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Governance and the
innovation system of the
fish-processing industry in
Northern Norway

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Preface

This report is part of the project ‘SME policy and the regional dimension of innovation’ (SMEPOL). The project was carried out by the European Community’s Targeted Socio-Economic Research Programme organized by DG XII. The work by the Step-group was co-financed by the Norwegian Ministry of Local Affair and Regional Development. The objective of the SMEPOL-project was to make comparative analysis of selected innovation support policies aimed at small and medium-sized enterprises in eight European countries, in order to single out ‘good practice’ policy tools aimed at different kinds of SMEs in different regions. This report presents the analysis of one of the three innovation policy tools selected for the studies in Norway, the NT-programme (The innovation and new technology programme in Northern Norway). The two other innovation policy tools were the TEFT (diffusion technology from research institutes to SMEs) and RUSH (regional development between state owned colleges and SMEs).

Oslo, Desember 1999

Heidi Wiig Aslesen

Abstract

The aim of this paper is to see if the goals and working methods of a particular public support programme directed towards innovation in the firm (the NT-programme) was suited for the innovation challenges in the fish processing industry. By looking closely at the innovation activity among fish processing firms, we get an insight into the system of innovation of this industry, and into what kind of innovation support the industry need.

In general the NT Programme has been well adapted to the challenges for the fish processing industry and its need for diversified support in the innovation process. The very profile of combining funding with close follow-up has been highly supported both from industry as well as from other programmes and initiatives that are interlinked with the NT-programme.

The technology advisory contracts are important to offset co-operation with R&D institutions and firms. The NT-secretariat constitutes an important part of the network for firms in their innovation activity, especially for small firms. The NT-programme contributes to a large degree to raise the firms' co-operation activity, and thereby contributes to strengthen the regional innovation system for firms. Having only one region to relate to (Northern Norway), have given the NT-secretariat a very good knowledge about how to do business in this part of the country.

Overall the NT-programmes flexible working methods seems to be well suited for strengthening many aspects of the innovation process in the fish processing industry. However, the criteria for being selected into the programme do seem too stiff, leaving a very large share of firms in the fish processing industry outside the programmes target area. This could be changed in favour of the fish processing industry, since this industry is of such a great importance for the region. The programme could also use more resources to help firms with developing new market contacts, both with Norwegian customers (i.e. with food chains as a market) or foreign markets by i.e. motivating competing firms to co-operate on the market side. This might improve the low level of product innovation in the industry.

Keywords: Fish processing; Governance; Innovation; Industrial policy; Northern Norway

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Governance and the innovation system of the fish-processing industry in Northern Norway

1. Introduction

The aim of this paper is to look into a particular public innovation support programme called the New Technology Programme for Northern Norway (the NT Programme). We are interested in exploring the aims, instruments and working methods of this programme, by using one of the most important industries in the region of Northern Norway as a case; namely the fish processing industry. The paper describes the aims and the working methods of the programme, and discusses the 'success-criteria' for the programme in relation to the fish processing industry in Northern Norway.

The fish processing industry is often characterised as 'low-tech', mature and with little innovation activity. For the industry to be competitive on the world market, it is a strong need for it to update production processes and to develop new products; the industry needs to be innovative and there seems to be a need for governance in the regional innovation system of this industry. For a public innovation support programme to be successful it is necessary to be able to reflect the needs of an industry in relation to innovation. To be able to answer if the NT Programme is suited as a policy tool for the fish processing industry, we will firstly analyse the *extent of innovation* activity, thereafter analyse *how innovation takes place* in this industry.

The NT Programme is regarded as a state of the art of this kind of public support structure for peripheral areas. The NT Programme is intended to "promote new activities in Northern Norwegian companies that have the ability and drive to innovate. This is done by investing capital in company projects with potential"¹. The NT programme's working methods are fairly unusual in an international perspective, providing substantial support for development projects that have both technological and business dimensions.

1.1 Regional innovation and innovation policy

Theoretical and political interest in the effects of innovation has led to interest in how innovation actually takes place in firms or industries. Today, innovation is looked upon as a non-linear process, including other elements than formal R&D. Innovation activities such as acquisition of machinery, purchase of patents and licenses and design might be very important ingredients for firms' innovation activity. There has been a gradual realisation that in terms of technological innovation the emphasis has shifted from the single act philosophy of technological innovation to the social process underlying economically oriented technical novelty

¹ Quote from "NT-programmet 1993-1996. Strategi og måldokument" (p. 2)

(OECD, 1992). Innovation is a process of interactive learning, characterised by continuous internal and external feedbacks that initiate steady changes to products, processes and services. Firms combine the different factors differently in innovation processes. This makes them not only produce differentiated products, processes or services, but it generates innovation differently. The implication is that firms innovate differently and industries innovate differently, making it hard to find one model that can describe the innovation process.

The interactive model of innovation emphasises two forms of interaction for firms; the first form takes place within a firm or within a group of firms working closely together; the second takes place between firms and the science and technology system within which they are located. Freeman² defines a national system of innovation as the network of institutions in the public and private sector whose activities and interactions initiate, import, modify and diffuse new technologies. The importance of this concept is that it places explicit emphasis on “intangible”³ investments made in an effort to stimulate technology adaptation and advances by a diverse series of actors rather than solely depending on the efforts of the research and development community (Nauwelaers & Reid, 1995).

At the regional or local level studies have underlined the importance of organisational factors, alongside the more traditional economic variables, in defining a technological and industrial development trajectory. Innovation is first and foremost a collective and social endeavour, a collaborative process in which the firm, especially the small firm, depends on the expertise of a wider social constituency than is often imagined (workforce, suppliers, customers, technical institutes, training bodies, etc.) (Philip Cooke & Kevin Morgan, 1994). The attention that has been given to the study of regional innovation systems is related to the idea that the interrelationships between agents in a regional economy have an impact on the competitiveness of individual firms and subsequently the region as a whole. The performance of the regional innovation system will depend much on the organisational capacities of these networks of relationships.

The new theoretical understanding of the innovation process has had implication for the changes in innovation policy⁴. The shift from the linear model of innovation (formal, research-based knowledge, industrialisation of results of research, large firms, national innovation systems) to a bottom-up interactive model developed within a network perspective, opens up new possibilities for non R&D-intensive small and medium sized companies (SMEs) which have inadequate internal resources to rely heavily on R&D-work. Traditional small and medium-sized enterprises often lack the competence and resources needed to carry out their own research and development, they may also have problems in recognising their own needs in the innovation process, and further, they lack opportunities to partake in wide-reaching networks (Tödtling 1994). Innovation policy should therefore be directed to the need for a firm specific stimulation of searching and learning, and thereby raising the technological capacity of the firms.

² 1987, as quoted in OECD, 1992, op.cit.,pg 80.

³ Intangible investment covers, in addition to investment on technology, expenditure on training, a range of business services, marketing, and the acquisition and exploration of software.

⁴ Parts taken from Arne Isaksen (eds) 1999. “SME policy and the regional dimension of innovation. The Norwegian report”. Smepol report no. 5.

Focusing on SMEs in innovation policy has also meant having a greater awareness of the importance of the *regional level* in innovation policy, resting on the notion of the importance of regional innovation systems where proximity facilitates collaboration and learning stimulates innovation activity. The idea is that the region forms an appropriate level for developing more strategic initiatives for technology support for local firms based on network principles. Chabbal (1995; 109) thus argues that “innovation policy is aimed primarily at SMEs. (...) An innovation policy for SMEs is above all a local policy: it is, therefore, essentially the domain of regional policies”. Similarly, Cooke (1995: 19) argues that “the region (is) the optimal level of industrial, governmental, and technological support, especially for small and medium-sized enterprises”. A key component of regional innovation policy is the infrastructure aimed at providing support and services. It is argued that non R&D-intensive SMEs’ often need help from intermediary organisations to acquire technological knowledge from research institutes, pointing to the need for local organisations and a regional innovation policy (Hassink, 1996).

The regional innovation policy in Norway corresponds with important elements in the policy in other countries. Generally, a central aim of regional innovation policies has been “to support regional endogenous potential by encouraging the diffusion of new technologies in general and the diffusion of new technologies from higher education institutes ... and public research establishments ... to small and medium-sized enterprises in particular” (Hassink 1996: 167).

