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An empirical study of
the innovation system
in Finnmark

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Table of contents

TABLE OF CONTENTS	III
1. INTRODUCTION	1
2. GENERAL MAIN FINDINGS	3
3. CULTURAL IDENTITY AND INSTITUTIONAL BASIS OF THE FINNMARK REGION	5
3.1 Historical background to the development of Finnmark	5
3.1.1 The weak industrialisation of Finnmark.....	7
3.1.2 Today's industry and support structure	8
3.1.3 Physical infrastructure and communications.....	9
3.2 Education, knowledge and competencies	9
3.3 Finnmark's Regional County Council.....	11
3.4 Summary.....	12
4. THEORETICAL QUESTIONS AND PRESENTATION OF KEY THEMES OF REGIONAL INNOVATION SYSTEMS.....	13
4.1 Understanding the term 'Regional Innovation Systems'	14
4.1.1 Innovation and proximity between actors	14
4.1.2 Regional Innovation Systems.....	16
5. THE REGION OF FINNMARK. EMPIRICAL FINDINGS.....	19
5.1 Methodology.....	19
5.2 The region's role as economic base, and the importance of regional factors for firms' competitiveness.....	21
5.2.1 The region as an economic base.....	21
5.2.2 Regional factors of importance to firms.....	23
5.2.3 Co-operation and network between firms in the region	25
5.2.4 Summary	27
5.3 The Innovative System	28
5.3.1 Innovation costs - input in the innovation process	29
5.3.2 Different innovation costs	29
5.3.3 Support and other sources of input in the innovation process	32
5.3.4 Restrictions in the innovation process	33
5.3.5 Summary	35
6. NEEDS AND INSTITUTIONS FOR THE FUTURE RIS IN FINNMARK-CONCLUSIONS.	37
REFERENCES	41

Index of tables and figures

Figure 1. Percentage of employees with higher education by county, 1994	10
Figure 2. Number of respondents by industry (n=100)	20
Figure 3. Distribution of sales by innovative and non-innovative firms (n=100).....	22
Figure 4. Importance of general regional factors to firms competitiveness (n=99).....	23
Figure 5. Importance of regional infrastructural factors to firms competitiveness (n=99).....	24
Figure 6. Distribution of co-operation/network partners (n=62)	27
Figure 7. Number of innovative and non-innovative firms in the sample (n=100)	28
Figure 8. Distribution of total innovation costs (n=56)	30
Figure 9. Innovation costs in 3 different industries (n=40)	31
Figure 10. Factors seen to restrict product/process innovation (n=97-99)	34
Table 1. How to organise the regional economy of finnmark to make it learn better;	40

1. Introduction¹

Understanding the region as an economic and technological entity has become important for policy makers in Norway. There has been a change in regional policy away from a “redistributive policy” to policy more directed towards endogenous growth in the regions (Amdam et al. 1995). The “redistributive policy” was aimed at redistributing wealth from areas with high growth, investment and high rates of employment, to less prosperous areas. Potential for growth in the regions was supposed to come from external sources. From the end of 1970, endogenous development has received a great deal of attention in regional policy, focusing attention on the periphery’s own resources and internal growth potential.

The activation and utilisation of endogenous innovation resources for regional development constitutes an important challenge for technological-oriented regional policy, this is especially important in view of the increased globalisation which is highlighted by firm take-overs, co-operation between enterprises and the setting up of production sites with free trade zones (Koschatzky 1995). Globalisation together with the new concept of flexibility and optimisation of the production process made choice of location based on cross-spatial and cross branch networks possible, and started competition between regions to attract new firms and enterprises. The question for each region was then how to exploit its growth potentials. The answer was often aimed at interlinking diversified regional actors in innovative networks, for interactive learning (Tödtling 1994).

Increasing attention has therefore recently been given to analysing the regions on the basis of endogenous growth potential and as ‘regional innovation systems’ (Héraud 1994; Longhi and Quere 1994). On these bases this report will examine innovation activities and outputs at a regional level, discussing the importance of the region as a base for economic and technological activities of the firms located there. We have gathered information from 100 manufacturing firms operating in the administrative county of Finnmark in the farthest north of Norway. The findings in this report are empirical evidence from a survey based research methodology, together with results from interviews with firms and institutions in the region. The aim is to reveal characteristics of the ‘regional innovation system’ in Finnmark by focusing on the region as a source of firms’ economic and technological activities.

The rationale for focusing on peripheral regions, operating in traditional resource-based manufacturing industries, is to get a better understanding of how less-developed economic and technological regions operate. Too often, emphasis has been on core growth regions which have had great success as innovation systems, making comparisons to regions in Norway difficult. Lessons learnt from these regions are seldom applicable to regions with other characteristics. It is therefore necessary to start mapping ‘regional innovation systems’ (or lack of regional innovation systems) in less-successful areas, to try to determine what distinguishes

¹ Acknowledgement; Thanks to Arild Jansen at Høgskolen i Finnmark for his help in guiding his students in gathering data for this regional survey, and for his background material on Finnmark. He has also been contributing with valuable suggestion for the completion of this paper.

these types of regions from growth regions, in order to improve our understanding of different kinds of 'regional innovation systems'.

2. General main findings

More than half of the firms in our survey are small (56% less than 10 employees) independent firms (81% were independent as adverse to owned by another firm). One third of the companies are exporters, and the largest exportmarket is the EU. Firms' exportshare is dependent on the size of the firm. The smallest firms have the lowest share of sales to markets outside Europe.

55% of the total sales in Norway is sold in Finnmark, although being a small market, there seems to be firms that have a strong dependency on the regional market. The share of turnover sold in Finnmark is dependent on firm size, the smallest firms have the largest share, firms that employ less than 10 employees sell 84% of total sales in Norway to Finnmark. Spatial proximity to Norwegian markets outside Finnmark, do not necessarily have effect on firms sales. The southern parts of Norway is more important for firms sales then the neighbouring regions.

Firms that sell more than 50% of turnover to Finnmark (introvert firms as opposed to extrovert firms that sell less than 50% of turnover in Finnmark) has a larger share of small firms than extrovert firms, they do not participate in innovation, and they have a smaller portion of firms engaged in cooperation/networking with other firms in the region, than do extrovert firms.

As much as 58% of the firms take part in the innovation process, and will be categorised as innovative firms. On average the firms use 11,5% of turnover for product- and process development (on innovation), trial-production and product start-up has the greatest share. Only 4% of the innovation cost are used for market analysis. Different firms size and different industries emphasis different innovation costs. The smallest firms has a larger innovation cost intensity (innovation costs as share of turnover) than larger firms, but the number of firms engaged in innovation activity is much less for small firms. There is no difference in the number of firms engaged in innovation activity between independent firms and firms that are owned by another company.

Over half of the firms received financial support for innovation activities, firms between 50 and 99 employees had the greatest share of firms that had received financial support (63%).

Factors perceived as limitations to firms competitiveness are lack of risk/investment capital (especially small firms and firms that have innovation costs emphasis this), lack of support/infrastructure in the region, and lack of qualified personnel (a greater share of innovative firms and firms that are extrovert report this). As much as 60% of the firms participate in cooperation/network with other companies in the region. Smaller firms have a lowest share of firms participating in such activities than other size categories. The share of firms cooperating with suppliers (43%) is greater than the share of firms cooperating with competing firms (32%), this holds especially for the smallest firms, the opposite is true for larger firms (50 to 99) where the share of firms cooperating with suppliers is 30% and with competitors 50%. Only 11% of the firms do nor perceive innovation as important for innovation.

Proximity to customers/markets and possibilities for finance, are perceived as important regional factors for firms competitiveness. Proximity to suppliers is more important for companies that are owned by other companies than for independent firms. Infrastructural factors perceived as important to the firms are frequent reliable transportation systems and the quality of telecommunication. Proximity of HEI/research centres/science parks is not seen to be important for firms. Regional labour factors, such as quality of labour and availability of labour with specific skills are seen to be important for firms, especially for innovating firms and for firms that are independent.

3. Cultural identity and institutional basis of the Finnmark Region²

This section will shortly present the administrative region of Finnmark. It will give a short historical background of the development of the region and the industrial base. Some characteristics of the region today will also be given, both in terms of industry, education and research, infrastructure and administration.

3.1 Historical background to the development of Finnmark

Finnmark is the largest county in Norway, covering 48 649 km². The region has a long, complicated coastline and deep fjords, resulting in great distances between a widely dispersed populace. Climatic conditions make communications difficult during the winter, both by road as well as by sea and air.

The population today consists of approximately 76 400 inhabitants. Population levels in the region peaked in 1975 with approximately 78 500 persons, before falling to around 74 000 in 1988 due to emigration and a falling birth-rate. We can trace the current settlement of Finnmark back 2000 years. Of the three contemporary groups (Lapp, Norwegian and Finnish/Kvensk), the Lapp population were the first to inhabit the region. Their livelihood was essentially based on reindeer and the harvesting of natural resources. Permanent Norwegian settlement did not take place until ca 1300 AD and was concentrated around the coastal areas, relying on fishing as the main source of livelihood.

