SNF Working Paper No. 61/05

Regulation and innovation: The case of the pelagic fisheries sector in Norway

A theoretical and methodological approach for an empirical analysis

Stig-Erik Jakobsen

Bernt Aarset

SNF Project No. 5276: ”Teknologiske innovasjoner i pelagisk sektor – drivkrefter og konsekvenser
The project is funded by the Research Council of Norway

INSTITUTE FOR RESEARCH IN ECONOMICS AND BUSINESS ADMINISTRATION

BERGEN, OCTOBER 2005

ISSN 1503-2140

1 Introduction

The pelagic consumption industry has experienced a considerable growth during the last decade. One important factor to explain this growth is the increase of the stocks of the most important target species, in particular herring, over the past 15 to 20 years. Another important factor is the opening of new markets and price development. From 1993 until 2001 the production capacity within the industry was tripled (Bendiksen 2002). The rise in capacity was both due to investment in existing processing plants and the establishment of new. The industry seems to have responded well to these changes. New products, new technology, and refined organisational forms have been developed. However, during the last couple of years this sector has experienced increased international competition and reduced profit, which has triggered the need for further adjustment and innovations within the industry. Despite recent reforms, the pelagic sector in Norway is still a regulated industry with a complex set of laws and directives. This situation engaged our curiosity to explore how regulation and innovation combines within an industry. *The main intention of this study is to analyse how specific industry regulations encourage or prevent different types of innovations.*

There is an increasing international attention on this interaction between regulation and innovation (Blind 2004). This issue was previously dominated by the liberalist call for removal of regulations in order to encourage innovations. In general, it seems like most regulatory regimes generate contradictory effects. Pro-competitive (antitrust) regulations will for instance limit the extent of strategic alliances between actors. Innovation often takes place in more or less formalized cooperation between actors that involve collective learning and exchange of resources and knowledge. Jorde and Teece (1992) claim that these long term alliances are essential for innovations, and they concluded that a pro-competitive regulatory regime at times can reduce firms' ability to innovate.

In this paper, we will, first, discuss theories of regulation and innovation. Next, the pelagic sector will be presented in terms of technical division and regulative regimes. The paper is concluded by a framework for the empirical analysis.

2 Theoretical and conceptual approach

2.1 The concept of regulation

Regulation refers to a set of laws and directives introduced by public authorities to influence the behaviour of economic actors. Such government intervention is justified by the goal to increase distribution of goods and the collective welfare. Regulation is thus a politically sanctioned intervention in order to achieve specific goals.

A common divide in the regulation literature is between economic and social regulation. In short, economic regulations refer to interventions in order to remedy market failures. Neoclassical economic theory assumes that competitive markets are the best way to achieve economic efficiency (Arrow 1966). However, some times the market fails and needs correction. The most central forms of market failure are the lack of competition leading to monopoly, destructive competition resulting in strong fluctuations (information asymmetry), inefficient adaptations, negative external effects (e.g. pollution), or excess use of public goods. However, the use of regulations to correct market failures will vary between political regimes. A liberal market-economic regime will minimize the level of intervention, while a Keynesian mixed-economic regime will rely more on political regulations to remedy market failure (Mjøset & Bohlin 1986;Jakobsen 1996). A mixed-economic regime may justify the introduction of regulations to attain specific distributive goals in order to fulfil ideological measure of equality. A market-economic regime may also introduce measures that are expected to ensure a more equal distribution of resources, but in this case the driving force is a more efficient use of the total resource base (Sandmo 1992). In general terms, there is a difference between interventions that regulate access to the market and interventions that regulate behaviour in the market.

The concept of social regulations traditionally refer to interventions to correct externalities in general (Blind 2004). This includes the protection of the environment, protection of buyers from risky, poor or defective goods and services, and provision of different public goods. Public policies are generally more concerned with negative than with positive externalities, since the former generally cause more damage to social welfare.

2.2 The concept of innovation

The emphasis on the role of innovation in economic development is increasing (see e.g. OECD (2000)). To understand the complexity of innovation is vital for policy makers. In a classic work, Schumpeter (1934) refer to innovations as "new combinations" within the economy. The literature has defined innovations as new or significantly improved products, covering both goods and services that have been introduced to the market (Christensen 1995;Nås 2000). Process innovation, that is new or significantly improved technology, as well as organisational innovation; i.e. new modes of organisation within the economy, are usually included in the common definition of innovation.