The increased significance of policy tools initiated and accomplished by local and regional authorities, reflects a ‘rediscovery’ by researchers and policy makers of the region and its resources as being an important competitive advantage. Appropriate innovation policies based on lessons available in the 1990s also need to reflect the multiple needs of the demand side, i.e. that firms need more than technological competence to carry out innovation projects.

The next section will introduce the reader to the region of Northern Norway.

1.2 The regional context⁵

The region of Northern Norway has for a long time been a target for massive public support. The political background for this is many fold, varying from traditional challenges of peripheral communities to a defence-political motivation to sustain the population in the northern areas bordering to Russia. The key issue at stake, however, has been the thin population base and a high degree of dependence on raw materials, in particular fish and the associated food processing industry (Remøe, 1999).

The Northern Norway share of the population was ca 10-11% in the late –80’s, but is slowly, albeit consistently being reduced through migration to the south. The region has about a similar share of the workforce, but a higher share of the population in the public sector. The relative size of the industrial work force was lower than the

⁵ Parts taken from Svend Otto Remøe, 1999. “The new technology programme for Northern Norway”, in “Part 3. Policy analysis” of the Norwegian SMEPOL report.

Norwegian average and the gross regional product significantly lower (Arbo and Gulowsen 1992).

The overall profile of the industrial structure is a raw-material based economy. The food-processing industry covers about 1/3 of the industrial firms in the region and about 40% of the industrial work force, a fact that lends it self to the region's proximity to the vast harvesting area of the Norwegian and Barents seas and to fish-processing firms along the long stretch of coast from Russia down to Mid-Norway. The raw-material based activities are dominating, serving the wider national and to some extent international economy with the raw materials for further industrial production: Norway is the tenth largest fishing nation in the world measured in quantity and the world's second largest fish exporter. Norway has long traditions in the exploitation of ocean resources; fish products have for a long time been one of the country's most important export products. Fish product exports have in recent years been worth over 20 billion Kroner annually, and fish products are Norway's second largest export products (Dreyer, Bent 1998). Raw materials and intermediate products dominate fish exports, and competition is stiff. The national economic importance of this source of raw materials has resulted in close regulation of the industry through a variety of policy tools.

The fish processing industry is considered to be low-tech and 'mature'; its technological fundamentals are not based on internal R&D, but rather on testing and adaptation of new or existing technology. However, the fish processing industry also makes use of technologically advanced and R&D-based equipment brought in from outside the firm or industry. The industry often uses advanced technology in all stages of the production process and new technology and knowledge is constantly spreading within the industry.

The high degree of resource dependency in the food processing industry paved the way for serious economic impacts, both directly as well as through externalities, when the supply of fish slumped in the mid- and late 80's; this hit the area hard. It was reinforced by the emerging cutbacks of state budgets from 1988 and onwards.

A returning feature of the region has been the low degree of innovation and entrepreneurship, a fact that should be seen in relation with the self-contained industrial activity that has dominated the region's history and culture. Based on the studies by Arbo and Gulowsen (1992), Isaksen et al (1996) and others, the following can be seen as significant elements of barriers to innovation:

A problematic combination of extreme advantages (raw material) with extreme disadvantages (weather, distance) has reproduced a one-sided activity. People's choices have been few.

The self-contained industrial culture is linked to the culture of abundance: No need, no innovation.

The region's geographical characteristics are a clear barrier to innovation, with a scattered population, vast distances and low degree of agglomeration. Proximity as a dimension of regional density is very low, leading to poor conditions for communication, creativity and spontaneous action. This is linked to the conditions

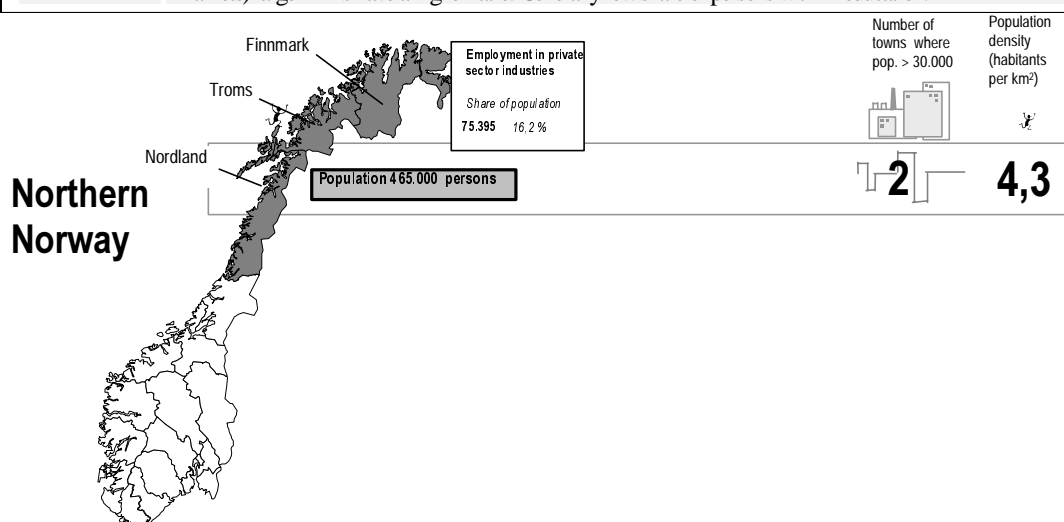
for collective action, and poor networks and poor social capital does not provide a compensation for lacking infrastructure and agglomeration.

The firms themselves are small and with lacking human and financial resources, there are great difficulties in building technological capacities on the firm level.

To complete the picture, it should be mentioned that the overall level of welfare and employment has been secured though a high level of state activity. The degree of public employment is high, and various initiatives in the region are not regional in nature, but decentralised state activities. The NT-programme is but an example of this. Thus it might be relevant to say that the regional context has improved in the sense that an overall economic welfare is in place, that there has been a growth in knowledge institutions and a growing modernisation of physical infrastructure. What is still lacking, is the economic capacity of the firms themselves.

Figure 1. Characteristics of Northern Norway

	Northern Norway
demo- graphy/ geography	Low degree of urbanisation. Low population
industrial structure	Homogenous industrial structure, large sectors (compared to national average) are transport and food. Large sectors (in volume) are hotels / restaurants, food/beverages and transport
firm size structure	Higher share of small firms than national average, fewer large enterprises (similar to southern counties). High share of innovation activities performed by medium-sized and large enterprises.
education	Relatively few persons with higher education. 32 percent of population have only primary school, 51 percent have secondary school.
R&D and higher education	Low share of firms reporting to have performed R&D. Very low share of R&D man-years. Six institutes performing science or technology research. 7 colleges and one university. 16.323 students (1996). Total number of scientists: 1300.
technology co-operation	Northern firms have a higher share than southern firm in terms of market co-operation.
innovation activities	Few innovation activities compared to the south. Small firms are much less innovative than larger firms. Small firms best at introducing new products. On other variables (process innovations, establishing new markets) larger firms have a higher ratio. Generally low share of persons with IT education.



1.3 The fish processing industry in Northern Norway

Northern Norway has only one large industrial sector; fish processing. The industry is heterogeneous; the heterogeneity is linked to different processing techniques; varying degrees of trimming as well as different preservation techniques. Products fall into the following categories; fresh fish, frozen, salted, and dried (i.e. stockfish and clipfish), canned products and processed products. The aim here is to sketch innovation activities in the industry as a whole, not to understand the dynamics within each sub-group.

Both the supply side and the demand side of the fish processing industry are unpredictable and complex. On the supply side the industry is based on natural, renewable resources, so that supply of raw materials varies according to the season as well as from year to year. Supply of raw materials is determined by factors beyond any control, such as climatic and ecological conditions. State-regulated quotas are determined by stock levels and are set on an annual basis. It is hard to find any kind of established pattern to the quotas or to make any prediction for years to come (Dreyer, Bent 1998). Russian cod deliveries have supplemented the Norwegian fleet and eased the situation. However the section of the industry that depends on Russian deliveries has no guarantee that these will continue indefinitely.