Fish resources off the coast of Finnmark and in the Barents Sea have played a decisive role in the economic, social and political development of the region. Until the second World War the majority of the population were settled on the coast, either employed directly in fishing or in fishing-related industry. The rest of the population belonged to either the Lapp or the Finnish groups. The Lapps were the larger group, and reindeer husbandry was by far their most important source of income, as well as being a bearer of culture. Finnish immigration from the 1700s until the latter half of the 1800s contributed greatly to the development of agriculture in Finnmark.

Historically, three countries have collected taxes in North-Troms and Finnmark, and it was only in 1826 that the border with Russia was permanently established. The uncertainty surrounding the border, and Finnmark's strategic position, meant that it was important for the authorities to establish Norwegian rule. One way in which they did so was through colonisation from the south. A strong policy of Norwegian culturalisation was practised towards the Finns and the Lapps through, for example, the development of the mines and industrialisation of the Kirkenes area at the end of the 1800s.

Buildings and other elements of infrastructure in Finnmark are relatively recent. In the last phase of the second World War, almost all buildings were destroyed. 10 400

² This section has been written mostly by Arild Jansen at Høgskolen i Finnmark, only with few supplements of the author.

homes, most industrial plants, roads, harbour constructions, telephone lines, power stations and fishing boats were burned. Post-war reconstruction of Finnmark entailed a degree of centralisation and alteration of settlement patterns, but was by no means as centralised as the authorities desired. Some coastal communities were not rebuilt, whilst communities such as Alta, Vadsø and Kirkenes experienced significant population growth and became important service centres.

The county is often subdivided into four geographic and industrial parts:

Coastal-Finnmark, west: Loppa, Hasvik, Hammerfest, Kvalsund, Nordkapp, Måsøy

Coastal Finnmark, east: Lebesby, Gamvik, Berlevåg, Båtsfjord, Vardø

These areas are dominated by fishing/fishing-related industries, as well as a significant tourist industry (in particular Hammerfest and Honningsvåg/Nordkapp).

Inland: Kautokeino, Karasjok, Porsanger, Tana and Nesseby; core Lapp areas. Reindeer and agriculture dominate here, as well as crafts (Douji) and tourism.

Service/administrative centres: Alta, Vadsø and Kirkenes. Kirkenes also has a large mining industry.

Traditionally, proximity to fishing resources has secured the economic basis for population of Finnmark, as well as the Pomor trade export of fish-products to Europe secured good economic development from the 1800s and well into this century. The general economic crisis in the 1930s led to strong population growth and positive economic developments for Finnmark, possibly because it was possible for many people to make a living of natural resources that were plentiful in the region. However, a range of factors have contributed to change the conditions of development, in the Northern region in general and Finnmark in particular. These include:

- closing of the border, and the end of the Pomor trade in 1917, which led to great losses for Finnmark. A situation arose where South-Norwegian interests took control of fisheries and fish sales. From being a centre of trade the region became a periphery to a well-established trade network that was controlled from the south.
- introduction of export regulations in 1932, which removed the rights of producers to export their goods. This function was thereafter carried out by well-established exporters from outside the region. The introduction of revised export laws in 1955 reinforced this structure, so that only a few firms in Finnmark possessed export permits.
- the war, in particular the destruction of the infrastructure and forced evacuation of the entire populace, which meant that practically all industrial activity had to be rebuilt from scratch, without significant capacity for self-finance.
- common ownership: the common ownership of fishing rights has led to over-fishing by the capital intensive ocean fleet. In the mid-1980s this led to a collapse of the fishing-stocks, in particular in the Barents Sea. This had particularly serious consequences for Finnmark. Strict quota regulations were introduced in order to rebuild stocks, and the coastal fleet in Finnmark emerged rather badly from these problems.
- concentrating investment on cornerstone industries such as the mines in South-Varanger, which ensured high levels of employment and income for many years, but which also entailed a high degree of vulnerability and significant problems in turnover when firms no longer operated securely.

These developments have resulted in a high degree of dependency on national and international capital. The size of the region's fishing fleet and fishing-industry has been severely reduced, and the degree of processing of resources is too low, even though sections of the fishing industry are significantly modernised and highly competitive (in particular Båtsfjord, see below).

The same development towards ecological imbalance can be seen on the Finnmark plains (Finnmarksvidda), where the industrialisation of reindeer husbandry is leading to the over-exploitation of pasture. This is a consequence of an externally-driven policy, supported by the most capital-intensive section of the reindeer-industry.

3.1.1 The weak industrialisation of Finnmark³

It appears to be common for all of North-Norway that no locally based industry developed before 1950. Ottar Brox finds the explanation for this in the easy access to natural resources (the sea, coastal areas and plains) which led to a widely dispersed population and a dominating domestic economy until well into this century, and in Lapp areas until the 1970s. In Finnmark, industry developed mainly in fishing and mining. Mining activities are by and large controlled by external forces, and local entrepreneurship has little influence.

Northern Norway was largely an egalitarian society, but the ownership of fishing grounds resulted in a clear class-society, where inhabitants leased grounds from the owner. This meant that in practice entrepreneurship was restricted to the fishing-grounds owners, who often had little interest in industrial development. From the late 1880s a local entrepreneur group, of local traders and fish-purchasers began to develop. However, these attempts were hindered by the fish-farming structure. The continuation of traditional fish-farmer society until the middle of the twentieth century was not simply the result of internal control, but also due to central government's regulation of economic activity, which included, for example, the protection of coastal fisheries, which entailed keeping modern fishing technology away from the coast. We thus find little locally based industrial development, compared to that, for example, found in Vestlandet (Western Norway).

After the second World War, the authorities initiated a policy of radical restructuring, through industrialisation of Northern Norway as a whole and Finnmark in particular. This was due to the low standard of living in the North, in addition to the authorities' opinion that the region contributed little to the GNP. This industrialisation was based on restructuring the fisheries into trawler fleets and all-year fishing, and the development of a modern processing industry. In addition, large-scale factories and mines were to be developed. The aim was to develop a small number of urban centres in Finnmark.

However, these plans met with strong local resistance, and a compromise was reached. The fleet consisted of a mixture of (externally owned) large trawlers, and a number of smaller trawlers. This illustrates the difference between Northern Norway,

³ This section is based on O Wicken "Fravær av industri og forsøk på å ta det store spranget", Arbeidsnotat STEP, August 1995.

with its small-scale seasonal fishing-boats, and Vestlandet, which has a far more capitalised and modern sea-going fleet structure.

3.1.2 Today's industry and support structure

The labour market in the region has changed since 1960, with a shift in line of industry from primary to secondary industry and services. The number of people employed in the primary sector in Finnmark decreased from 1960 to 1990 from 31% to 8%. For Norway as a whole the share was 6% in 1990. Employment in the public sector, social and private service sector, has in the same period risen from 16% to 41%. The average share for Norway in 1990 was 35%. Manufacturing industry in the county is dominated by resource-based industry, especially fishing industry. The resource based industry in the region has experienced a strong decrease in the value of production, degree of industrial processing and number of enterprises and employees compared to the rest of the country (Onsager & Eikeland 1992).

Traditionally Finnmark is the county in Norway that has had the highest unemployment rates, ranging from 2,8%-5,4%. The unemployment rate for Norway as a whole has risen dramatically the last years, so Finnmark now is on the average for Norway, 5,4%. Manufacturing industry employment in Norway as whole has been reduced by 35% from 1982 to 1992, for Finnmark by 37%. Problems in the labour market in Finnmark lie in the trade-off between the skills wanted by firms in the region and the skills the labour market can offer.

Economic life in the county is characterised by resource- and economic cycles. In the fish industry employment figures have declined from 3 535 persons in 1982 to 2 037 persons in 1992. The number of firms in the fish industry has declined since 1985 from 91 firms to 48, but the industry still accounts for 78% of people employed in manufacturing industry.

In recent years this region has experienced a phase of renewal and economic recovery, stimulated by the higher prices of its products and increasing extraction of raw materials. The northern Norwegian industrial environment is small, segmented and heterogeneous, composed of firms with very different goals for production and adjustments, which creates special challenges for regional policy (Onsager & Eikeland 1992). The regional gross value added at market prices for Finnmark is the lowest in Norway, and there has been a decline since 1986. The number of patents is very low in Finnmark, with 5 in 1982 and only 1 patent in 1992. The number of patents must of course be related to the small number of people living in the region, and that the industry is dominated by fishindustry.

The following support arrangements are available to businesses in Finnmark:

SND⁴, Support for businesses in inner Finnmark, Restructuring-programme for inner Finnmark, Further community development in Finnmark, Lapp business fund,

⁴ SND - the Norwegian Industrial Regional Development Fund - has as its aim to establish a profitable socioeconomic environment for industrial development i Norway. SND shall help product development and establishment of new firms, and help modernising and reajust Norwegioan industry. Employment in less favoured regions is of great concern to SND. SND gives loans, garanties, economic subsidies.

Council business funds and Self-financing for youth investment in coastal fishing-vessels.