Current innovation studies emphasise increasingly innovation as interactive learning, constituted by collaboration between stakeholders, such as producers, costumers, suppliers, R&D-institutions, and public administration (Lundvall 1992;Edquist 1997;Morgan 1997;OECD 2002). Flow of information have received large attention in the literature (Lundvall 1992), and Porters (2000) cluster theory has revealed that the business environment is essential for innovation. It is in this context, the concept of "innovation systems" has been introduced in contrast to previous research that base technological change on a narrow definition of R&D, and thus ignoring the significance of other types of innovation inputs (Lundvall 1992;Edquist 1997).

Another characteristic of comprehensive innovation studies is the growing focus on organisational innovation as a source of the firms' competitiveness. A movement towards new organisational principles seems to occur which encourage the creation of organisations that are able to cope with rapid changes and pursue product innovations (Lundvall & Borrás 1997). It is not adequate to analyse product, technological, or process innovation without including the development of new modes of organisation. Such modes include both the internal organisation of firms and linkages and alliances across and between firms. In addition, the introduction of process innovation, or new technology, is often crucial for the development of new goods and services.

As indicated, innovation is a complex process that is hard to measure, it is versatile, and often time sequenced. Innovations may take the form of marginal changes, and it can be difficult to define when the changes qualify as an innovation.

2.3 Links between the regulative regime and innovation

Regulation has traditionally been regarded as the antagonism to innovation where removal of regulations is a precondition for innovations. In this paper, we take the opposite position and emphasise the interconnection between political regulation and the capability to innovate. Here we choose to analyse regulations as arrangements that can facilitate as well as restrict innovations.

In general, the systematic empirical research on the connection between regulation and innovation has been moderate, and the debate has been characterised by a high anecdotal level (Kemp 1998). In a survey of the economic literature, Brousseau (1998) found that few studies have explicitly emphasised the link between regulation and innovation. Most of the existing insights are by-products of broader studies. This indicates that it is a research topic that is difficult to grasp (Michie & Sheehan 2003). The reason for this is both the complexity of the innovation process, which involves different actors linked in various ways, and the complexity of the regulative framework, which is many-sided and has various effects on the practice of actors.

Still, there are studies that assume that regulations have a linear and mechanistic effect on innovations, since they do not take into account the complexity of regulations and the difficulties of measuring and categorising innovative activities (Brousseau 1998). Our point of departure is that regulations have several links with the innovation processes. Regulations can affect the introduction and the distribution of innovation in various ways. Since innovations may be made up of small changes over time, the impact of regulations can take place over a long period and affect the innovation process in different ways at different stages of the innovation process. Thus, it is not possible to draw one conclusion on the significance of regulation on innovation.

2.3.1 Economic regulation and innovation

Traditionally, economic regulations are seen as interventions that ensure a balanced competition. In general, it is assumed that removal of obstacles to market access and conduct will promote innovation. The liberalisation of a licence system, for example, can generate a more competitive environment, which is supposed to be favourable to industrial innovations. The presence of a large number of competitors increase the diffusion of information and technological knowledge, and in a competitive milieu, continuous innovation is essential to

remain within the market (Caves & Barton 1990). The deregulation of market behaviour implies fewer constraints on the firms' strategies and is thus supposed to promote innovation. However, there are few analyses of deregulation of market behaviour. Most of the studies are analyses of deregulation of highly regulated sectors, such as telecommunication (see Macauley (1986)), and the observation of increased innovations subsequent to the deregulation is not surprising.

A recent study funded by the European Commission focussed explicitly on the linkage between regulations and innovations (Blind 2004). Through studies of selected sectors they found that national deregulation within telecommunication resulted in a broad range of new products and services, while the liberalisation of the energy sector is still at its very beginning and the supply of new products and services are still restricted. They also found that in the opinion of the companies, the regulation increased the cost of innovation and also lengthened the time to the market.

In general, it seems like most regulatory regimes generate contradictory effects. Pro-competitive (antitrust) regulations limit the extent of strategic alliances between actors. Innovations often occur in a more or less formalized cooperation between actors that involve collective learning and exchange of resources and knowledge. These alliances are thus vital for the innovation process. Jorde and Teece (1992) claim that long term alliances are essential for innovations, and they conclude that a pro-competitive regulatory regime at times can reduce the firms' ability to innovate.

In order to promote technological breakthroughs in technological and capital intensive industries, some kind of industrial agglomeration may be beneficial. Schumpeter (1934) stressed the importance of large firms that may institutionalise the innovation process through their own R&D laboratories. According to his view, more innovation will occur when there are just a few firms that dominate the market, rather than a situation characterised by a high degree of competition. However, the effect of market concentration remains unclear. Cohen and Levin (1989) conclude their empirical research that the relation between firm size, market structure, and innovation best can be described as fragile. Other studies show that markets dominated either by small firms or large firms are more innovative then markets dominated by firms of intermediate size (see for example Acs and Audretsch (1981;1991)).