In addition to uncertainties surrounding raw materials, there are also substantial variations in demand for final products. These fluctuations have led to repeated crises within the industry and demand flexible responses from firms. Suggested strategies for the industry have focused on greater degree of processing as well as more market-oriented product development. Thus strategies include; changing product ranges, developing new markets and market channels, greater degree of processing, making greater use of new information technology, seeking out more information and processing greater amounts of information, focusing more on product security and quality and on more formal qualifications at all levels in the firm (Välitalo, Ingilæ and Edvardsen, 1997).

The overall position of the industry means that firms are forced to be innovative, either by updating production equipment or developing new products. Knowledge about factors that encourage or obstruct the development and spread of new technology is therefore of great importance for survival in a competitive world market. In order for change and adaptation to take place, it is necessary for firms to have both the will and the ability to innovate.

2. Innovation in the fish processing industry – focus on Northern Norway

This chapter presents both product and process innovation activities of firms in the fish processing industry. The aim is also to try and explain the pattern of firm's innovation activity in light of their daily reality. The chapter also presents data on how firms innovate, and on what they perceive to be obstacles to this process. Firms' external relations are also important for innovation, and we will present the most important ones. Finally the chapter will sum up the most important findings, and comment on the innovation system for the fish processing industry in Northern Norway.

Our findings are based mainly on data from the Community Innovation Survey (CIS2) carried out in Norway in 1997, and concentrates on the fish processing⁶ industry in Northern Norway (Nordland, Troms and Finnmark). The CIS2 collected data on 54 firms in the fish processing industry in the three counties Nordland (25), Troms (19) and Finnmark (10). The CIS2 did not include any firms with fewer than 10 employees. The largest share of firms in our population has between 20 and 100 employees (56%) (33% have between 10 and 20 employees, whilst 11% has more than 100 employees).

In addition, interviews have been carried out with managers from a selection of firms from different segments of the fish processing industry. Interviews have also been carried out with regional researchers and experts, as well as with a representative for the NT programme.

2.1 Innovation activity and modes of innovation

The table below shows the share of innovative firms in fish processing for Northern Norway and for the rest Norway.

Table 1. Share of firms that report having innovation activity in the period of 1995-1997. Weighted shares. Source: Community Innovation Survey, 1997.

Employees	Fish processing industry in Northern Norway (n=54)			Fish processing industry in rest of Norway (n=67)		
	Yes	No	N	Yes	No	N
10-49	24%	76%	35	39%	61%	43
50-99	23%	77%	13	75%	25%	16
100+	83%	11%	6	50%	50%	8
Total	27%	73%	100%	46%	54%	100%
N	16	38	54	33	34	67

⁶ We have defined fish processing to be NACE code 1520.

Almost 30% of the fish processing firms in Northern Norway reported innovation activity⁷ in the period 1995-1997. For the fish processing industry in other parts of Norway the share of innovative firms is significantly higher, at 46%. Innovation activity differs between size groups; in Northern Norway firms with more than 100 employees have a much greater share of innovative firms than smaller size groups. This is not the case for the rest of the country, where the most innovate size group of firms is 50-99 employees.

Our data show that the fish processing firms in Northern Norway seem to be slightly more involved in process innovations than in product innovations, which is also true for the industry at a national level.

Table 2. Estimation of turnover in 1997 due to technologically new or improved products. Weighted shares. Source: Community Innovation Survey, 1997.

Average turnover	Fish processing industry in Northern Norway (n=16) Average turnover	Fish processing industry rest of Norway (n=33) Average turnover
New products	7%	16%
Improved products	5%	9%
Unchanged products	88%	75%

The greatest share of sales was accounted for by products that were unaltered (88%), indicating a low degree of product innovation in the industry. This is true also for the fish processing industry in the rest of Norway, although this share is lower than for the northern regions at 75%. The largest part of the industry is mainly characterised by selling standardised products to well known and established customers, here lie however a potential for the industry.

A recent study found that most firms in the fish processing industry continuously work to increase the efficiency of existing production and that firms are less actively involved in aspects of product development that are new to the firm or new to the market (Hansen, Kåre 1998). These findings do correspond to our findings from CIS2. There are however differences between firms that handle different types of fish and thereby use different kinds of technology to process this fish (or prawns). A striking result is that a very low share of firms that use conventional technology had carried out more advanced product development activities. As many as 66% of these firms were located in Northern Norway (Nordland, Troms and Finnmark), indicating regional differences in the fish type and the technology used.

⁷ A firm is innovative if it has had either of the three activities in the time period;

1. Introduction of any technologically new or improved products.
2. Introduction of any technologically new or improved processes.
3. Had unsuccessful or uncompleted projects to develop or introduce technologically new or improved products or processes.

When considering product innovations, the main issue for firms is how far down the processing path to go. The greater the degree of processing, the greater the need to meet market demands, which again reduces firms' flexibility to make rapid alterations to production to suit conditions of price and demand. Processed fish products have to meet regional requirements; food habits are highly traditional and are embedded in local conventions. Further processing of fish products to meet regional requirements would lead to greater product innovation within the industry. We do find examples of changes to product development in the region. For example in Finnmark the greatest share of firms produce filleted fish. A large share of production is now aimed at specialised products, which produces significantly greater returns than frozen fish. The driving force for this change has come from firms with previous market contact (Iversen, Audun 1999).

Market contact can be an important source for initiating product innovations. Market contact is of course important for firms' economic activity, but it also stimulates firms' internal competence building as well as their own demand for external assistance to build up competence (Onsager & Eikeland 1992). One of the main challenges for producers in the fishing industry is to combine the knowledge about consumer demands and their unique knowledge about food production. Being able to combine these knowledge bases will make the fish processing industry particularly well suited to product development in the food industry (Hanssen, Berit 1999). The industry should come closer to the market in order to receive important signals that can direct future product development. A study of the fish industry in the county of Nordland found that proximity to its most important clients is important for product innovations (Rotefoss, Beate 1997). The potential lies in production of products that are inexpensive and of high enough quality for a demanding food market.

As the above illustrates, product development in the fish processing industry is complex, requiring knowledge about products, processes and markets. In addition, knowledge about project organisation and completion is required for effective management of product development processes (Hansen, Kåre 1998).

The largest share of innovative firms did engage in process innovation. It is widely recognised that the majority of innovations in the industry are technological in nature. Interviews with firms showed that these innovations to a large degree were linked to adjustment of imported technology. The main suppliers and partners of choice for co-operation in technologically oriented activities are equipment suppliers, which are largely foreign (especially German and Danish suppliers, but also some Icelandic and Canadian suppliers). A small number of actors seem to have dominated the market for a long time, offering flexible machinery of long-lasting high quality. Foreign suppliers of machinery are well established in the market, making it hard for Norwegian suppliers to compete. In relation to acquisition of new machinery, firms (or suppliers of machinery) often engage consultants and R&D personnel to adjust machinery to the firms' specific needs. These actors can be Norwegian as well as foreign. The technological innovation in the industry is incremental with a high degree of adaptation of equipment and machines, and with a high degree of learning by using, interacting and doing.

Interviews, however, reveal that firms also had taken part in R&D projects where development of new technology linked to the production process was carried out. Examples of process innovation included implementation of new filleting-

technology, new freezing technology – which also gave higher returns on filleting – as well as new prawn storage techniques (salt water instead of freezing).

Firms that report process innovations say that it had a positive effect on production capacity, on working milieu or the environment and on operating costs. The same pattern is found for fish processing industry in Norway as a whole.

The Community Innovation Survey for 1997 also asked the firms to report on costs related to innovation activity. This would give an idea of how firms in the fish processing industry innovate.

Table 3. Innovation activity in the fish processing industry in Northern Norway and the rest of Norway. N=16, 33. Source: Community Innovation Survey, 1997.