Responsibility for advice services for small and medium sized firms was handed over to the county councils in 1988. In Finnmark it was reorganised through *Finnmark næringservice* (Finnmark business service, FNS), in which the council has an 80% holding. The purpose of FNS is to strengthen and develop business activities in Finnmark by helping firms to develop, arranging and encouraging contact-networks and improving competence amongst fishing and animal husbandry firms, tourism and trade. These advice services are to a certain degree free of charge, and normal consultancy services are also offered.

FINNUT is an organisation for development of industry in Finnmark, which is owned by the county Council, the banks and local councils in Finnmark. Its aim is to be a driving force behind processes and projects which create activity and renewal in industry and in the public sector. In individual council areas we also find similar council-run development organisations.

In addition, there are various private consultancy and advice firms, some of which have high levels of competence and international networks.

3.1.3 Physical infrastructure and communications

Until the second World War, sea traffic was the most important form of communication. However, this has been replaced over the last forty years by road and - not least - air traffic. Today the county has three large airports and ten smaller ones. The last ten years have seen significant development of the road network, with all densely settled areas having all-year road connections. It may be useful to remember that the inland road (between Kautokeino and Karasjok) was only built in 1986.

3.2 Education, knowledge and competencies

There are four further education schools in the county (Alta, Hammerfest, Vadsø and Kirkenes), as well as Lapp-speaking schools in Kautokeino and Karasjok, while all local councils (except Nesseby and Kvalsund) have school branches. In addition, some branches offer fishing qualifications; Honningsvåg (fleet-orientated) and Vardø (fishing-industry related). The further education school in Kautokeino also offers reindeer husbandry courses.

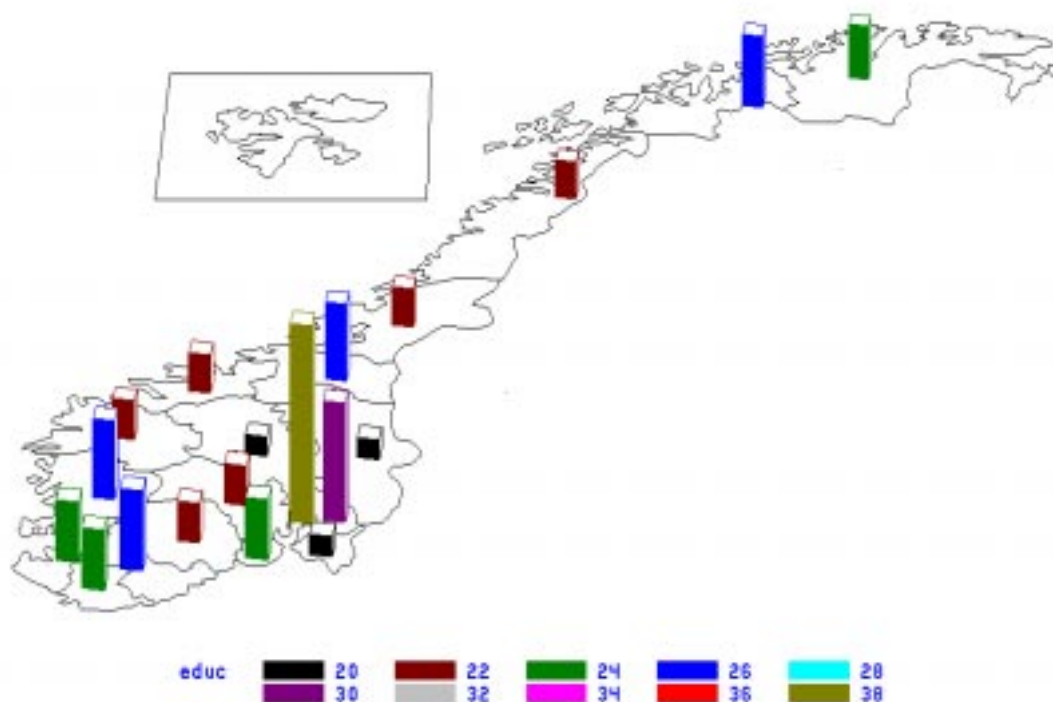
There are today two colleges of higher education in the county:

- *Høgskolen i Finnmark*, based mainly in Alta, with health-service education based in Hammerfest. The school in Alta offers economic-administrative and managerial courses, animal husbandry, information technology, Finnish and Russian, social-work and health-care, physical education and outdoor life, as well as teacher-training. There is a health-service department of education at Hammerfest hospital. The regional college in Finnmark (*Høgskolen i Finnmark*) is an important educational institution for the region. In 1994 67% of the enrolled students came from Finnmark. From the neighbouring regions Troms and Nordland, 12% and 5% were enrolled respectively. The last five years have seen a

steady increase in student numbers at the college. The most popular subject has been 'travel and tourism', which can be explained by this being a growing industry in the region. More administrative and economic subjects, and subjects related to telecommunication, have declined in the period 1991-94, indicating that these subjects have reached their peak as being the most popular subjects. A survey shows that 98% of the students that finished college in 1991, and who lived in Finnmark, started their work career in work related to the public sector.⁵

- *Samisk Høgskolen i Kautokeino*, which offers teacher-training, Lapp language and culture, and other subjects.
- In addition, the Narvik engineering Høgskole has a branch at Alta, where first and third-year electronics and data-technology are offered. Further, there is a technical college in Alta.

Figure 1. Percentage of employees with higher education by county, 1994⁶



The average share of the population with higher education has risen in Finnmark, but is still below the national average. The above figure shows the percentage of employees with higher education by county. The average number of people with higher education in employment is 26% in Norway. The capital area (Oslo and Akershus) has the highest percentage of employees with higher education. Finnmark is below the national average, with approximately 24%. It is women, especially younger women, that account for the greatest share of higher education among people in Finnmark. Women with higher education tend to start working in the public sector; as many as 70% of the people employed in the public sector are

⁵ Kandidat undersøkelse 1991. Høgskolen i Finnmark, våren 1991. (Det regionale høgskolestyret i Finnmark).

⁶ Non-corrected numbers based on administrative registers (in Statistics Norway).

women. Although in general the development of the population is positive, the demographic conditions in some of the coastal communities are very worrying. The younger, well-educated female members of the population cannot find work and subsequently move from Finnmark. The proportion of working women is lower in Finnmark than in the rest of the country. A separate programme aimed at encouraging women has been established, offering education and business-establishment support, support for women in fishing, personnel and career development, and all-women enterprises within Lapp development projects.

During the 1970s and 1980s three research institutions were established in Finnmark⁷. These continue to exist, and have concentrated within different areas of industry and society. In addition, several consultancy firms have been established in the region, with customer from within and outside the county. Some also have customers from abroad (especially from Russia).

The three research institutions are;

- *Finnmarksforskningen (FiFO, Finnmark Research)*, established in 1988, is oriented towards natural sciences and technology, covering aquaculture, geology and exploitation of resources, information technology and some aspects of tourism. It is largely financed through public channels (Ministries, SND and the Research Council, Landsdelsutvalget for Northern Norway. Less than 5% is financed by private firms).
- *A branch of Norsk Institutt for By og Regionforskning (NIBR, Norwegian Institute for Town and Regional research)*. Deals with social science issues. All relevant finance is from public bodies.
- *Nordisk samisk Institutt i Kautokeino (Nordic Lapp Institute in Kautokeino)*. Carries out research into Lapp language, literature, culture and history.

3.3 Finnmark's Regional County Council

The Finnmark County Council (fylkeskommune) is the political dimension in the region, and represents the people in the county by elections (every four years) to the chief administrative body of the county (fylkestinget). The county council is an administrative unit: it should be close to local realities whilst at the same time having political influence and resources to relate to development and planning in society as a whole. The county council has the right and the duty to have opinions on conditions that are important for the development of the county.

Regional political opinions are implemented in the 'county-plan' (fylkesplanen), which is thus a regional political plan for development of the county. The plan focuses on development trends, discusses core areas, and sets goals for the development of the county. The planning process in the county has a double governing function. Firstly, it is an important steering mechanism for the county council to enable overall development of the region. Secondly, the county-plan is a

⁷ Researchers are today employed in 4 institutions; Høgskolen i Finnmark, Finnmarksforskning, NIBR.Nord-Norge og Nordisk Samisk Institutt i Kautokeino.

means by which central government is able to promote national goals and interests in social planning.

The council is based in Vadsø, which is also the seat of the chief administrative officer. In addition to the general areas of concern to industrial development in the region - such as education, communications, culture and health - the county council deals with important regional-political offices tied to development of business and area-planning.

The department of development is organised into three sections

- fishing, sea-use and resource management
- tourism, private sector services and trade
- other industry and business activity

Their contribution consists of planning and enterprise-related activities, as well as processing applications for - amongst other things - SND funds. During the period of decentralised councils (1989-91) the chief administrative officer administered most state R&D and other funds, and many developmental programmes were carried out, aimed at - amongst other things - the fishing fleets and industry, as well as IT.

3.4 Summary

The greatest proportion of the work-force in Finnmark is employed in the public sector and the social and private service sector. The number of people employed in the primary sector has decreased drastically during recent decades, and now accounts for only 8% of the work-force. Manufacturing industry in the region is dominated by traditional resource based industries, which are now in a period of revitalisation after major crisis in the 1980s. The region's unemployment rate - traditionally one of the highest in Norway - is now level with the national average, which is largely explained by the drastic rise in unemployment in Norway. Finnmark has the lowest gross value added in Norway in the period from 1986 until 1990. Few patents are registered in Finnmark: in 1992 only one was registered.