Regulative measures may be beneficiary for protection of an innovation process in its infant stage. Innovation is a costly and high-risk activity, and some kind of R&D subsidy may be suitable in order to provide firms with the incentives to take this risk and thus promote the innovation process. For small firms in particular, risk capital at the start-up of an innovation process may prove hard to find (Billings & Fried 1999). Various regulative measures can be implemented to adjust this kind of market failure. Innovations can also be protected by different intellectual property rights system. Blind (2004) found that regulation can provide a legal security framework for companies that try to introduce new products. But Merges and Nelson (1994) points to the dilemma between diffusion and invention. A strong protection of patents provides incentives to innovative and may create a temporary monopoly situation in the market, while a weak patent protection promotes rapid diffusion of new ideas and products. A system for licensing of production rights can often be a good solution for protecting of the innovation as well as spreading the new product.

2.3.2 Social regulation and innovation

Environmental regulations, i.e. interventions to protect the environment, are vital types of regulation within the category of social regulations. A particular literature claims that environmental regulations have an adverse effect on productivity by diverting resources from productive use and slowing down the development (see Jaffe et al. (1995) for a summary). Other studies suggest that environmental regulations stimulate the invention of new technologies that comply with the requirement of the regulations. Still, many of these studies focus on the environmental practice of firms and not on R&D and inventions.

Another aspect of social regulations is the inventions that aim to protect buyers from risky goods and services. Blind (2004) found that these regulations may have a positive impact on the quality of products and services. When the regulatory body determine a minimum threshold, it can stimulate firms to improve the quality of the products and increase the public acceptance for new products. Still, if the quality requirement is set to high, the introduction of new products is prevented.

2.3.3 The wider regulatory framework

The discussion so far has emphasised how regulations affect actors' access to the market and their behaviour in this market (i.e. competition policy). In addition the wider regulatory framework influences innovations within an industry. Generally it is assumed that labour

market deregulations are important for competitive success and promotes the innovative activities of the firm. However, Michie and Sheehan (2003) found a negative correlation between a de-regulated labour market (i.e. use of short term contracts, low level of training and so on) and innovation in their study, and complementary, there was a positive correlation between a highly regulated labour market and innovation.

Studies have emphasised how deregulation of the financial sector resulted in the development of several new financial products that have been of importance for the innovation activities in other industries (Green 1991). On the other hand, a regulated financial sector promotes stability in financial transactions, which is of importance for conducting long term innovations projects (Aoki 1990). Further, it has been stressed that the impact of the deregulation of the telecommunication sector had an impact on the innovation activity in industries that used telecommunication (Brousseau 1998).

The literature also point to the fact that different regulatory frameworks promote different types of innovation. Birecree et al. (1997) claim that a cooperative regulative system, characterised by workers codetermination, strong inter-firm links, an active state, and a system of trade associations and trade unions, are particularly supportive of incremental innovations. On the other hand, radical innovations demand a regulatory framework supportive of risk taking and entrepreneurship, managerial autonomy and a flexible labour market. While the first system to a certain degree characterise the Europeans regulatory system, the latter is closer to the US system (Simonazzi 2003).

3 The existing regulation of the pelagic sector

3.1 Characteristics of the sector

The empirical focus for our study of the interconnection between innovations and regulations is the Norwegian pelagic fisheries sector. The pelagic sector comprises the fishing fleet that target pelagic species such as mackerel, herring and capelin, and the fish processing industry that buy and process such species. The pelagic sector has increased their share of the total value of fish landed in Norway from around 25 % in 1993 to about 40 % in the first part of this century. The sector comprises a relatively homogenous fleet of large purse-seiners, smaller coastal seiners, and a relatively diversified processing industry. During the last decade the industry has been through huge transformations. The sector has traditionally been dominated by the production of fishmeal and oil, but now, however, the industry is dominated

by production for a consumption market. This implies a huge rise in per kilo value, but also that the industry is confronted with a new set of regulations.

3.1.1 The fleet

Several different gear types are engaged in the pelagic fishery. Seine, in contrast to other gear types, is specialised for the fishing of pelagic species. Most of the total quota of the pelagic species is caught by seine.