Innovation activities	Firms engaged in the activity; Northern Norway N=16	Total costs in % by activity in 1997	Firms engaged in the activity ; rest of Norway N=33	Total costs in % by activity in 1997
Intramural R&D	7	17	8	6
Extramural R&D	3	2	5	1
Acquisition of machines and equipment linked to product and process innovation	10	70	19	78
Acquisition of other external technology linked to product and process innovation	2	2	5	7
Industrial design, or production preparations for technologically new or improved products	2	3	3	0
Training in relation to technological innovation	6	2	11	3
Market introduction of technological innovations	3	4	4	4
	-	100	-	100

The innovation activity engaged in by the greatest number of fish processing firms was ‘purchase of machines and equipment for innovation’. As much as 70% of total innovation costs was associated with this activity, suggesting that much developmental effort was put in adjusting new machines and techniques to their own use. This is also found for the fish processing industry in the rest of the country. These findings agree with our previous findings, which showed that firms are mostly engaged in process innovations, the greatest positive effect being on production capacity.

The second largest cost component was internal R&D which accounted for 17% of total costs. Close to half of the firms with innovation activity engaged in internal R&D. As mentioned above, much R&D activity can be linked to acquisition of machinery, very few firms also engage in R&D projects in response to needs or ideas that cannot be taken care of by existing technology. Interviews with company managers gave the impression that those internal R&D projects that firms engage in, were initiated by public programmes and by contact (both formal and informal) with regional R&D milieus. Interviews with managers suggest that the most successful

R&D projects are those where the ideas have sprung out from the firms themselves but where the firm is supported by external partners where relevant. When asked about R&D personnel within the enterprise in 1997, almost 60% of the firms reported having such personnel, albeit on a small scale (5 firms reported one man-year or more). Only 2 firms were continuously engaged in R&D activity, and 8 firms were occasionally engaged (out of a total of 16). In general, internal R&D activity seems not to be an ongoing or continuous process for firms, but is treated as a way in which to solve problems as and when required.

Only 3 firms were engaged in market introduction of technological innovation. These results may indicate the low share of technological innovations actually introduced to the market. Firms have hardly any costs associated with buying external R&D (1.7% of total innovation costs), or in the purchase of external technology for innovation (2% of total innovation costs). This might indicate that firms make little use of external relations in the innovation process other than suppliers of equipment of machinery.

Even though little money is used on it (1.9% of total innovation costs), more than half the firms engaged in competence building in relation to innovation. There has been a remarkable development in the fish processing industry during recent years. As one manager put it, “[w]hen I started my business I used to have 40 ladies peeling prawns, today I have 3 persons controlling the machines that carry out the work. Technological developments in recent years have made great changes to the industry”. Previous workers in the industry have largely transferred to operating machines, while constant development and use of information technology in different processes have made it necessary for firms to engage in internal training of employees. Raising competence levels of the workforce is essential if equipment is to be used to its full potential. The industry is dependent on a natural, renewable source of raw material, the supply of which varies seasonally as well as from year to year. This means that the workforce has to be able to adapt to process different volumes and different products at different times. The cost of adapting production, the speed of that adaptation, and any loss of productivity will depend on the abilities of the workforce (Dreyer, Bent 1998).

The fish industry is considered to be an industry with low levels of formal education, however formal education and training skills tend to become obsolete at a faster rate in times of rapid technological change (Lee and Has, 1995). There must exist a unique informal competence within the firms in this industry since they are able to survive under such difficult conditions.

Access to capital is important for firms to appropriate flexible and advanced technologies. Many of the firms that carried out innovation did receive government support to finance their innovation activity.

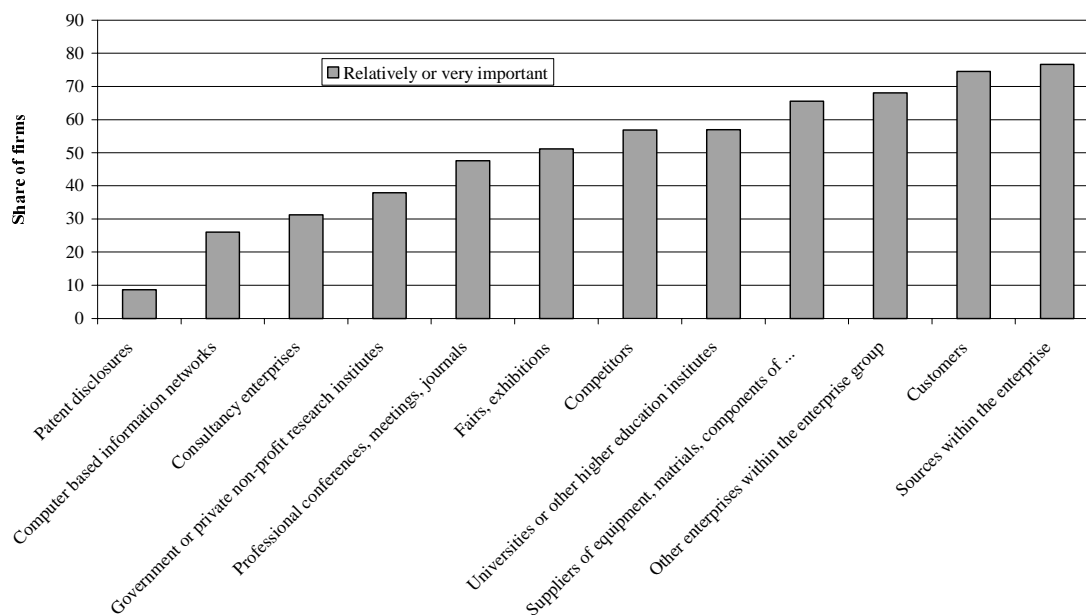
In Northern Norway 52% of firms that engaged in innovation received innovation support, a significantly higher share than for the fish processing industry in the rest of the country. This must be understood in relation to the vast array of public institutions and programmes giving loans, regional development grants, investment grants, and other types of support for business development. The main actors are the

various county councils and SND⁸. Much of the company level support comes from regional policy funds.

There is also a market for private investors willing to provide risk-willing capital for this industry (i.e. Nordnorsk Vekst). However, investors in the fish industry report cultural differences between the regions. Fish industry firms in the western parts of Norway have a much greater demand for private capital than firms further North. Northern firms seem to be more sceptical to investors. Besides providing risk willing capital, investors are often perceived as providing ‘competent capital’. A survey carried out among firms in the Oslo region showed that investors contributed to management, as well as to internationalisation of projects or other activities (Aslesen, 1997). They are also able to provide advice on economic and organisational development matters, knowledge that would be extremely useful for this industry.

The Community Innovation Survey also gathered information on information sources firms perceived as most important for innovation. The figure below shows the results.

Figure 2. Share of firms that have answered that the following sources are relatively or very important information sources for innovation. Innovative firms. Weighted shares. Source: Community Innovation Survey, 1997.



The most important information sources for innovation for the fish processing industry in Northern Norway, are sources within the enterprise. The human capital and skill that exists in the firms is of great importance for innovation. The second most important source of information for innovation is customers. This is to a low degree reflected in firms’ sales of new products, since 88% of sales consists of unchanged products. Firms also emphasise the importance of information from within the enterprise or other enterprises within the enterprise group (11 of the 16

⁸ The Norwegian Industrial and Development Fund (SND).

innovative firms are part of an enterprise group). Suppliers of equipment, materials etc. are also important as source of innovation. As earlier noted firms' innovation activity is to a large degree linked to process innovations, with strong links and co-operation with suppliers of machinery.

None of the firms perceive universities or higher education institutions or government or private non-profit research institutes as very important information sources for innovation, but some do find them relatively important for that purpose (57% and 38% respectively), even though there are several institutions that could be of relevance to the industry. These findings suggest that firms have proven little use of regional knowledge suppliers, firms report to use little money on R&D activity and few firms continuously engage in innovation projects. There may be many reasons for this. One explanation may be that the industry has a small administrative staff that can carry out R&D projects, and the share of employees with university and college education is very low. This leads to a low ability to participate, as well as a lack of a common professional platform (Iversen, Audun 1999). This leads to differences in language, norms, culture and understanding of problems between firms and the scientific community. This is confirmed in interviews with company managers. Other important aspects include different perceptions of time scales, issues of cost, understanding of direct relevance, as well as the fear that scientific milieus might not be secure enough and that news might reach competitors. There are however examples of successful research projects. Firms that took part in these have often broken through an important barrier and find it easier to make contact with research milieus at a later date.