The average number of people with higher education in employment in Finnmark is only slightly below the national average, but the traditional industries have problems with attracting younger people. Most of the students finishing the regional college find positions in the public sector, seeking job security.

The Finnmark county council has many problems to relate to, since they have regional responsibility for developing and planning a better future for the people living there, and for the regional economy. The county of Finnmark can not be called a successful region in Norway, but there are sub-regions and industries that are very successful. This report will focus on this not-so-successful region which is dominated by traditional resource based industries.

4. Theoretical questions and presentation of key themes of regional innovation systems.

Social scientists have made efforts to understand the economic and technological dynamics of industrial systems operating in particular regions or localities. This is especially evident in the arena of industrial geography where models are often based on the much cited ‘industrial districts’ concept of Marshall (see Brusco 1990; Amin and Robins 1990; Asheim 1992). Thus, different commentators focus on the economic and technological dynamics of ‘technology’ districts (Storper 1991), ‘growth poles’ (Perroux 1955), ‘clusters’ often incorporating high technologies (Porter 1990), innovation networks (Cooke and Morgan 1994) and other types of ‘innovative milieus’ (Castells and Hall 1994). These theories all have in common the wish to better understand the technological capabilities and social structures tied to specific regions that are the driving force behind growth of the firm.

The above mentioned theoretical contributions all differ in terminology, but have common ideas about the importance of inter-firm relationships, such as co-operation between firms, often citing the importance of trust and informal interaction in social networks (Castells and Hall, 1994).

The importance of geography to innovation is also stressed in that spatial proximity between actors in the ‘innovation system’ is seen to provide synergetic relationships owing to aspects of common culture and understanding, as well as the possibility of frequent ‘face to face’ meeting between managers and others. These relationships can further be seen to provide external economies which can be exploited in the provision of innovation services and support. This is emphasised by Storper (1991) who states:

“Innovation and modification of products and processes, i.e. innovation and learning, rests on an extraordinary complex variety of institutions, social habits, ideologies and expectations, and that even firm and market structures are to a certain extent outcomes of these underlying social structures”

where the social structures are seen to be bound to specific regions.

Many existing studies are seen to be ‘place specific’ and based on observations from particular regions or localities where the innovation system is highly visible. This includes regions such as Silicon Valley in California (Saxenian 1985), the ‘Third Italy’ (Brusco 1990), and Baden Württemberg in Germany (Cooke and Morgan 1994). As such, there has arguably been an overemphasis on success stories in large regions in Europe, while the criticism also points out that the sporadic nature of such studies often results in inconsistency in use of conceptual tools across different studies. This also creates difficulties for the application of findings from such studies, particularly when attempting to analyse innovation systems or innovation dynamics in other, smaller and less technologically advanced regions, where innovation dynamics are less obvious.

Other authors and researchers approach problems related to the regional dimension of the innovation process from another standpoint, including ideas from evolutionary

economics, systems theory and innovation theory. With the increasing realisation of innovation's complexities, this has given rise to the idea of systems or network models for mapping innovation (see especially Lundvall 1992). Such approaches may be discussed in terms of different types of systems such as social, economic, political and scientific. The context within which, for example, firms conduct innovation, is seen to be highly important and may be modelled by analysing the interrelationships between social, economic and technological systems. There are various components and linkages within such systems, including other firms, such as customers and suppliers; education institutions and research laboratories as sources of skilled labour and knowledge; government agencies as sources of finance, regulatory constraints and support for innovation; financial agencies such as banks or venture capitalists; and providers of business services. Such systems models are becoming increasingly evident in innovation studies (see for example Lundvall (1992), Tödting (1994)).

Systems models may however be criticised as ignoring the role of factors arising from the particular locality or region within which the system operates; this despite attempts to investigate the 'embeddedness' of firms within particular cultural environments. Despite this, the studies and research programmes which have been mentioned here raise key questions concerning the role and importance of geographic factors in the operation of the social, economic and technological systems within a specific region. Treatment of these questions forms an important basis for our research, and the next section will look more closely at the concept of a "regional innovation system" (RIS).

4.1 Understanding the term 'Regional Innovation Systems'

There is no coherent and sharply defined theory of "regional innovation systems", rather it is a result of theories from many different 'schools'. It includes elements of development theory, evolutionary theory and the above mentioned theories from economic geography. The concept of RIS is closely linked to the concept of "National Innovation System" brought forward by Lundvall (1992). This section will describe these innovation systems. However before doing so it is important to define what is meant by 'innovation', and thereafter to look at the link between innovation and geography.

4.1.1 Innovation and proximity between actors

Nelson & Rosenberg (1993) use a broad definition of the term "innovation". It includes the process in which firms introduce product design and production processes that are new to the firm but not necessarily to other firms, whether abroad or at home. Innovation is therefore a subjective term that will vary between different firms and industries. Innovations are difficult to compare, and difficult to measure (Nås, Sandven, Smith 1994). In this paper we are concerned with technological innovations in the firm, such as product and process innovation.

The focus on innovation is linked to its effect on economic activity, and thereby on economic growth. Innovations are rooted in the production structure and institutional set-up of an economy. As Lundvall (1992) notes:

“...it is assumed that the most fundamental resources in the modern economy is knowledge and, accordingly, that the most important process is learning”.

Likewise the ability to forget (creative forgetting) is looked upon as positive for innovation because habits in the economy might block potentially fertile learning processes (Johnson 1992).

The innovative process is characterised by “uncertain activity of search and problem solving based upon varying combinations of public and private (people-specific or firm-specific) knowledge, general scientific principles and rather idiosyncratic experience, well articulated procedures and rather tacit competencies” (Dosi 1988). Modern innovation theory perceives innovation as a complex non-linear process that involves different actors and sources for knowledge generation. Innovation and the spread of new technology is a complex interactive and collective process in which communication, co-operation and co-ordination of different actors involved is necessary for generating and spreading new products and processes (Kline and Rosenberg, 1986).

“ The learning process that takes place as users try to adapt technological potentials into their purpose is an important precondition for economic success and economic restructuring”(Körfer and Latniak 1994).

As mentioned earlier, innovation is tied to the process of learning, which is very dependent on contacts between persons and milieu with great diversities. These diversities are related to differences in work experiences and sources of knowledge, and the importance of sharing these experiences. Co-operation between different actors enables the diffusion of experiences. Not only economic actors should co-operate; research institutions, higher education, vocational education, business service centres, business consultants and public institutions should interact for reciprocal sharing of technological knowledge. Interaction between different actors is a potential source for learning.

The uncertainty of the innovation process and the importance of learning means complex communication between the parties involved (Isaksen 1995). Innovation demands co-ordination of both technological and economic activities in the firm.

These views on innovation indicate a more sociological view of the process, since it involves interactive learning between actors that are socially embedded, who act in an institutional and cultural context. “This implies that technological innovation...is increasingly a product of social innovation, a process happening both at the intra-regional level in the form of collective learning processes, and through inter-regional linkages facilitating the firm’s access to different, though localised, innovation capabilities” (Camagni 1991). Smith (1994) argues that innovative firms must be understood as parts of technological paradigms or regimes, i.e. like more or less formal networks of relations between firms, markets, public sector (universities, research institutions). These complex sets of institutions and environmental factors make up a system of innovation, which usually has specific geographic and political boundaries. Such systems can be understood as either as a regional system of innovation (perhaps crossing national boundaries) or a national system of innovation.

Geographic proximity between actors will often be a prerequisite for their interaction. Proximity makes it possible to create informal regional capacity based on personal relations which can create new ways of co-operation. The importance of geographical proximity is discussed by Camagni (1991);

“ a local milieu may be defined as a set of territorial relationships encompassing a production system, different economic and social actors, a specific culture and representation system in a coherent way, and generating a dynamic collective ‘learning process’.....That is reducing the degree of static and dynamic uncertainty of firms by tacitly or explicitly organizing the functional and informational interdependence of local actors....”

Such a milieu might act as an incubator for innovation and technological development, and suggests that a regional economy is a relevant environment for a system of innovation, consisting of all interrelated, institutional and structural factors in a region which generate, select and diffuse innovation.

4.1.2 Regional Innovation Systems

How then should one understand the concept of RIS. First of all, a ‘system’ is “anything that is not chaos” says Boulding (1985), and can be understood as elements and the relationships between these elements.

“A system of innovation is constituted by the elements and relationships which interact in the production, diffusion and use of new, and economically useful, knowledge and that a national system encompasses elements and relationships, either located within or rooted inside the borders of a nation state” (Lundvall 1992).

A Regional Innovation System must be viewed as a parallel to Lundvall’s concept of national innovation systems, and will therefore be related to the regionally located institutions that determine the innovation capacity in the region. But, the region can not be viewed simply as a ‘micro national system’ because (as noted earlier) the region has a synergetic meaning by itself, not always found to the same extent at the national level. There will not necessarily be an “operative” RIS even if the region has all the institutions that are needed (Isaksen 1995). Spatial proximity between actors is per se no precondition for the emergence of an industrial network. Such network linkages must often be promoted, and is an important field of action for regional policy.