The pelagic fleet is dominated by large pure-seiners. In 2003, the purse seine fleet comprised 88 vessels. These purse-seiners are vessels larger than 90 feet that possess concession and a vessel quota that determines a fixed share of the annual TAC (Total Allowable Catch). In 2001, this fleet was awarded 67 % of the TAC of herring (Norwegian Spring Spawning Herring), mackerel, and capelin, in the Barents Sea. This indicates that about 2/3 of the rawfish to the pelagic sectors is landed by the purse seine fleet. The geographic centre of gravity of the purse seine fleet is the western regions of Norway, especially Hordaland (37 vessels or 42 % of the fleet) and Møre og Romsdal (23 vessels or 26 % of the fleet) (www.fiskeridir.no). There are also a large number of smaller coastal seiners that participate in the pelagic fisheries. In 2003, 727 coastal vessels (vessels < 90 feet) participated in the pelagic fisheries.

The market for pelagic raw fish is internationalised, and the Norwegian processors experience a rawfish deficit. For mackerel, in particular, foreign vessels have been important suppliers. In 2002, 311000 tons mackerel were landed in Norway, where about 40 % was landed by foreign vessels. The landed quantity of herring in 2001 was 583000 tons, with a foreign share of about 16 %. The main foreign contributors are vessels from United Kingdom, Denmark, Iceland and the Faeroe Island. Of the total catch of herring and mackerel by the Norwegian fleet, 10 % and 14 %, respectively, was landed abroad (www.fiskeridir.no). Denmark, United Kingdom and Iceland in particular have been important destinations. The pelagic industry was developed earlier in Norway than in other countries around the North Sea basin, and Norway has thus been a net-importer of pelagic rawfish for a number of years. However, a huge processing capacity is developed in countries such as the Faeroe Island and the United Kingdom (particularly Scotland and the Shetland Islands), and the competition for rawfish has increased. The large pure-seiners are mobile and able to choose the buyer that is willing to pay the highest price. The smaller vessels that are catching closer to the coast are less mobile.

In 2001, 17 of the purse seine vessels were equipped for processing at sea (fillets or frozen fish). However, only about 5 % of the herring catch and about 15 % of the capelin catch were processed at sea. It may not be profitable to invest in the appropriate equipment to process at sea (Bendiksen 2002).

3.1.2 The processors

Our analysis is restricted to those actors that operate in the consumption market. Thus, we are not including the fish oil and meal processors or the canned fish processors, and the vessels that are exclusively landing their catch to these producers. Today there are four such processors remaining in Norway, all owned by the same company. In 2001 the pelagic consumption industry counted 98 fish processors, i.e. factories that processed pelagic species for consumption market. However, a substantial part of these companies have a restricted pelagic production, and 40 companies bought less then 1000 tons of fish (Bendiksen 2002). Of the remaining 58 companies, 18 bought between 1000 and 8000 tons of rawfish, another 18 bought between 8000 and 20000 tons, while 22 bought more then 20000 tons. Statistics from 2003 documented that the 30 largest companies received 91 % (quantitatively) of the catch (Bendiksen 2004). Further, 26 of these 58 companies specialises in the processing of pelagic products. The remaining combine this activity with production of other products, mainly based on input from the whitefish sector. In 2001, the processing of pelagic fish accounted for a total of 1600 man years.

The pelagic consumption industry is concentrated to the Western part of Norway, especially to the county of Møre og Romsdal. In 2001, processors in this county accounted for 39.4 % of the total production capacity. In total, 65.7 % of the capacity is located to the western part of Norway (counties of Sogn og Fjordane and Hordaland in addition to Møre og Romsdal). Processors in the northern part of Norway (Nordland, Troms and Finnmark) counted for 22 % of the capacity.

The production reached an all time high of more than one million tons of rawfish processed in 2000. Reduced quotas of herring, mackerel and capelin the following years resulted in a decline in production. In 2003, the overall catches were 25 % less than in 2000. Also the profit has been reduced during the last couple of years. An analysis of a sample of about 30 companies within the pelagic sector documented an operational margin of 2.5 % in 2000 and 1.9 % in 2001, respectively. However, there are variations among these firms. In 2000, 59.4

% of the total mass of firms produced a profit, while in 2001 the figure was 70 %, in 2002 19.4 %, and in 2003 46.4 % (Bendiksen 2004). At present, the stock situation for herring is improving, but the mackerel quota is reduced. In addition, the catch of capelin in the Barents Sea was stopped temporarily in 2004.

3.1.3 The consumption market

Nearly all the processed pelagic products are exported. In 2004, the export value of the pelagic products was NOK 5.1 billion, or about 20 % of the total export value of the Norwegian fisheries (farmed fish accounted for 44 %, whitefish for 30 %). Herring products comprise NOK 2.8 billion or 55 % of the export value of the pelagic sector in 2004, mackerel products NOK 2.2 billion or 43 %. A minor export of capelin to the consumer market in Russia has occurred, but this export has ceased due to the stop in the capelin fisheries in the Barents Sea.