Links and co-operation with other firms may also have a positive effect on firms' abilities to learn. Half the firms that engaged in innovation did engage in co-operation for innovation. The co-operation partners were mainly located in Norway or in the European Union. The co-operation partners most cited were other enterprises within the group (5 in Norway, 2 in EU, 1 in USA) and suppliers of equipment (3 in Norway and 3 in the EU). Some firms also reported co-operation with universities or higher education institutions in Norway (3 out of 8), and with research institutes (2). There are a fair number of research milieus in Northern Norway that are relevant to the industry, so that the low degree of co-operation cannot be explained by a lack of relevant milieus.

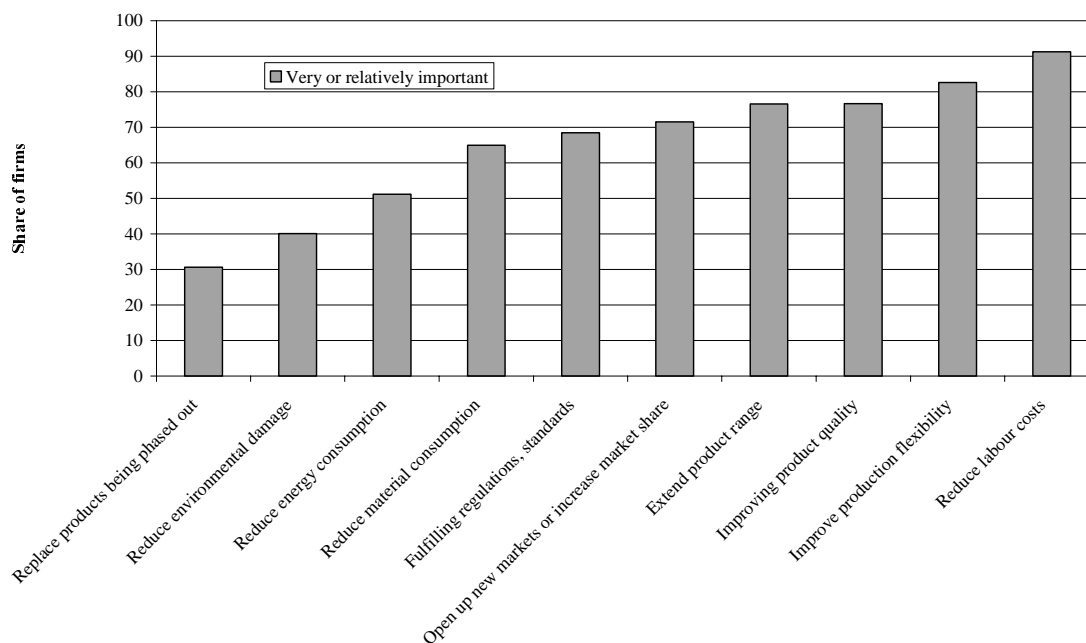
A study of the fish processing industry in Norway (Hansen, Kåre 1992) has looked at which agents firms perceive as most important for the spread of new technology to the firm. The firms perceived suppliers as the most important (97.5% very important and important), 'other firms' (95.1% very important and important), branch organisations (80.4% very important and important), and then research institutions (75.6% very important and important). The study also looked at the effect these actors have on firms ability to adapt new technology. The results were that only research institutions could explain variations in firm's ability to adapt new technology. These findings do suggest that links should be enforced between firms and parts of the scientific infrastructure, since these links are positive to firms' acquisition of new technology.

2.2 Factors affecting and restricting innovation

During the last 10 years the total number of employees in this industry has decreased drastically, especially in the northern parts of Norway. In part this is due to a lower degree of differentiation in production here than for the industry further south in Norway (Dietrichs, 1994). There has been great political will to help the industry through difficult periods as the fishing industry is important to maintain Norwegian settlement patterns in the North. The industry itself faces problems of migration, as young people (particularly women) are moving away to seek education and more interesting employment. Few ever return. These developments are contrary industry needs and to the maintenance of populations in the districts. In response to this situation, the fish processing industry must offer young people more interesting employment opportunities in order to make the districts an attractive place to live. Herein lie a number of development challenges for existing industry.

Firms were asked to report which factors were important for innovation activity. This gives an indication of the challenges this industry faces.

Figure 3. Share of firms that have answered that the following factors are very or relatively important reasons for engaging in innovation. Innovative firms. Weighted shares N=16. Source: Community Innovation Survey, 1997.



Firms in this study emphasise the importance of reducing labour costs, with 91% of the firms saying this is relatively or very important. This explains firms' large emphasis on process innovations. Wages are the largest single cost component after raw materials (Dreyer, Bent 1998). Fluctuating supplies of raw materials make income levels uncertain, a factor which results in a greater tendency to lay off workers in this industry than in any other Norwegian industry. The fish industry is frequently criticised for laying off workers often and at short notice. Industries that provide relatively insecure employment opportunities could be expected to have trouble with recruitment. A survey of innovative fishing communities shows that the

population of Norwegian fishing communities are not particularly interested in working for the industry as long as they have alternative options (Mariussen, Åge 1999). The 'ideal' community to provide a workforce for the fishing industry has low education levels – thus reducing the workforces' opportunities on the national labour market – combined with local identities linked to fishing and the fish industry.

Improving production flexibility is also perceived as one of the most important reason for engaging in innovation activity among firms in the fish processing industry, with close to 83% of firms perceiving this as relatively important or very important. There is great uncertainty surrounding profit margins for the different products that can be made from this raw material. Raw materials vary on a seasonal basis in terms of both quality and quantity, which in turn affects production patterns in the industry. The table below shows how one firm makes use of different types of fish during different periods of the season in order to have a supply of raw materials all year long. In addition to these categories the firm carried out fish farming of trout and salmon which was available all year round. The production process therefore had to be adjusted to the different raw material on one hand, and to differences in market demand on the other.

Table 4. Seasonal patterns for main supplies of raw materials

Month/ Fish	January	April	July	October	December
Cod	-----				-----
Wolf-fish		-----			
Coalfish			-----		
Herring	---			-----	

Another example is provided by the Northern Norwegian producers of salted fish, who have established fairly substantial production plants so that they can vary production and dry salt cod for the dry cod (clip fish) market when market conditions make this the most attractive option (Ottesen, Geir Grundvåg 1998). Investigations show that it is not only basic production that varies from year to year, but that production of all the firms' goods also varies from year to year (Dreyer, Bent 1998). Extending product range and improving product quality are therefore important factors for firms to be able to have resource mobility and thereby product flexibility.

There is much to suggest that those firms that succeed are those with certain competencies; competencies which enable the firm to exploit uncertain supplies of raw materials and turbulent market conditions by rapidly changing the range of products. In other words, there is a strong connection between supply of raw materials, product range and market conditions. There is also a connection between degrees of production flexibility and the production processes/equipment available within the firm. If we consider the degree to which firms prioritise flexible production through investment, we find that firms that survive tend to invest more in production equipment than firms that go bankrupt (Dreyer, Bent 1998).

Extending product range and improving product quality is also an important incentive for firms to engage in innovation. In terms of product quality, firms face strict regulation through EU directives.

Entering new markets and extending market share is also perceived as an important factor for innovation (close to 72% of the firms perceive this as relatively important or very important). It is often said that the fish processing industry is too production oriented, that few new products are developed and that there is a lack of brand names. Retail outlets for fish and seafood have declined drastically in recent times; in 1965 there were 2 500 fishmongers in Norway, while in 1995 there were 380 (Hanssen, Berit 1999). Consumption of fresh fish fell in Norway in the period 1965-1995, due in part to the fact that preparing fish is time-consuming, but also due to the fact that the supermarket chains tend not to offer fresh fish for sale. Consumer reports do however show that attitudes to fish are generally positive and that many consumers would prefer fresh fish to frozen (Hanssen, Berit 1999), this shows that there lie a great potential in product development in the industry. The industry has not managed to organise into a powerful lobby (as the meat industry has through Gilde and Prior). The challenge lies in convincing consumers to buy the fish industry's products. This depends on the industry gaining access to the supermarket chains, which in turn depends on long-term co-operation between suppliers and the supermarkets. It is widely held that firms have to be market oriented, and that the customer is the most important factor in the firms' environment. (Ottessen, Geir Grundvåg 1998). For company managers, it is important to understand how the market works so that the right products can be aimed at the right markets at the right time. However, there are great obstacles for the fish processing industry, the following quote underlines this (Ottessen, Geir Grundvåg 1998);

“The first thing is that the market has two directions. If we had unlimited supply of raw materials well then it would be easy to define the market further. But everything is so unpredictable, the Lord gives us storms in the mildest seasons, so our market orientation is adaptable. It's just as important to watch the sea as it is to follow developments on land” (Manager, production company, salt cod and salmon).