How then should one identify a regional innovation system, and what are the performance indicators? There is a theoretical challenge in integrating analysis of innovation and technological change with regional analyses, and making them operational. As for the national innovation system, the RIS performance should “reflect the efficiency and effectiveness in producing, diffusing and exploiting economically useful knowledge” (Lundvall 1992). One indicator for this performance, also used in our survey, is the proportion of new products in sales (Kristensen and Lundvall 1991). This indicator says something about the extent of innovation activity, but will tell us nothing about ‘how innovation takes place within the firm or within a region’, which is what we are interested in. The problem so far is how to find quantitative measures which can give RIS a meaning, and help us improve our understanding of the importance of the region in firms’ innovation processes. Even if there are indicators that can and are used, there are still many questions on how to interpret them: how strong must the interrelatedness between

actors be, and what 'sort' of relations (only relations that involve innovation) are we interested in when defining a RIS? How great a portion of the firms must take part in the innovation process, and use institutional and structural factors in the region, to be able to call the region a RIS?

The definition of a RIS is theoretical, and raises many questions about how to use and measure it. Another question is: how realistic is it to try to construct 'innovation system' definitions which are applicable to a whole range of different localities and regions (Higgins 1995). To what extent can traditional, mature, often resource-based industry, operating in densely populated areas in Norway be analysed by concepts developed by looking at successful regions in large areas in Europe where innovations links are strong? Northern parts of Norway are characterised by a considerable diversity in industry sectors, forms of ownership and geographical location (Onsager & Eikeland 1992). The manufacturing sector in this region might be called segmented and scattered, synergy-effects from information sharing and co-operation between firms in the same industry are often difficult. But, is there still a RIS in Finnmark, or are the firms in the region part of a national or international innovation system, or is innovation activity more or less an isolated process within each firm?

5. The region of Finnmark. Empirical findings

The aim of this chapter is to see how important the region is for firms' learning processes in Finnmark, and to get an understanding of how best to organise the regional economy to make learning possible. This is done by looking at factors related to the firms' economic and innovative activity. The last section will look especially at firms taking part in the innovation process, to see what kinds of need they have that could be (or are) accounted for by the region. This chapter use quantitative and qualitative data gathered from firms and institutions in the county of Finnmark.

5.1 Methodology⁸

This survey will use the same definitions and questions on innovation inputs and outputs, and questions related to a range of locational issues, as those used in a study of another region in Norway, namely Møre & Romsdal (Wiig & Wood 1995). The questionnaire used as a background to this report has been slightly modified as a result of our experiences with the Møre & Romsdal survey. These surveys are the first in a series of regional studies in Norway, and might be looked upon as pilot studies for testing out regional indicators. The indicators are taken from related studies in this field.

During the 1980s a number of independent research teams attempted to develop survey approaches to innovation which would widen the scope of statistical methods in innovation analysis (for an overview of such work, see Smith 1992). These surveys mainly attempted to collect data on new product development, and on the firm-level activities which supported such development. In the early 1990s, these approaches were synthesised by the OECD into a statistical manual which recommended a future 'standard practice' for the collection of such data. This approach was taken up by the European Commission, in a collaborative action involving DG-XIII (European Innovation Monitoring Initiative) and Eurostat, who implemented a 'Community Innovation Survey' in all Member States in 1993/4. This survey collected harmonised data on approximately 40 000 firms.

Simultaneously with this exercise, the European Commission sponsored a study to explore the possibilities of extending this approach to a regional level. This project, known as ERIS (European Regional Innovation Surveys), was important background for the study reported here.

The Community Innovation Survey collected three broad types of data. Firstly, economic data on the introduction of new products and sales, R&D and non-R&D inputs to innovation, sales and employment. Secondly it collected binary data on, for example, patterns of technological collaboration. Finally it collected ordinal data, asking firms to rank the importance of various information sources, obstacles to innovation, support measures, and so on.

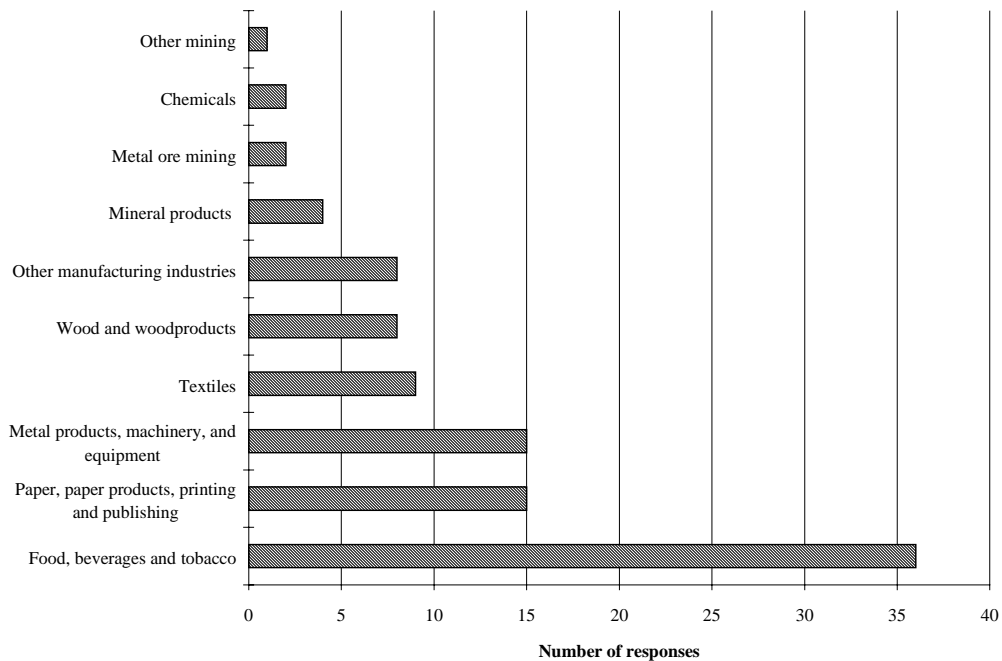
⁸ The first part of this section is taken from Wiig, H. & Wood, M. "What comprises a Regional Innovation System? An Empirical Study". [Step report 1/95](#).

This survey (as in the Møre & Romsdal survey) uses definitions and questions on innovation inputs and outputs identical to those used by the Community Innovation Survey. We also adapted the questionnaire to reflect a range of locational issues, such as location of main suppliers and customers, roles of specific regional agencies, importance of specific regional infrastructural institutions and so on.

A postal survey was sent to the gross population of manufacturing firms in Finnmark. We started out with 407 firms. However a large number of firms (approximately 174) were either not relevant (that is, they had been mis-classified as being involved in manufacturing production), or were impossible to contact, reducing the gross sample to 233 firms. Of this 51 firms declined to respond, and 93 firms we still had problems with getting hold of. We received a total of 100 responses, a response rate of 43% of the population. A subsequent non-response analysis was carried out with the 51 non-respondents, which suggested that there were no significant differences between respondents and non-respondents. We also carried out interviews with 5 firms in the region; 3 from the fish industry, 1 in mining and 1 in wood products. We also held interviews with the regional college in Alta, the regional research institution Finnmarksforskning, a consultancy firm and a representative from Finnmark County Council (department of industry). The interviews were structured around key issues related to 'innovation in firms and the importance of the region'.

The number of respondents is divided as follows on industries;

Figure 2. Number of respondents by industry (N=100)



5.2 The region's role as economic base, and the importance of regional factors for firms' competitiveness

This section will firstly look more closely at the importance of the region as an economic environment for the firms located there, by looking at firms' regional input-output relations. Secondly it will examine regional factors of importance to firms, before turning to firms' networking/co-operation with other regional firms. How important are these economic links and regional factors to firms located there? In particular we will focus on the differences between innovative⁹ and non-innovative firms. Differences between firm sizes and how they relate to the region will also be emphasised.