The herring products is exported as frozen round fish (65 % in 2004) or frozen fillets (23 %), in addition to small amounts exported as fresh, salted, smoked, or dried. The main market is Eastern Europe, especially Russia (40 %) and Ukraine (18 %). Other important consumption markets for the pelagic products are Poland, Denmark and Germany. Nearly all the mackerel is exported as frozen fish (97 %). Japan has traditionally been the main market for mackerel and was the destination for 45 % of mackerel export in 2004 (www.seafood.no). Earlier their share has been even higher, and the Japanese market for mackerel has been an important factor for the growth of the pelagic consume sector during the second half of the 1990s. Other markets for mackerel are China, Russia and Ukraine.

3.2 The regulation regime

There is a complex set of laws and directives that regulate the practice of economic actors. Regulations can either be sector specific and detailed, or more general, such as tax rules and labour rules. Here, we will limit our study to industry specific regulations, and emphasise the industry specific regulation regime with a focus on the regulations that have vital implications for the pelagic sector. We will start our discussion by presenting some examples from the history of regulations of the fishery, before we outline new tendencies in the regulation regime.

3.2.1 The post-war regulation regime

Traditionally, the Norwegian fishing industry has been “a regulated” industry. In the post WWII era, a number of regulations have been introduced to protect the industry from “destructive competition”. The major intention of this regime was to reduce competition in an industry that was characterised by strong fluctuations in the rawfish supply as well as in the end market for processed products. In line with the overall post-war Norwegian politics, a mixed-regulation regime based on the theory of Keynes was established. This line of thought claimed a strong belief in political regulations to remedy situations of market failure (Jakobsen 1998). Here, the major regulations will be presented very briefly. The intention is thus not to provide an exhaustive analysis of their genesis and development.

The Raw Fish Act (RFA) (1938/1951) regulates the first hand trade of rawfish. All fist hand trade have to be organised through sales organizations that are set up, owned, and controlled by the fishermen. The RFA mandate the sales organization the right to establish a minimum prize for the fish and to approve buyers of rawfish, and in general mandate the sales organisation to initiate curtailment of the fisheries when demand decrease.

The Participation Act (PA) (1917/1939/1951/1951/1972/1999) regulates the participation in the fisheries. The PA is based on the principle that the fishing fleet should be owned by fishermen. In order to fish professionally, the fisherman needs a permission to obtain a vessel for this purpose. The fisherman also has to be registered at “blad B”, which means that a certain level of fishing activity has to be documented. This regulation is mandated in the PA. This principle makes it difficult for the industry to have ownership in the fishing fleet, but some dispensations have been given. In addition, the licensing system is mandated in the PA. Fisheries such as trawl and purse seine fisheries can not be conducted without a specific permission from the Department of Fisheries.

The Seawater Fisheries Act (SFA) (1937/1955/1975/1983) mandates the Department of Fisheries duty to detail the regulation of the fisheries to the extent they find necessary. Examples of such regulations are size of quotas, types of gear, number of vessels, periodisation of fisheries, minimum fish size, regionalisation, etc. Trawlers and purse-seiners that acquire a license mandated by the PA will usually gain a vessel quota as a share of the TAC, mandated by the SFA.

The Processing Act (ProA) was established 1971 and removed 1992. The intention of the ProA was to regulate processed products. Selected organizations within the processing industry were given the exclusive right to sell certain products, but the ProA never achieved any further significance. The most prominent obstacle for this structure was the increasing liberalisation of the export sector of the fisheries in the 1980s and early 1990s (Jakobsen 1998).

The Fishery Export Act (FEA) established 1955, impose a strict regulation of the participation in the export of fish and fish products. According to Jakobsen (1998), the regulation of the participation in the fishery export was based on three regulations. First, for certain products a membership in publicly certified trade organisations was required. Second, parts of the export was organised by publicly appointed export councils. And third, the authorities put specified claims to the exporters in order to grant them right to export. The permission to operate as an exporter in selected markets has been an exclusive right for certain organizations or groups.

3.2.2 New tendencies: deregulation and reregulation (1990 =>)

In line with general trends in western politics of the 1980s and 1990s, deregulation reached the fisheries as well. A trend towards deregulation was initiated in order to increase the profitability of the sector by increasing the competitions within the fishing industry. The four main objectives of fisheries regulation are maintained, but profitability achieves a more prominent position.