We were interested in which factors firms perceived as restrictive in their innovation process. Most firms mentioned 'organisational rigidities' as the most important factor restricting the innovation process. The changes in supply and the shifts in demand are often unpredictable and complex, and result in great organisational uncertainty (Välitalo and Edvardsen 1997). The organisations must be able to respond well to turbulent conditions, and the better a firm's internal diversity meets the challenges of the environmental complexity, the more successful the firm is considered. The organisations inability to meet these challenges can affect firms' ability to innovate.

Excessive perceived economic risks are also mentioned as important factors hampering innovation in the industry. As mentioned earlier the industry is faced with many elements of uncertainty. Entering an innovation process simply adds to this list of uncertainties and is thus a disincentive. One strategy is to wait until other firms have implemented and adapted e.g., new machinery to an industries needs, and then buy. One manager said: “I'm happy to come second place when it comes to process innovations; the innovation process is too long, complex and expensive. It's often best to wait and see what your competitors do”.

Lack of technical information is also mentioned by innovative firms. Interviews show that firms make use of relatively large numbers of information sources in their search for information. These include keeping track of projects taking place in research milieus, reading published reports, taking part in relevant trade organisations, or by keeping a close eye on what related firms are doing. Constantly surveying numerous sources of information requires a lot of time and energy, few firms have the resources needed to be fully informed.

The next section will sum up our findings on innovation in the fish processing industry.

2.3 The innovation system of the fish processing industry in Northern Norway

Our findings suggest that almost one third of the fish processing industry in Northern Norway engages in innovation activity. Innovation activity is very costly and risky, and since the industry already is challenged by a great deal of uncertainty, large scale innovation projects are often postponed. Information flows easily in the industry, this reduces the incentive for firms to engage in costly innovation projects, often making them inclined to adopt a 'wait and see' attitude, preferring to wait until competitors have implemented new technologies which allows them to appropriate technological solutions much more cheaply. The largest share of firms were engaged in process innovations. Innovations in the fish processing industry are mainly incremental as opposed to radical. Innovation in the industry requires knowledge about both product, processes and the market. It is thus a complex activity, and the firms must relate to a variety of unpredictable factors such as access to raw materials and market demand. Our findings show that there are high levels of purchase and probably adaptation of machines into the fish processing industry, and one can expect that internal R&D is largely used to adjust machines and equipment to firms' needs. Apart from suppliers of machines and equipment, firms seem to have little external contact in their innovation activity. Little use of external R&D is registered, and there are few purchases of external technology linked to innovation (such as products or licenses). The high share of firms engaged in internal competence building indicates a turbulent industry undergoing constant development and change, adjusting to fluctuations in the raw material situation and to market demands and needs. Public support might be an important motivation or enabling factor for firms to engage in innovation activity. A large share of innovative firms received government support for innovation activity.

The most important information sources for innovation are customers, and sources within the firms. It seems that firms that are part of a larger company receive valuable input into the innovation process from other parts of the company, also as partners for innovation co-operation. Suppliers of equipment and materials used in the processing of fish are also important sources for information for innovation, they are also the most cited co-operation partners. Half the firms in the study did engage in co-operation for innovation, and mainly Norwegian partners were chosen. Universities and higher education institutions and research institutes are not perceived as an important source of information for innovation, however some firms do engage in innovation co-operation with such institutions. Interviews with

managers revealed that a number of firms had been in contact with these milieus, both formally and informally. Contact was often initiated by public programs or public initiatives. Managers also reported many obstacles in co-operating with the scientific infrastructure, often linked to cultural differences. However, studies show that they are important for spread of new technology to firms, and thereby have a positive effect on firms' ability to adapt new technology. This suggest that co-operation in some way should be enforced.

Factors motivating innovations are closely linked to the production process and to adjustments in relation to the market. Important elements are the firms need to reduce costs, especially labour costs. Flexibility in the production process is one of the most important factors for survival in this industry. Firms need to be flexible in their product range, in relation to supply of raw materials, market demand and price. The industry is often criticised for not being strongly market oriented, but a large number of firms in the survey perceive entry into new markets or increasing market shares as beneficial to innovation within the firm. The need for flexibility provides a new incentive for innovation, so that innovation is both encouraged and hampered by the uncertain conditions surrounding the firm. Firms consider 'organisational rigidities' to be a factor which hampers innovative activity. A further hindrance is the high costs associated with innovation, and 'excessive perceived economic risks' is a final obstacle to innovation.

The table below tries to sum up the innovation challenges we found by analysing the Community Innovation Survey for the fish processing industry in Northern Norway. We have also given some possible solutions to the innovation challenges.

Table 5. Innovation challenges related to the fish processing industry in Northern Norway.

Activity	Innovation challenges	Possible solutions
<ul style="list-style-type: none"> • Product 	<ul style="list-style-type: none"> • Unpredictable supply of raw material • Resource mobility (shift between different kinds of raw material) 	<ul style="list-style-type: none"> • Enter new niches i.e. aquaculture of new species, to be able to have supply of raw material all year round
<ul style="list-style-type: none"> • Product development 	<ul style="list-style-type: none"> • Use of new raw material • Use of by-products • Use known material in new ways • Greater utilisation of fish • Product flexibility • Improve product quality 	<ul style="list-style-type: none"> • Internal R&D on product development • Be more open towards ideas sprung out from research milieus • Enter co-operation projects on product development with scientific milieus • Broaden product range • Efforts to direct links to food chains for new product ideas
<ul style="list-style-type: none"> • Production process 	<ul style="list-style-type: none"> • Reduce production costs (labour and fish) • Improve the labour stock • Improve production process • Improve production flexibility (both on product mix and volume) • Improve organisational rigidities 	<ul style="list-style-type: none"> • Internal competence building is important to be able to have a flexible and efficient labour stock • Aim for stable workforce, which provides valuable experience-based knowledge • Reduce internal rigidities • Enter into R&D projects with relevant milieus on how to make more cost- and resource efficient machinery
<ul style="list-style-type: none"> • Product market 	<ul style="list-style-type: none"> • Open up new markets or increase market shares (e.g., Norwegian food chains) • Increase market orientation • Develop own market channels 	<ul style="list-style-type: none"> • Improve distribution • Develop the market apparatus • Put pressure on supermarket chains to improve competencies on handling fish as raw material • Create a powerful lobby towards the market

The table shows that some of the innovation challenges found in the industry could be reduced if some links between firms and other actors could be strengthened and improved. Co-operation between similar firms for the development of a stronger market apparatus, for example, would strengthen the industry's bargaining power *vis a vis* big market operators, and possibly open up new markets or increase market shares. Firms do enter into co-operation with other Norwegian firms, but these tend to be firms that are part of the same company. An obvious hindrance to co-operation with firms in the industry is that these are firms' main competitors. However there are examples of competing firms co-operating on areas of common interest (e.g., in Båtsfjord). These firms are located in the same area and are thus more strongly embedded than other firms. There is a need for firms to be more market oriented, market orientation do also have a positive effect on firms innovation. Firms do value customer contact as important for innovation, this is not reflected in firms sales, 88%

of the sales in 1997 consisted of unchanged products. There is a constant need for innovation for firms to be able to survive.