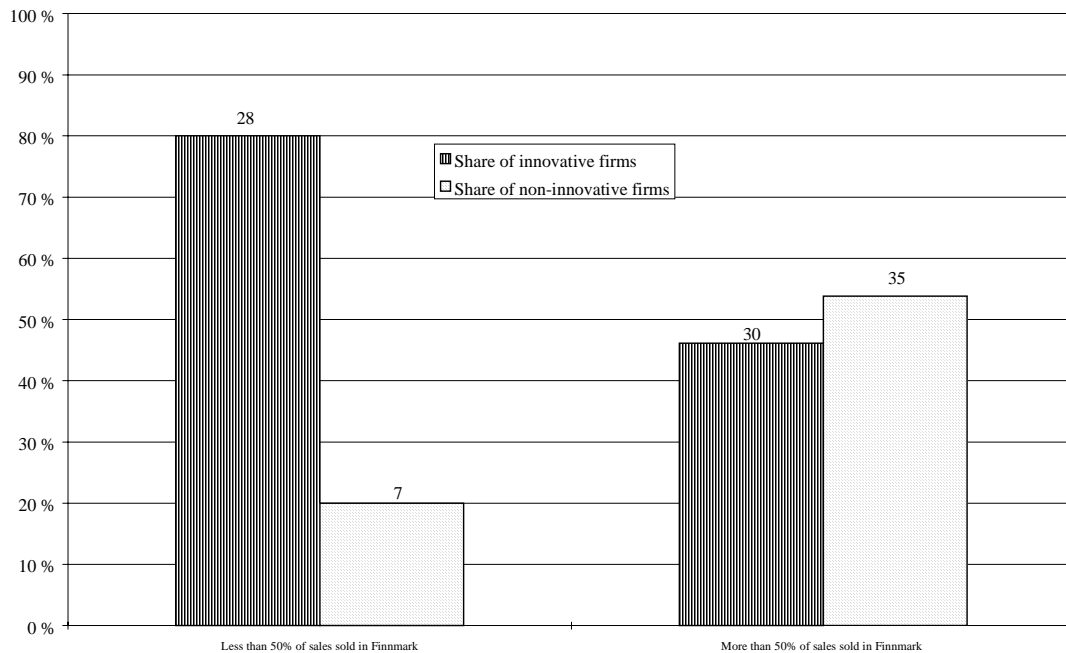
5.2.1 The region as an economic base

Does the region function as an economic base for firms' activities, or do firms depend on firms outside the region for sales and supplies. We are interested in finding out to what degree the region functions as an 'economic system' for firms located there.

As many as 80% of all firms sell some of their turnover to the region. Regional markets are important to firms, and both innovative and non-innovative firms have strong economic ties to the region, even though innovative firms have a smaller average proportion of sales to Finnmark compared to non-innovative firms (51% - 66%). Looking at how this relates to firm size, we find that firms with fewer than 10 employees have 84% of their domestic sales to markets in Finnmark. The share of sales to the region reduces as firm size increases. Non-innovative firms with less than 10 employees have as much as 96% of domestic sales going to Finnmark (innovating firms have 67%).

⁹ Innovative firms are firms that say they have developed new or have changed existing products and processes during the last three years.

Figure 3. Distribution of sales by innovative and non-innovative firms (N=100)



The figure shows that the share of firms that sell most of their products to the region (more than 50% of total sales to Finnmark), is overrepresented by non-innovative firms. The firms selling mostly to the region are concentrated within three industries; 'Food products' (14 out of the total 36 firms in the sample), 'Paper, paper products, printing and publishing' (13 out of the total of 15) and 'Metal products, machinery, and equipment' (13 out of the total of 15). Why is there more non-innovating firms in the group of firms selling mostly to the region? Does the region consist of few demanding customers?

In output terms non-innovative small firms are more dependent on the region as an economic environment for sales than innovative firms. Rothwell (1979) reports these results when examining the effects on product and process development in firms in the European Agricultural Engineering Industry. His findings are of interest here:

"...total reliance on local markets often resulted, in the longer term, in technological backwardness in the smaller firms. Small firms, supplying local farmers with conventional equipment, and successfully selling all they could make, failed to detect changes in technology introduced by their larger, less parochial (often foreign) competitors"....it appears that while small independent firms can be highly innovative, the number and nature of their innovations will depend to a larger extent on the technological requirements of local markets"(Rothwell and Zegveld 1979).

Our results indicate that firms which are mainly oriented towards the regional market are not subject to the technological demands and specifications that motivate for innovation, and that this may effect their innovativeness. The explanation could also be linked to the fact that firms selling mostly to the region are small firms, and that certain less innovative industries dominate. Another explanation could be that the regional market becomes too small for innovating firms, and that this prompts them to move into external markets.

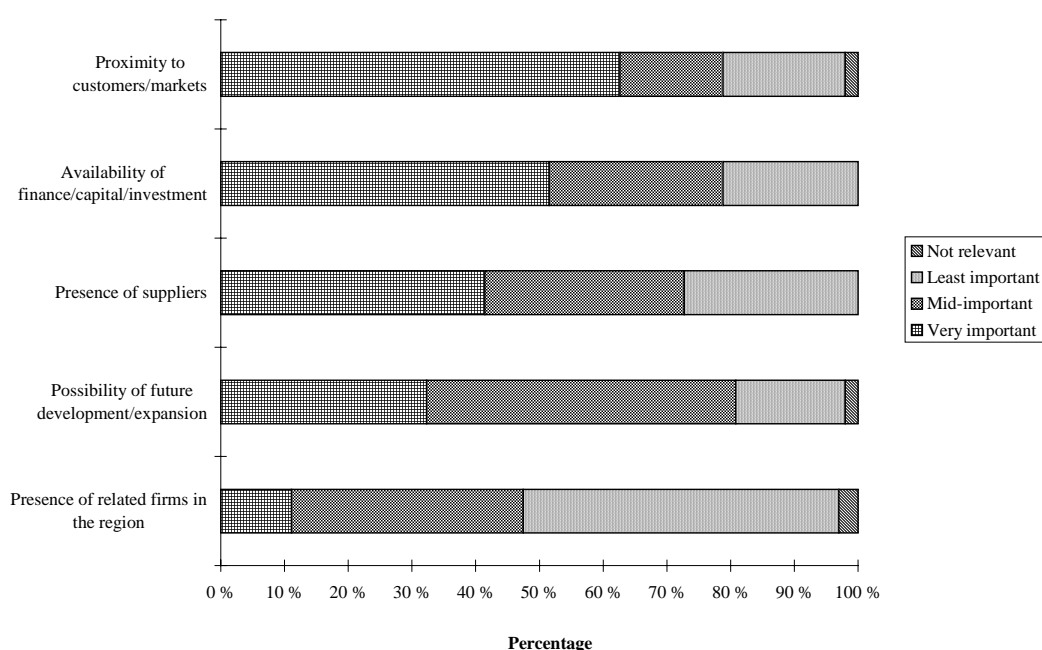
As many as 31% of firms have their suppliers in the region, with non-innovative firms having a greater share (34%) than innovative firms (28%). These results

indicate that the region is important for firms' input and output relations, especially for non-innovative firms and for small firms. Non-innovative firms sell most of their products within the region, and receive a large part of their supplies from the region. There is evidence to suggest that the region forms an 'economic base' for firms located there, especially for small non-innovating firms. The next section looks at regional factors of importance for the firms.

5.2.2 Regional factors of importance to firms

This report puts particular emphasis on the region as a source of innovative activity in firms. It is therefore interesting to look at what regional factors firms consider important for their competitiveness, especially innovating firms. Focusing on these factors can help us to understand the dynamics of a region, and what makes it a locational option for firms.

Figure 4. Importance of general regional factors to firms competitiveness (N=99)



The results in the figure above emphasise the importance of the region as an economic base: 63% of the firms perceive proximity to markets to be a very important regional factor. This is the regional factor that the most firms have considered 'very important'.

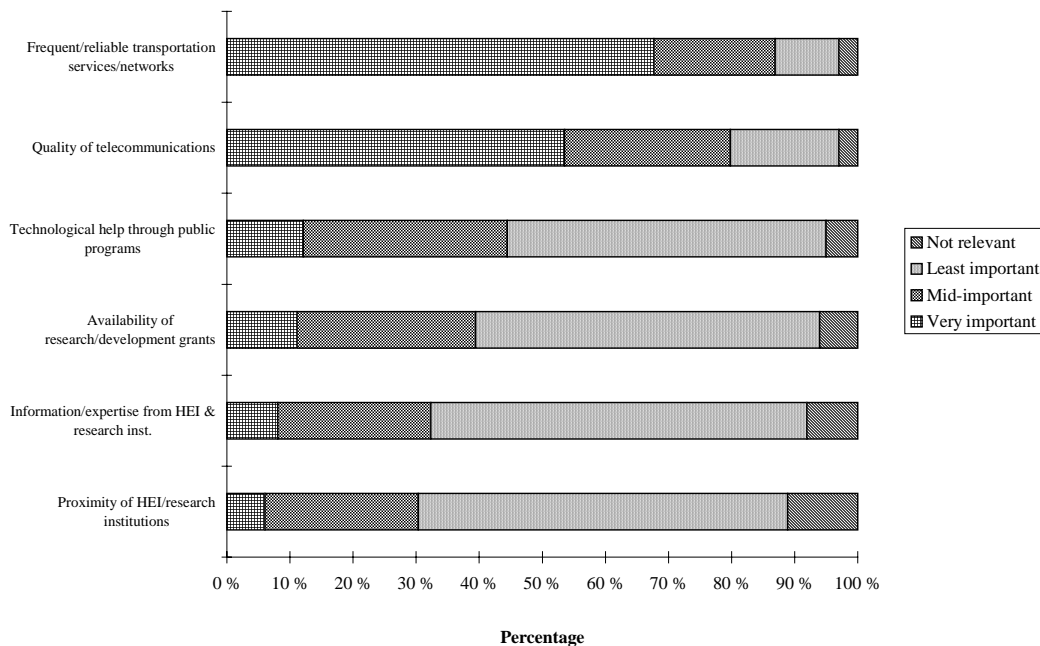
The importance attached to proximity to markets varies between firm size. It is a more important factor for small firms than for large ones. There is no difference between innovative and non-innovative firms in how much importance they attach to proximity to markets. The presence of suppliers is relatively important for firms in the survey, 41% see it as 'very important', and 31% see it as 'fairly important'. As many as 49% of the innovative firms see proximity of suppliers as 'very important', and only 31% of the non-innovative firms, indicating that presence of suppliers might be an important locational factor for innovative firms to a greater degree than for non-innovating firms.