The fishermen's sales organisations have no longer the right to approve buyers of rawfish. However, the buyers that are interested in the trade of specific species are registered by the Directorate of Fisheries. The relevant sales organisation (Norges Sildesalgslag for buyers of pelagic species) must be stated in the application. This registration is mandated in the First Hand Fish Buyer Registration Act (RFA) (1994). The intention of the RFA is to supervise the first-hand trade of fish. As mentioned, the ProA was removed in 1992. A new Fishery Export Act (NFEA) was established in 1990. The NFEA represents a liberalisation of the export of fish, and means that it is practically possible for everyone to start export of fish and fishery products (free entry). An adjustment of the Fishery Border Act (in 1992) liberalised the opportunity for foreign vessels to land their catch in Norway. But still, vital parts of the regulation has been maintained, in particular the main part of the Rawfish act and the Participation act.

There are also some contradictory regulations that indicate a re-regulation of the industry. An increasing number of fisheries have been "closed" through the introduction of licence systems and the allocation of vessel-quotas, not only for the large sea-fishing vessels but also for the coastal fleet. In addition, the number of technicalities and the detail richness of these regulations have increased (Rånes 2003), and the somewhat failed intentions of these regulations propels the capacity development further out of control (Standal & Aarset 2002). An increasing number of technical regulations have been implemented in the processing stage. A new Norwegian Food Law implies an adjustment and harmonization of Norwegian practice to international standards and legal framework (especially the "Food Law" of the European Union). Norway enjoys a close relationship to the European Union through the European Economic Area (EEA) agreement. The intention of the new food law is food security, and the national systems have to be fitted international standards to operate on the international market.

In addition, there are a number of regulations related to the entrance to export markets, which is a consequence of Norway being outside the EU. This is both about import duty (in general the level of import duty increase with the level of processing), and restriction on entry (export quotas, time restrictions).

4 Framework for the empirical analysis

There are constantly changes going on in the regulatory framework mainly through the introduction or elimination of provisions. Our analysis of the coherence between innovations and regulations within the pelagic fisheries sector will be restricted to selected provisions. In the following section we will present issues and methods for the empirical analysis.

4.1 Issues for regulation and innovation in the pelagic sector

The target for this part of the study is the link and reciprocal impact between innovations and regulations. How do regulations guide the behaviour of the actors? How are innovations promoting or obstructing innovations? We emphasise four different fisheries regulations, or provision, and investigate their impact on recent and current innovations.

4.1.1 The Raw Fish Act

The intention of this act is to regulate the first hand trade of fish. All fish except salmon (wild and farmed) is sold on first hand by sales organisations controlled by fishermen. Recent

liberalisations have opened for different types of transactions. Most of the volume of pelagic species, for example, is traded on auctions. But this marketplace is organised by the sales organisation for pelagic species, Norges Sildeslagslag. Issues of concern for us here is to what extent the organised transaction of fish disturb or restrict the exchange of information that is necessary for innovations to take place? It is possible to imagine that a processor may want to invest in the storage and handling equipment of a vessel in order to improve the quality of the purchased fish. But if processor is stopped from buying from that particular vessel, the incentives for this relation are removed.

4.1.2 The Participation Act

The basic principle of the regulation is that the fishing fleet should be own by active fishermen. The implications of this act and its provisions have been a lack of vertical integration between the fleet and the fish processing industry. The industry has been allowed to have minority ownership in the fleet. About 10% of the purse seine vessels have fish processing companies as minority owners. However, there are no restrictions on the possibilities for the fleet to have ownership within the fish processing industry. About 1/5 of the processors of the pelagic sector has fishermen and vessel owners as majority or minority owners (in 2000) (Bendiksen 2002).

Why is vertical integration important? Uncertainty related to the supply of raw fish provides the processors with incentives to reduce the risk by trying to control the rawfish supply. Vertical integration supports an increased possibility of long term planning for the processing plant (important for product innovation), and a quality focus through the whole value chain (important for developing better products (innovation)). Even if there are some tendencies towards vertical integration, the regulation of the first hand sale, warranted by the RFA, limits the possibilities of realizing potential advantages. The principle of auction within the pelagic sector makes it difficult our impossible for a plant to control the rawfish supply from their own fleet. How is lack of vertical integration affecting the innovativeness of the pelagic sector? Which regulatory alteration regarding the linkages between the fleet and fish processing plants can increase the innovativeness within the sector?

4.1.3 The Seawater Fisheries Act

The SFA details the conduct of the fishery by a series of regulations. In this study, the implication of the Unit Quota System (UQS) is central. A licensing system mandated by the

PA, and a quota system mandated by the SFA, are used to adjust the catch capacity to the stock of fish. The licensing system for the purse seine fleet was established in 1973, followed by vessel quotas decided by departmental resolutions. These regulation limits the size and catch capacity for each vessels. In 1996 a UQS was introduced, where purse seine vessel owners with more than one vessel can concentrate the quotas of two vessels to one if the other is permanently withdrawn form the fishery. The number of pure seine vessel has been reduced from 103 to 88 since the introduction of the system. Larger quotas and a more cost efficient fishery per vessel is the outcome.

