement of the power-block technology, the ring net fishing and the combined ring net and trawler fishing. Some of the innovations, radical or more incremental, were met with scepticism. But as soon as they were conceived of as promising, the entrepreneurial milieu secured a wide spread and quick diffusion of innovations (Bjarnar, Berge and Melle 2006). The flow of knowledge was free and extensive within a highly competitive as well as co-operative culture.

The rapid and extensive modernisation within deep sea fishing posed a considerable challenge to the related maritime industry. The close contact between fishing and related industry, therefore, led to a substantial development of knowledge and production capacity within ship-yards and diverse equipment suppliers. Thus, both the region's industrial structure and institutional setting emerged as an important precondition for the above outlined regionalisation of the maritime industrial complex. Furthermore, this knowledge and capacity placed the region in the national and international forefront of the booming offshore supply vessel segment since the late 1970s.

In this regional setting, ship building is not mass production, but the construction of rather unique and individual products. Moreover, it is still largely craft based production. Specific demands and specifications will be attached to each ship, and the production is very complex, involving a wide range of components, work operations, professions, suppliers and sub-suppliers etc. The production process thus may be unpredictable and demands excellence in managing it. Complicated logistics at the shop-floor level moreover require a pool of highly developed tacit knowledge. Shipbuilding has a "fluid" character, since the interaction between managers, workers, specialists and suppliers may vary from ship to ship. The cluster is thus to a certain extent consisting of temporary production systems. Experience-based knowledge flowing from deep sea fishing, has, so far, specifically been of vital importance to the soaring offshore supply segment. The mobility of knowledge is not only promoted through co-operative traditions, but also the fact that many of the workers poses experience from deep sea fishing, and many of the fishermen poses intimate knowledge about the construction process through interaction or simply via previous employment at ship-yards (see also Isaksen 1999). Egalitarian social structures characterising this region have, in general, also stimulated the flow of and adoption and transformation of new ideas (Bjarnar, Løseth and Gammelsæter 2004).

Table 1: Deep sea fishing vessels' share (per cent) of construction of new vessels at central ship-yards in Møre and Romsdal

	1960-69	1979-79	1980-89	1990-99	2000-2005
A.M.Liaaen	65	62	23		
Kleven Mek. Verksted	72	0	32	4	8
Vaagland Båtbyggeri	80	80	50	19	57
Solstrand Verft	83	83	96	93	100
Langsten Slip&Båtbyggeri	87	66	87	15	14
Ulstein Verft	36	9	27	5	0
Myklebust Mek. Verksted	-	44	0	25	30
Brattvaag Skipsverft	88	8	21	19	0
Fiskerstrand Verft	18	42	75	14	17

Source: Bjarnar, Berge and Melle 2006

Specialisation, concentration and regional fragmentation

Until the 1960s, the fishing fleet largely consisted of vessels that could be used in different seasonal fisheries within the white fish and pelagic sectors. One and the same vessel was

often engaged in long line fishing and fishing using different kinds of nets. This pattern was completely changed during the 1960s. Highly specialised deep sea fishing emerged as a consequence of the mentioned technological innovations. Deep sea fishing over vastly enlarged geographical areas with high tech capital-intensive vessels implied a radical change of fishing as a life form. These vessels would also operate over much longer time spans, so that the traditional family life was profoundly challenged.

Two distinct patterns seem interconnected: the areas of the region with a broad co-operative infrastructure and where the skipper-owner tradition was apparent managed this transition very well. Areas characterized by weaker institutions and by larger and more bureaucratically organised shipping companies were over time unable to cope with the new way of fishing. Thus, some of the previous strong-holds within deep sea fishing over a couple of decades simply vanished. In some parts of Mid-Norway the capital-intensive fishing came in conflict with cultural traditions, and earlier entrepreneurs within deep sea fishing invested their knowledge and resources in fish farming (Berge 2000, 2002). Thus, they created one of the most blooming marine industries in recent Norwegian industrial history.

Not only deep sea fishing, but marine and maritime industry as well, has been increasingly concentrated to a few prosperous localities. The same pattern is witnessed within the offshore supply vessel segment. It seems apparent on this background, that technological modernisation and innovation may go hand in hand with geographical and economic concentration. The region is still a centre of gravity within maritime and marine industry as well as deep sea fishing. The innovative potential is still apparent, however, it is put under a considerable pressure by far reaching specialisation and concentration.