Availability of finance/capital/investment is also considered an important regional factor for firms' competitiveness. A far greater share of innovative firms see this

factor as being very important than non-innovative firms (67% - 29%), indicating that innovative firms need to have proper finance and investment possibilities to be able to engage in innovation, which is a costly process. The least important factor for firms' competitiveness is the presence of related firms in the region, which may indicate that related (competitive) firms in the region do not have much interaction (lack of horizontal integration). This can be due to a fear of loss of new technology or ideas, or simply that related firms have different specialisations. The firms may however have contact with related firms outside the region.

Regional infrastructural factors act as an catalyst for the economic and technological potential of firms. We asked the firms which infrastructural factors they perceived as important for their activities. Frequent reliable transportation services/networks and quality of telecommunication were regarded as very important by most of the firms, which indicates that more traditional basic factors are important to the firms in the region.

Figure 5. Importance of regional infrastructural factors to firms competitiveness (N=99)



A greater share of innovative than non-innovative firms sees quality of telecommunication as very important. This may indicate that these firms more frequently use such systems, possibly due to greater use of external networks and export. Other regional infrastructural resources that are commonly regarded as important for firms, such as higher education institutions (HEIs) and research institutions, are not important for firms in the region. As many as 59% of the firms see information from these institutions as least important for their activity. Proximity to these institutions is therefore not important either, with 58% perceiving this as least important. This indicates that there is little contact between most firms and HEIs/research institutions. The few firms that attached importance to information/expertise or presence of HEIs or research institutions are mostly innovative firms.

Through interviews with some firms, and with the regional research institution in Finnmark (Finnmarksforskning), different aspects of the importance and problems between firms and the research institutes interaction were established. Firstly, firms that are interested in having joint projects with HEIs/research institutions often lack the capital needed to start projects. In fact most of the firms that have been in contact with the research institution have had some kind of public support enabling firms to join in an research project, and the contact between the firm and the research institution has lasted. Most of the co-operation projects between research institution and firms in the region were initiated by the regional research institute. This indicates that firms need to be motivated to join research projects, both by getting public funding and by getting ideas for research projects from the research institutions. There seems to be no 'spontaneous' link between the two.

Another problem is that regional research institutions seldom have the capacity to cover all research-fields needed by industry in the region. In particular part of the fish industry lacks R&D institutions with relevant experience - despite the fact that this is the largest industry in the region. Interviews with managers in the fish industry revealed that they had no contact with HEIs/research institutions in the region, due to the fact that these institutions did not have the expertise that was needed. There were actually no research institutions in the country that had the kind of technical expertise needed for technological development in the fishing industry (nevertheless there has been a remarkable development in the industry). Managers have been dependent on their own inventiveness with regards to new process technology in the firms, often adapting technologies from related industries in other countries. Their sources of information were most often external linkages with foreign suppliers of machinery.

Finnmarksforskning is aware of the needs of the fish industry, but they have only 17 researchers, and feel that they have good contact with the industry in the region considering their capacity. They have put efforts into research on fish farming, which is also becoming an important industry in the region.

As regards information/expertise from the regional college (Høgskolen i Finnmark) to local firms, arrangements have been made for students to work in industry while writing their theses. These arrangement were not carried out on a permanent basis at the regional college, due largely to the resource-consuming nature of the practice, for both the regional college and for the firms that participate. However, both students and firms reported very positive experiences from this arrangement. The most important factor for success was that the firm had a positive attitude to the arrangement from the start.

The presence of markets, suppliers and available finance, together with a good transportation system and quality of telecommunication, are the most important regional factors for firms' competitiveness. This suggests that the region is very important as an economic base for firms situated there. Regional factors that in the literature are perceived as important for firms innovation activity, such as contact with HEI/research institutions are not important for firms. Horizontal linkages are also of minor importance to firms.

5.2.3 Co-operation and network between firms in the region

This section will focus on networks/collaboration with other firms in the region, and will be an indication of how important the region is for firms located there. We have

seen earlier that many firms are dependent on the regional market, and that firms have suppliers in the region. Another question is who they network/co-operate with. Co-operation can be viewed as a way to co-ordinate specialised economic activities, and gain positive returns in the form of new technology, new market opportunities and reduced costs. Co-operation can be more or less formalised, the most 'classic' form of co-operation is between firms and their clients and suppliers (Lundvall 1992). Economists and sociologists have emphasised informal contact and trust between actors as an important factor that might develop into collaboration (Callon 1995). Marshall (1919) emphasises place specific social and cultural factors related to interdependence and mutual trust between persons, as an important factor for firms' co-operation, but co-operation can also be a cost for firms that participate in it (Cook and Wells 1992);

“ Collaboration adds to management costs, introduces an asset or assets to a possible new competitor, and obviously diminishes control for both partners”

As many as 60% of the firms said they had participated in some form of network/collaboration with other firms in the region. Extrovert firms (more than 50% of sales out of the region) have a larger share of firms engaged in co-operation than do introvert firms (less than 50% of sales out of the region), indicating that strong economic ties in the region do not necessarily result in collaborative activity.

Innovative firms have a larger share of firms that are active in co-operation than non-innovative firms. Firms that are owned by another company, have a larger share of co-operating firms than independent firms, indicating that dependent firms (or branch plants) have more local ties than the literature indicates.

Studies show that co-operation is dependent on firm size (Semlinger 1993):

“...for the time being it is big industry which is increasing its co-operation with other firms and it is big industry where companies join in strategic alliances. In contrast, small firms still have their subjective reservations and objective difficulties in regard to cooperative action. Therefore in general, although being more restricted by their limited internal resources, small firms show a higher level of self-containment than do bigger ones. “

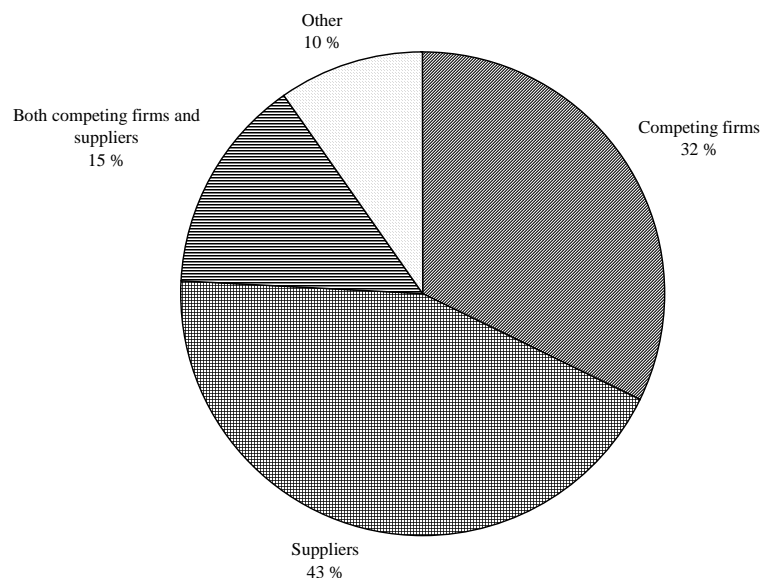
Small firms have more reasons to engage in co-operation activities, but still do not engage as much as larger firms. Small firms lack the network that larger firms often have (Pyke and Sengenberger 1990):

“the main problem of small firms appears not to be that of being small, but that of being isolated”.

Among firms with less than 10 employees 45% have taken part in co-operation. For firms with 10 -49 employees, and firms with 50-99 employees, the share is 77% and 82% respectively. These findings do indicate that there is a strong relationship between firm size and co-operation activity, small firms do not take part in networking/co-operation as much as larger firms, even though they have motivations for it.

Who do firms co-operate with? We gave firms the following alternatives; competing firms, suppliers or both.

Figure 6. Distribution of co-operation/network partners (N=62)



For the firm, 43% of network/co-operation activity is with suppliers. Firms with less than 10 employees have a greater share of network/co-operation with supplying firms (59%) than the average. Only one category co-operates to a larger degree with competing firms than with supplying firms, namely the firms with 50-99 employees. This indicates that network/co-operation partner is dependent on firm size. Smaller firms seem to have contact only with firms that they must ‘naturally’ relate to to be able to do business, i.e. suppliers rather than competitors. Co-operating with competing firms demands another strategy for firms because of the risk of revealing your comparative advantage. Small firms often have few products, and are therefore more vulnerable than larger firms, and thus network/co-operate to a lesser degree with competing firms. Co-operation between competing firms demands a “dynamic equilibrium” of the competing and co-operative forces. Such balance is seen to be very important to the production structure in the region (Gabi Dei Ottati 1994):

“This is because the cooperative elements contribute in a decisive way to the integration of the system, while forces of competition keep it flexible and innovative. This is because competition in the particular socio-economic district environment encourages better utilization of available resources and above all, development of latent capabilities and diffuse creativity” (Dei Ottati 1994).