Another solution can be found by a larger degree of co-operation activity between firms and the scientific community. There are a number of universities, colleges and research milieus in the region carrying out relevant research activities. Interviews with company managers indicate substantial variation in firms' familiarity with and knowledge about these milieus. Some firms try to keep up-to-date whilst others lack any inclination to do so, an attitude that is often tied up with previous negative experiences. Firms' attitudes to co-operation with these actors is often characterised by the view that 'others' understanding of the world have little relevance to their own understanding and experience. There are however also examples where such bottlenecks have been overcome and fruitful co-operation has been achieved. Company managers with positive experiences do not experience the same barriers in relation to establishing contact with research milieus. There is a great potential to be realised by developing contact with the scientific community in the region and elsewhere.

The survey indicates that there is no operational regional innovation system for the fish processing industry in Northern Norway. The reason for this is that the most important innovation input comes from actors that are international or in rare cases national (customers and suppliers of equipment). Firms' customers may be regional, but then most often act in the capacity of sales companies aimed at the EU (in particular) and other international markets, we see that the most important actors for the firm are located some distance away, a fact which company managers consider to be an obstacle to innovation.

The public infrastructure encountered by firms is of course regionally embedded, and there are a number of initiatives and programmes aimed at the firms. Our material shows that a large number of firms received support from public funds for their innovative activity. Thus the regional level is also important, at least in terms of economic support. It should not be a primary aim to create any kind of regional innovation system, as the industry is oriented towards a international innovation systems. However our study suggests at the same time that there are regional links which can be improved.

The next section will look closer into a public programme directed towards innovation in firms in Northern Norway that could help firms overcome their bottlenecks.

3. Is the New Technology Programme (NT) a policy measure suited for the fish processing industry?

The NT programme contains important elements in public support of innovation activity, particularly amongst SMEs in rural areas. Innovative activity is a process that demands active follow up on the part of the support structure. In particular, small firms often require advice and guidance during the course of a project. Support and advice may be needed that firms themselves do not recognise. Support needs can also vary during the course of innovation, and may be different from firm to firm. Consequently there is a need to develop a flexible apparatus and to tailor make support to meet individual needs.

The NT Programme is regional in the sense that it covers a multi-county section of Norway which is considered to be challenged by the same, or similar set of problems. It is also regional in the sense that the programme is derived from strategic analysis of the region's industrial outlook and prospects. The programme is in its third period, and is a non-traditional programme in the Norwegian context. The programme orientation of Norwegian technology and innovation policy consist usually of programmes of short or medium length orientation. The NT Programme started in 1987, and will be finalised in 2000.

The key objective of the NT Programme is described in the strategic document within one statement;

”The NT-programme shall create new activity in north Norwegian firms with the ability and commitment to innovate. This will be done through investing capital in the firms' projects with great potential. The basis for the projects shall be economic profitability, market potential and the exploitation of competitive advantages”.

The third period's statement on this point is somewhat adapted, to allow for ”investing capital, *contribute with competence as well as develop networks between firms and between firms and knowledge institutions*”. The very philosophy of the NT-programme gives much emphasis to the capacity and role of the programme staff. The NT-programme is not only a provider of financial resources, but of a variety of contributions. And the success of programme will be highly dependent upon the effectiveness of the staff, and the way of handling these contributions.

The table below gives a presentation of the NT-programmes.

Table 6. Key information of the NT-programmes policy instruments

	NT
Aim	Promote new innovative activities in companies
Time period	1987-
Budget	3,1 mill ECU per year
Geographical target area	Northern Norway
Industrial target area	Manufacturing and consulting
Main target group of firm	Technology based firms, in practice often SMEs
Responsible	The Norwegian Industrial and Regional Development Fund
Operator	An independent secretariat in Tromsø
Financial instruments	Ca. 50% support for innovation projects
Other instruments	Technology advisory contracts
Working method	All round and long-term support of firms, proactive

The programme gives financial support to product and process development as well as market development in Northern Norway. The programme helps to strengthen co-operation between firms and R&D institutions, both in Northern Norway and outside this part of the country, as well as with other competence centres through a system of “technological advisory contracts”.

The NT programme has three main types of policy instruments:

- 1) The programme provides financial support for projects in Northern Norwegian firms, and is aimed at projects that can be profitable within three to five years. Support is mainly given to existing firms but new firms are also eligible. Yearly budget is 3.1 mill ECU.
- 2) The NT programme also aims to strengthen co-operation between scientific communities and firms. Thus the NT programme has initiated a “sponsor grant” aimed at cases where one or more companies establish contact with a specialist researcher who has a well-established network within an area of significant strategic value to the firm(s). The researcher is charged with informing the firm(s) about innovations within an area and/or with solving concrete problems for the firm(s).
- 3) The third area of activity aims to increase competence levels and to develop networks of co-operation between firms. The NT programme arranges trade gatherings and courses 1-2 times a year, in for example, project management, patents, product development, negotiating techniques and company accountancy. Further, the programme aims to establish ‘meeting rooms’ for managers and to create networks for the exchange of ideas, experience and knowledge from innovation activities.

The NT programme is well-suited to the perspectives of modern innovation theory. The programme addresses innovation as an interactive and market-led activity. It

emphasises strong guidance of projects within the framework of explicit business plans. The region has relatively fewer innovative firms than the country as a whole. This low level of innovative activity is not due primarily to unfavourable industry conditions, indicating a potential for increasing innovation activity.

The next section will look closer into the different working methods and aims of the NT-programme, and see how they correspond to firms in the fish processing industry and their mode of innovation.

3.1 The NT-programme and the needs in the fish processing industry.

Below, the special features and working methods of the NT-programme is presented in three points. The aim is to see if there is correspondence between the programme and innovation performance and innovation barriers in the fish processing industry.

The target group.

Does the NT-programmes 'target' group, fit with our view of the firms in the fish processing industry in Northern Norway? Do these firms have the characteristics that are needed to participate in the programme?

The NT programme *selects the "best" Northern Norwegian firms*, that is, firms oriented towards innovation and which have the financial and human resources necessary to carry out development projects. The firms should be technologically advanced and have products with significant market potential.

We found that 30% of the fish processing firms did engage in innovation activity, there exist an innovative core of fish processing firms, the share being lower than for the fish processing industry in the rest of Norway. Since as much as 70% of the firms in our survey do not engage in innovation activity, many firms will fall out of the NT programmes 'target group' of firms, leaving a dual economy with a little hard core of innovators and a large group not being innovative. Firms in the fish processing industry have characteristics that in many ways could leave them outside the NT-programmes target group of firms, especially when it comes to financial ability and human resources to carry out innovation. As we have commented on earlier, fish processing firms often have low financial flexibility to carry out innovation projects, and the share of administrative personnel that can participate in such projects is often low. The industry is often perceived as 'low tech', our findings suggest that this industry actually uses sophisticated technology and practises to enhance productivity and innovation, making the term 'low tech' to this industry irrelevant. There should be initiatives to reach out to this large group of firms. With the existing competence on the fish processing industry and innovation that exists in the NT secretariat, they can easily function as 'gate openers' for non-innovative firms.

The NT-programme report many interesting innovation projects from the fish processing industry. However, they report that they need to have in mind the special characteristics of the industry when evaluating which projects they will follow up. The NT programme should for the fish processing industry also look towards the firms not being looked upon as 'the best', there are great potentials in the large share of firms perceived as 'mature' and 'low tech'.

All-round support

Innovative firms in the fish processing industry emphasised different obstacles in their innovation process. Firms see a great economic risk in carrying out innovation projects, and half the firms have received government support for their innovation activity. This suggests that financial support is an important enabling factor for innovation. The NT programme is first and foremost concerned to provide *financial support* to projects in Northern Norwegian firms. In this area the NT-programme does not have a function that is not taken care of by other parts of the public support system, as SND. However, firms also report other than economic factors to be hampering for innovation such as 'organisational rigidities' and lack of 'technological information'. These kinds of problems need another and more thorough approach to firm assistance. For a public programme to be able to help firms with problems linked to innovation, one must try to understand and elaborate firms limits and possibilities in the innovation project. This is both time consuming and demands great efforts in understanding the industry. The NT programme do offer such assistance, it *provides an all-round support* not available through other Norwegian technology development programs aimed at firms. This suggest that the programme might be able to help fish processing firms with aspects of their innovation process that they find problematic.