Political regulations and processes have accelerated this pressure. The new effective technologies fostered regulation. As a consequence, the need to reduce the fleet's capacity has concentrated deep sea fishing to fewer, larger and even more effective vessels. Merged with this kind of specialisation and concentration is the extensive political knowledge needed to survive in the harsher competition. Modern deep sea fishing, it seems fair to argue, depends on a new kind of *political technology*. In contrast to the situation a few decades ago, the mastering of this technology has been fostering less space for regional knowledge flow and innovation. Simply put, the far reaching concentration of activity may have serious effects on the learning milieu that has so far proved such a developmental potential.

A few empirical observations may illustrate the point. The technological development in interaction with political regulations has substantially reduced the fishing communities. The number of vessels has declined radically as well as the number of fishermen. Only from 1980 to 2005, the number of smaller trawlers has declined from 28 to 12. The number of long line vessels is reduced from 44 to 23 in the same period. While the region had 21 larger trawlers within the white fish sector in 1980, the number was 15 in 2005. The decline within the region's ring net vessel sector is even more apparent, as it is reduced from 66 vessels in 1980 to only 23 in 2005 (Bjarnar, Berge and Melle 2006).

Table 2: Number of ring net vessels in Møre and Romsdal 1980-2005

	1980	1990	2000	2005
Averøy	5	1	1	1
Fræna	1	1	1	1
Giske	4	2	-	-
Haram	6	4	2	2
Hareid	3	2	-	-
Herøy	18	13	10	11
Midsund	4	4	3	3
Sandøy-	2	1	-	-
Smøla	4	3	3	1
Vanylven	3	1	-	-
Ørsta	2	2	1	1
Ålesund	7	5	3	3
Møre og Romsdal totalt	66	40	24	23

Source: Bjarnar, Berge and Melle 2006

Table 2 above illustrates that the fleet has vanished completely in many communities. These communities are located mostly in the mid- and northern part of the region, where the skipper-owner institution as well as the co-operative infrastructure has been less developed compared to the southern part of the region.

The skipper-owner institution seems to be weakened also in the vital deep sea fishing areas. Business entrance is limited by excessive capital requirements hence the recruitment of newer generations skipper-owners is problematic. Not the least, this is due to negotiable individual vessel quotas, which now have reached considerable prices. Such quotas are essential in the public regulation of Norwegian fishing, inspired by a general neo-liberal shift in public policy that emerged in the 1980`s (Holm, Rånes and Hersoug 1996 and Bjarnar, Berge and Melle 2006).

The companies are also managed to a larger extent by highly educated “professionals” than previously. This means that the flow of experience-based knowledge within the maritime complex in general may be losing momentum, and thus the innovative potential may be reduced over time. This has not only a qualitative dimension. As we have seen, the technological leaps within deep sea fishing have been major forces in establishing the region’s maritime cluster in the national and international forefront. The blooming offshore supply vessel segment has grown out of the flow of knowledge between fishing and maritime industry and the subsequent expansion of this industry. Fewer vessels to maintain and repair and an almost complete halt to construction of new fishing vessels affect both the production activity and the flow of knowledge. So far the expansion within the supply vessel segment has outweighed this tendency, but this is a segment exposed to quite volatile international market trends.

Innovations and processes of institutional thinning.

Amin and Thrift (1994) use the concept “institutional thickness” to sum up social and cultural factors which they assume as essential to local economic success in a global era (glocalisation). The concept is defined by 1. strong institutional presence, that is “a plethora of institutions of different kind”, 2. “high levels of interaction amongst the institutions in a local area” (including shared rules, convention and knowledge) 3. “sharply defined structures of domination and/or patterns of coalition” and 4. “a mutual awareness that they are involved in a common enterprise” (p. 14). In this vein, we may characterize the development of the deep sea fishing industry and its position in the maritime cluster in Møre og Romsdal since the 1960`s as *institutional thinning*.