Several adjustment has been made to the system since it was introduced, the latest adjustment in 2004. How has this new UQS affected the technological development within the fleet? What are the restrictions and what are the possibilities for technological innovations within this system?

4.1.4 The Food Law

In the mid 1990s a comprehensive reform of all regulations of food production was initiated, which was concluded by the establishment of the Food Law (FL) in January 2004. With respect to the practice of the processing fish, the most important regulation mandated by the FL is the Quality regulation for fish and fish products (Quality Regulation). The regulation was established in 1996, but amended several times, the latest in 2004 (Langhelle 2005). This regulation establishes a number of rules and procedures for the handling and processing of fish. How is the Quality Regulation affecting the processors ability to innovate? What about the vessels and how they handle the catch or in some cases process at sea?

It is both costly and time consuming for a processor to fulfil all the requirements, however, the fulfilment of such requirements may have some positive effects on innovation. For example, increased standardisation of the production can result in more efficient operations, and the “surplus time” can be invested in the reduction of costs or to increase the innovation focus. Second, increased insight in their own production process makes it easer for the processor to detect innovation potential. Third, the Quality Regulation gives a stronger emphasis on the importance of quality in the production process, which may result in a stronger focus on developing products of high quality. Further, an increased transparency in the production process makes in easier to involve external investors in innovation projects.

4.2 Methodological approach

The data gathering of this project will be conducted in two phases. First, a survey among processors and vessels, secondly, case studies of selected actors.

4.2.1 A survey among processors and vessels

Several types of vessels and gear are involved in pelagic fishery. However, we concentrate on the gear types that are dominating the sector, which are purse seiners and coastal seine vessels. According to the fish processing industry, our analysis is restricted to those actors that operate in the consumption market. An important part of the project is to study the effect of regulations on the innovation and communication between the two segments (processors and vessels) of the sector. In particular, their capability to innovate seen in light of selected regulations such as the RFA and the restrictions on first hand trade, the PA and the restrictions on ownership and license systems, the SFA and the UQS, the FL and the requirements of the Quality Regulation. What impacts will these regulations have for the innovativeness of the actors, and how can the regulatory framework be more conducive for innovations?

4.2.2 Case study of selected actors

In the study of selected cases, other relevant actor groups, such as technology suppliers, capital managers, trade organisations, etc. will be contacted as well. The intention here is to achieve in-depth knowledge of how regulations affect innovations, with emphasis on the different stages of the innovations process, and how it is affected by different regulations.

Examples of important issues of this part of the study is whether the action system prevents necessary communication between the market and rawfish supplier, and whether the regulation distorts the necessary predictability in order to engage in innovation activities. Quality is an increasingly important issue, which is affected by biological and environmental impact, but quality also depends on the catch, storage, and processing technology. Quality Regulation specify requirements here, but how are these requirements received in the industry, and to what extent can a vessel and a processor establish long term relationship based on trust on how the rawfish is handled?

Finally, what in the relationship between processors and vessels promote innovations, and what factors prevent innovations?

5 Reference List

Acs,Z.J. & Audretsch,D.B. (1991) Innovation and firm size in manufacturing. *Technovation*, **7**.

Acs,Z.J. & Audretsch,D.B. (1981) Innovation, market structure and firm size. *Review of Economics and Statistics*, **69**, 567-575.

Aoki,M. (1990) Towards an economic model of the japanese firm. *Journal of Economic Literature*, **28**, 1-27.

Arrow,K. (1966) *Social choice and individual values*. John Wiley, New York.

Bendiksen,B.I. (2002) *Struktur og kapasitet i pelagisk konsumsektor*. Rapport 11, Fiskeriforskning (Norsk institutt for fiskeri og havbruksforskning AS), Tromsø

Bendiksen,B.I. (2004) *Driftsundersøkelsen i fiskeindustrien. Oppsummering av inntjening og lønnsomhet i 2003*. 14, Fiskeriforskning, Tromsø

Billings,B.A. & Fried,Y. (1999) The effects of taxes and organizational variables on research and development intensity. *R & D Management*, **29**, 289-301.

Birecree,A., Konzelmann,S. & Wilkinson,F. (1997) Productive systems, competitive pressures, strategic choices and work organisation: an introduction. *International contribution to Labour Studies*, **7**, 3-17.