For a public programme to be able to engage in firms' innovation projects, it must have a flexible apparatus that can adjust to different industries or firms particular needs. The reason being that firms often specialise within certain areas of competence and expertise, and thereby see different obstacles and solutions to innovation. Firms limited resources and knowledge bases might narrow firms focus and thereby limit firm's ability to focus on vital elements of importance to the innovation process. For an innovation project to be successful, it must often be put in a broader context; i.e. firms must learn not to be technologically oriented in their development projects, and take account of other aspects of a project. As the innovation data shows, firms are very technologically oriented; new machinery and processes is the focus of the innovation process, and the largest share of cost used on innovation activity is used on acquisitions of machines and equipment. This leads to the fact that many firms are less focused on the market side of the production chain. Many firms therefore need help to develop their understanding of their potential market, and maybe also to develop their market apparatus. The NT programme has such a role in firms innovation projects, and is valuable helping firms see beyond their narrow focus. This approach takes account of the fact that innovation involves other activities such as trial production, design, and market research. The NT programme recognises this multi-faceted complexity in innovation with an appropriately varied set of instruments and actions well suited to each individual innovation project.

Non-technical support, such as assistance with project organisation, strategy-development and market research was seen as the most valuable input given by the NT-programme (Isaksen et. al. 1996), and not new technological solutions or broader technological contacts. It seems that firms already know the relevant actors that can provide technical information for their particular problem. However, the workforce in the fish processing industry often consists of people with very similar backgrounds that have learned to look for solutions in certain ways, adding little new insight or

competence to the industry. There is also a problem for firms to attract leaders from outside to work in the industry. The NT-programme do little to attract people to work in the industry, but they do engage people with a broad range of backgrounds, and with other qualifications, to participate in the project group that is established for all NT-projects. The project group is one of the most valuable information sources that go into the project, and the focus of the project group is always what is best for the firm. Persons chosen to be in the project group often have a critical and different approach to firms problems, since they often come from other industries or organisations. They will often present own ideas and working methods to the firms which in many instances have given valuable new input into innovation projects, and which have often challenged established ways of thinking. The projects group gives the firms external contacts with relevant persons or milieus, which go into the firm's broader network and adds to the firms information sources for innovation.

The fishing industry in Northern Norway have several schemes where they can receive financial support. The NT-programmes role as an actor giving all-round innovation support for firms, helping firms to set their innovation project in a broader perspective and helping firms with basic training in i.e. project planning is crucial. In many ways it seems like this aspect of the NT-programme should be expanded to be able to give more firms this valuable input.

Emphasis on the importance of co-operation.

Half the innovative fish processing firms in Northern Norway did participate in some kind of co-operation. However, the largest share of firms did co-operate with firms in the same enterprise group (mainly Norwegian but foreign also mentioned). The second most important co-operation partner where suppliers of equipment (both Norwegian and foreign). Firms did also report having co-operation with the scientific community, however small share of firms report this. The results show that some innovative firms do engage in co-operation, but there seems to be a potential for a larger degree of co-operation both with the scientific community and with customers.

Only a few firms did report having co-operation with customers, and parts of the fish processing industry seems to have little contact with markets outside Europe. There are great potentials in Asian and Eastern-European markets. Entering new markets would mean that firms would be less dependent on EU as a market. Firms could need help to enter these markets with new products. One possibility could be to enter in a co-operation with other firms wishing to approach the same markets.

As mentioned earlier there exist a number of institutions in the region that might be relevant as information sources or collaboration partners to firms in their innovation process. We found many innovation challenges both on the product, process and market side for fish processing firms. For example on the product side we know that the largest problems in this industry is the uncertainty in supply of raw material. As mentioned, some firms engage in fish farming to be able to have fish all year around. Research on different species that can be able to survive in the northern climate is carried out on research institutes in the region (i.e. Akvaplan-Niva AS). Contact with relevant research milieus could offset new activity in the firms. Developing new products is often said to be an area neglected by parts of the industry. Developing new products from fish is one of the main research areas for the research institute Fiskerforskning in Tromsø. When considering firm's innovation challenges (both on

the product and process side) there are several points where a better contact with research milieus and the firms can be seen as a solution to firms problems. As mentioned earlier firms see many obstacles in both approaching and co-operating with the scientific milieu, so even though the solution to many of the firms innovation obstacles lie there, making valuable contact is not free of problems. This is taken into account by the NT-programme which has initiated a system of “technological advisory contracts”, which links firms with the most central research institutions in Northern Norway. Technological advisory contracts can also be used in order to co-operate with centres elsewhere in Norway or abroad. The NT programme play an important role as a vigorous go-between linking research related activities with industrial development and industrialists.

3.2 The NT- programme in a broader context

From the point of view of firms the NT programme distinguishes itself from the Norwegian Industrial and Regional Development Fund (SND) in two areas in particular. Firstly NT is considered to provide a far greater degree of active follow-up of projects, and is considered to display greater interest in projects than is usual for SND. A typical comment by Northern Norwegian firms is that the NT programme is considered a partner to the firm, and not simply a source of funds. Secondly the NT programme is considered by firms to have a fast and flexible application procedure, whilst SND is considered more bureaucratic.

Differences in degree of follow-up and flexibility can in part be explained by different framework conditions for case handlers in NT and the local SND offices, as well as by different organisation and competency. The NT programme is aimed at a narrow target group of innovative firms, and each case handler is in charge of 15-20 projects which are continuously followed-up (as well as dealing with technological advisory contracts, courses, meetings etc.). The SND offices deal with all kinds of firm, including more “marginal” ones, and manage various types of policy instruments. At the policy division in the county of Troms, for example, each case handler is responsible for between 100-120 firms and entrepreneurs at any one time. The heavy work load and available resources mean that a lot of time is spent simply processing applications, and less time is available to follow up firms.

When compared with other company development and technology support programmes, NT stands out as more “all-round”. NT can cover all aspects of innovation processes and provides support on matters other than technology. Other programmes tend to concentrate on one stage in the innovation process, such as commercialisation of ideas from research centres, co-operation between firms and R&D institutions or co-operation with clients. An important point is that NT provides support for innovation (developing products and processes) *per se*, and not simply for particular stages in innovation processes.

The NT programme’s working methods are fairly unusual in an international perspective also. Various countries do have institutions which are responsible for long-term development of firms. What is unusual about the NT programme, however, is that it provides substantial support for development projects and that the support has both technological and have business dimensions. Compared to other public initiatives directed towards firms the NT-programmes working methods differ

from both the regional SND-offices and other programmes for technology development.

The NT-secretariat is perceived as an important conversation partner and motivating force for firms in their projects, and thereby fills an important role in firm innovation activity, especially for small firms. The NT-programme therefore stands out to be more 'all-round' than other programmes. Other programmes are often concentrated towards different stages of the innovation process, not seeing the process as a whole.

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STEP-gruppen ble etablert i 1991 for å forsyne beslutningstakere med forskning knyttet til alle sider ved innovasjon og teknologisk endring, med særlig vekt på forholdet mellom innovasjon, økonomisk vekst og de samfunnsmessige omgivelser. Basis for gruppens arbeid er erkjennelsen av at utviklingen innen vitenskap og teknologi er fundamental for økonomisk vekst. Det gjenstår likevel mange uløste problemer omkring hvordan prosessen med vitenskapelig og teknologisk endring forløper, og hvordan denne prosessen får samfunnsmessige og økonomiske konsekvenser. Forståelse av denne prosessen er av stor betydning for utformingen og iverksettelsen av forsknings-, teknologi- og innovasjonspolitikken. Forskningen i STEP-gruppen er derfor sentrert omkring historiske, økonomiske, sosiologiske og organisatoriske spørsmål som er relevante for de brede feltene innovasjonspolitik og økonomisk vekst.

The STEP-group was established in 1991 to support policy-makers with research on all aspects of innovation and technological change, with particular emphasis on the relationships between innovation, economic growth and the social context. The basis of the group's work is the recognition that science, technology and innovation are fundamental to economic growth; yet there remain many unresolved problems about how the processes of scientific and technological change actually occur, and about how they have social and economic impacts. Resolving such problems is central to the formation and implementation of science, technology and innovation policy. The research of the STEP group centres on historical, economic, social and organisational issues relevant for broad fields of innovation policy and economic growth.