The specialisation of fishing companies that followed the technological revolutions in the 1960`s, implied a fragmentation of the fishing industry and the knowledge important to innovation processes. The rationalization of structure meant that the number of fishermen, vessels and shipowners sharply declined and that the remaining activity was concentrated in a few local communities and in the region. It may thus be suggested that the deep sea fishing industry numerically is under a critical mass, too small to be a cornerstone in a marine/maritime cluster. E.g. the importance of the fishing fleet as demanding customers for the maritime industry (shipbuilding, equipment industry, service industry) has sharply declined. At the time, there is hardly a single fishing vessel under construction at the regional shipbuilding industry.

Moreover, there are some evidences that the skipper-owner institution may be threatened. The 1970s the skipper-owned fishing companies have been exposed to heavy national and international regulations. To some extent complicated regulations have promoted bureaucratisation of deep sea fishing companies. It is indicated that the flow of knowledge seems less free and more formalised. Thus, the hitherto dynamic linkage between practical knowledge and innovation this institutional form implied may crumble.

In other words, innovation and fragmentation of clusters (or declustering) may be interconnected processes. This phenomenon has not been predicted in the cluster literature or in territorial innovation models in general.

Implicit in much of the literature on territorially anchored economies/clusters outlined above is the view that regions are characterized by rather stable and enduring institutional frameworks that offer different potentials for innovation and modernisation. They are to a varying degree adaptable to environmental pressures (markets, technologies, policies). On the one hand regions may have institutional settings that over time lead regions into lock-in situations, on the other settings that promote flow of knowledge and innovations within a flexible and adaptable milieu. In this paper we have challenged this somewhat static perspective on institutions and institutional settings, and have argued for a more dynamic historical approach that reveal how technological development mediated through socio-economic or political processes may alter and – directly or indirectly – disrupt or even have a deteriorating effect on the hitherto institutional prerequisites for regional innovative excellence. In other words, technological innovations may over time undermine the institutional conditions that earlier on formed a basis for the very same innovations, that is institutional thinning, thus diminishing the space for new innovations and regional

development. This dynamic approach seems to be largely under-communicated in the above outlined literature.

This critique is in line with recent comparative studies of clustering of economic activity. When it comes to local social dynamics, Wolfe and Gertler (2003) argue, based on comprehensive cluster studies, that informal monitoring of other firm's activities as well as learning through the circulation of labour among firms is a relatively more important source of knowledge flow than formal collaborations among local firms or dense networks of buyer-supplier relationships. Also, community level institutions that promote associative governance are of great importance in the sense not the least that they can promote a kind of reflexivity within the cluster thus increasing its adaptability facing external challenges or opportunities. Nevertheless, they argue that "the most discerning test of 'true' cluster dynamics is one that assesses the alleged cluster's resilience and robustness over time.

It must be mentioned that the maritime cluster in the region is more vital than ever. However, the deep sea fishing companies have been replaced by ship owners in the offshore-supply business as frontline-institutions and demanding customers. Thus, it may be more correctly to speak of transformation of a cluster rather than fragmentation or declustering. An offshore-supply firm is in many respects quite different from a skipper owned fishing company. They are in average much bigger, thus more bureaucratized and "professionalized", has a completely different market (the fishing market v.s. huge oil companies) some of them are owned by MNCs and some of the big local firms are listed on the stock exchange. They are thus interwoven in other institutional settings compared with local fishing companies, which must be assumed to affect their role in the maritime cluster.

Also more general changes may be important. There has been a tremendous concentration in the Norwegian financial sector. There are hardly independent regional owned banks left. On the other hand, both offshore service vessels and fishing vessels have become very costly. To an increasing extent realization of new vessels are dependent on finance and marked knowledge localised in the capital – Oslo. Moreover, many regional maritime firms have been parts of MNCs. Incoming multinational corporations are buying up innovative local engineering workshops, which may also affect the regional flow of knowledge.

The Møre and Romsdal maritime cluster is apparently characterised by multiple heterogeneous historical processes. It is in the first place still dependent on an innovative economy characterised by collaborative and collective learning processes and interactive innovation. In the second place, however, we may witness the creation of new paths that may lead to higher diversity of knowledge bases and diverging learning processes diminishing the role of the traditional cluster. On the other hand, it should be of interest to scholars and practitioners in the field to pose the question whether interaction between old and emerging paths may also create new dynamic learning processes within the old industrial cluster framework.

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