Blind,K. (2004) *New products and services: Analysis of regulations shaping new markets*. Final report, Fraunhofer Institute for Systems and Innovation Research, Karlsruhe

Brousseau,E. (1998) The link between regulation and innovation: Some preliminary remarks. *The impact of EU-regulation on innovation of European industry* (eds J. Hemmelskamp & F. Leone), The European Commission Joint Research Centre, Institute for Prospective Technological Studies, Sevilla, Spain.

Caves,R.E. & Barton,D. (1990) *Efficiency in US: Manufacturing industries*. MIT Press.

Christensen,J.F. (1995) *Produkroduktinnovation - process og strategi*. Handelshøjskolens Forlag, København.

Cohen,W.M. & Levin,R. (1989) Empirical studies of innovation and market structure. *Handbook of industrial organisation* (eds R. Schmalensee & R. D. Wigg).

Edquist,C. (1997) Systrems of innovation approaches: Their emergence and characteristics. *Systems of innovation: Technologies, institutions and organisations* (ed C. Edquist), Pinter, London.

Green,M.B. (1991) *Venture Capital. International Comparisons*. Routledge, London.

Jaffe,A., Peterson,S.R., Portney,P.R. & Stavins,R. (1995) Environmental regulation and the competitiveness of U.S. manufacturing: What does the evidence tell us? *Journal of Economic Literature*, **33**, 132-163.

Jakobsen,S.-E. (1998) *Den politiske reguleringen av aktivitetene i det norske fiskerisystemet i etterkrigstiden - regulering for stabilitet eller konkurranse?* 21, Stiftelsen for samfunns- og næringslivsforskning, Bergen

Jakobsen,S.-E. (1996) Political regulation and market allocation. Development trends in the Norwegian fish farming industry. *Norsk Geografisk Tidsskrift*, **50**, 187-199.

Jorde,T.M. & Teece,D.J. (1992) *Antitrust, innovation and competitiveness*. Oxford University Press, Oxford.

Kemp,R. (1998) Environmental regulation and innovation. Key issues and questions for research. *The impact of EU-regulation on innovation of European industries. Papers presented at the expert meeing on Regulation* (eds F. Leone & J. Hemmelskamp).

Langhelle,O. (2005) *Implementering av internasjonalt regelverk: Matloven og ivaretakelsen av fiskeri- og havbruksnæringens interesser*. Rapport nr. 44, Rogalandsforskning, Stavanger

Lundvall,B.-Å. (1992) *National systems of innovation. Towards a theory of innovation and interactive learning*. Pinter Publishers, London.

Lundvall,B.-Å. & Borrás,S. (1997) *The globalising learning economy: Implications for innovation policy*. DG XII, Commission of the European Union, Brussels

Macauley,M.K. (1986) Out of Space - Regulation and Technical Change in Communications Satellites. *American Economic Review*, **76**, 280-284.

Merges,R.P. & Nelson,R.R. (1994) On limiting or encouraging rivalry in technical progress: The effect of patent scope decisions. *Journal of Economic Behavior & Organization*, **25**, 1-24.

Michie,J. & Sheehan,M. (2003) Labour market deregulation, flexibility and innovation. *Cambridge Journal Of Economics*, **27**, 123-143.

Mjøset,L. & Bohlin,J. (1986) *Introduksjon til reguleringsskolen*. 21/1985, Nordisk sommeruniversitet, Aalborg

Morgan,K. (1997) The learning region: Institutions, innovation and regional renewal. *Regional Studies*, **31**, 491-503.

Nås,S.O. (2000) *Innovasjon i Norge – belyst med tilgjengelig statistikk*. 1,

OECD (2000) *Innovation and Economic Performance*. internal working document,

OECD (2002) *Dynamising national innovation systems*. OECD, Paris

Porter,M.E. (2000) Location, competition, and economic development: Local clusters in a global economy. *Economic Development Quarterly*, **14**, 15-34.

Rånes,S.A. (2003) *Spesielle kvoteordninger. Iverksatte og foreslåtte enhetskvoteordninger i norske fiskerier*. Rapport 11, Fiskeriforskning, Tromsø

Sandmo,A. (1992) Økonomene og velferdsstaten. *Offentlig politikk og private incitamenter* (eds A. Sandmo & K. P. Hagen), Tano, Bergen.

Schumpeter,J.A. (1934) *The Theory of Economic Development*. Harvard University Press.

Simonazzi,A. (2003) Innovation and growth: supply and demand factors in the recent US expansion. *Cambridge Journal Of Economics*, **27**, 647-669.

Standal,D. & Aarset,B. (2002) The tragedy of soft choices: Capacity accumulation and lopsided allocation in the Norwegian coastal cod fishery. *Marine Policy*, **26**, 79-88.