Co-operation between competing firms seems to have a positive effect on firms engaged in it and for the milieu it operates in. However, there are no differences between innovative and non-innovative firms co-operation partner, but there is a difference in the share of firms engaging in network/co-operation activity. Innovative firms are more active in this process than non-innovative firms.

5.2.4 Summary

There seems to be an economic system in the region; most of the firms sell some share of sales there and one third of the firms have their most important supplier in the region. Non-innovating firms and small firms (by number of employees) have

greater shares of regional sales than innovating and larger firms. Proximity of markets and availability of finance/capital/investment are perceived as very important regional factors to firms' competitiveness.

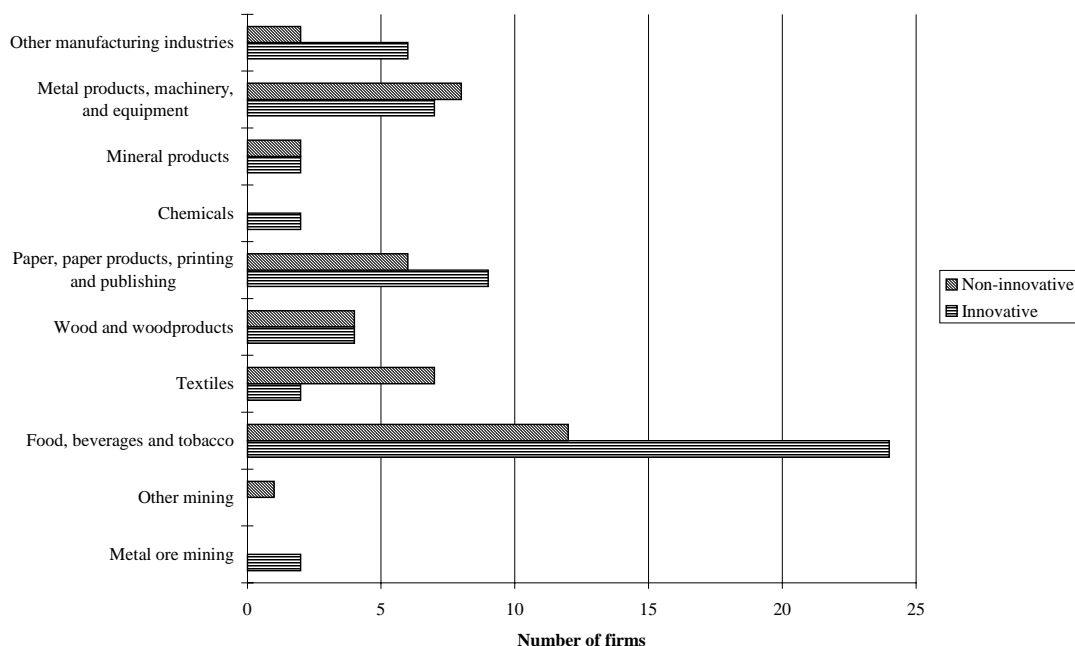
There are, however, few indications that the region is important for innovation purposes - presence of related firms is not important, suggesting that horizontal networking/co-operation is relatively unimportant for the average firm's competitiveness. Other inputs in the innovation process - such as information/expertise from regional HEIs or research institutions are viewed as least important for firms competitiveness, indicating a low degree of contact between these institutions and the average firm. Important regional infrastructural factors for firms' competitiveness are more traditional, enabling factors such as transportation and telecommunication. Firms are involved in networking/co-operation: 60% of the firms participate in some way in networking/co-operation, mainly vertical network/co-operation.

5.3 The Innovative System

This chapter will look more closely at firms that are active in the innovation process. We are interested in how firms with different characteristics innovate, how important the region is for firms innovation input, and what kind of restrictions are perceived as important by innovative and non-innovative firms.

As many as 58% of the firms engage in innovation activity. When looking more closely at which size categories innovate and which do not, it is obvious that the larger the firm, the higher proportion of firms do innovate. Firms that are owned by other firms have a smaller proportion of innovative firms (53%) than firms that are independent (59%).

Figure 7. Number of innovative and non-innovative firms in the sample (N=100)



The number of innovative firms is greater than non-innovative firms in only 2 industries; 'food, beverages and tobacco' (which is dominated by the fish industry)

and ‘paper, paper products etc.’ and ‘other manufacturing industries’. Another industry with a high proportion of innovative firms is ‘metal products, machinery and equipment’. While the rest of this section focuses on innovative firms, one must bear in mind the kind of industries that actually dominate the material.

5.3.1 Innovation costs - input in the innovation process

Innovation is a highly differentiated and heterogeneous activity, taking different forms and involving different activities. This section will look at firms’ innovation costs, how it is distributed over different innovation activities and how the innovation activity differs between firms. Studies show that innovation cost intensity (the share of innovation costs to turnover) is positively correlated to firms’ product innovation (innovation output)(Nås, Sandven, Smith 1994). One must though be careful in taking this conclusion too far, Kamien & Schwarts (1975) notes;

“..while there is little doubt that on average a direct relationship between various measures of innovative output exists...its is likely true that the transformation may depend on factors other than effort, and it may not be linear”.

There is reason to believe that certain input/output relations will vary between industries, and that the transformation will also vary within industries. The average innovation cost intensity for the sample is 11,5%. Independent firms have a share of 12,8%, while dependent firms only use 6,2% of total sales on innovation costs. This might indicate that firms owned by other firms are, to a larger degree, production units that are less involved in the innovation processes themselves. The share of innovative vs. non-innovative firms is quite similar between independent and dependent firms (53%-59%).

When looking at size categories we find that the innovation cost intensity varies between firm size, actually on average being higher than the average for firms with less than 49 employees, than for firms that are larger. But we must remember that small firms have a much lower proportion of innovative firms than larger firms. Smaller firms have higher input (as share of turnover) in the innovation process than larger firms, but the proportion of smaller firms with innovation cost is much smaller.

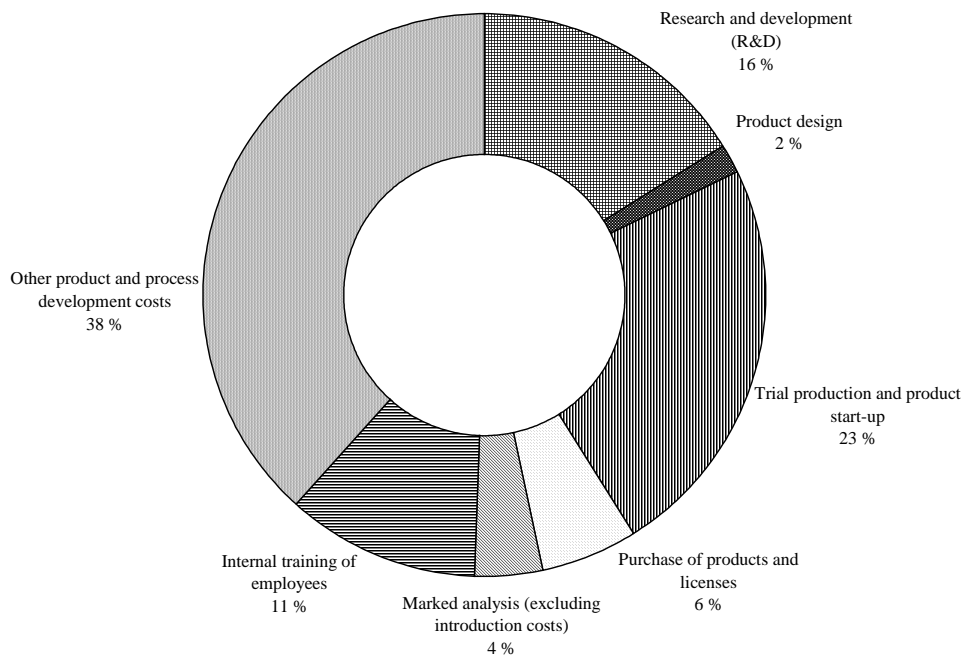
5.3.2 Different innovation costs

As noted earlier, innovation cost is one of many inputs in the firms innovation process. We were interested in establishing which costs were the most important for the innovative firms in the survey. We used the “Oslo Manual”¹⁰ to classify the different cost components¹¹.

¹⁰ OECD proposed guidelines for collecting and interpreting technological innovation data. - Oslo Manual - OECD/GD (92) 26 Paris.

¹¹ All but one cost component is taken from the Oslo Manual, and that is “Internal Training of Employees”.

Figure 8. Distribution of total innovation costs (N=56)



The distribution of total innovation costs indicate that the share of R&D is 16%. Yet it is not the most important factor. Trial production and product start-up is seen to be the most important factor, with 23% of total innovation costs used for this more applied work, documenting a need to further develop the established competence on the production side. Firms' developmental needs are not covered in the region: the college in the region has no technical education, but has collaborations with an engineering school in the neighbouring county (Narvik). There may be indications for either a further development of collaboration between these institutions or to consider starting a department at the college in Alta. Firms have technical needs that are scarcely supported by institutions, a point that is regarded as a lack in the educational provision in the region and perceived as a problem for many firms.

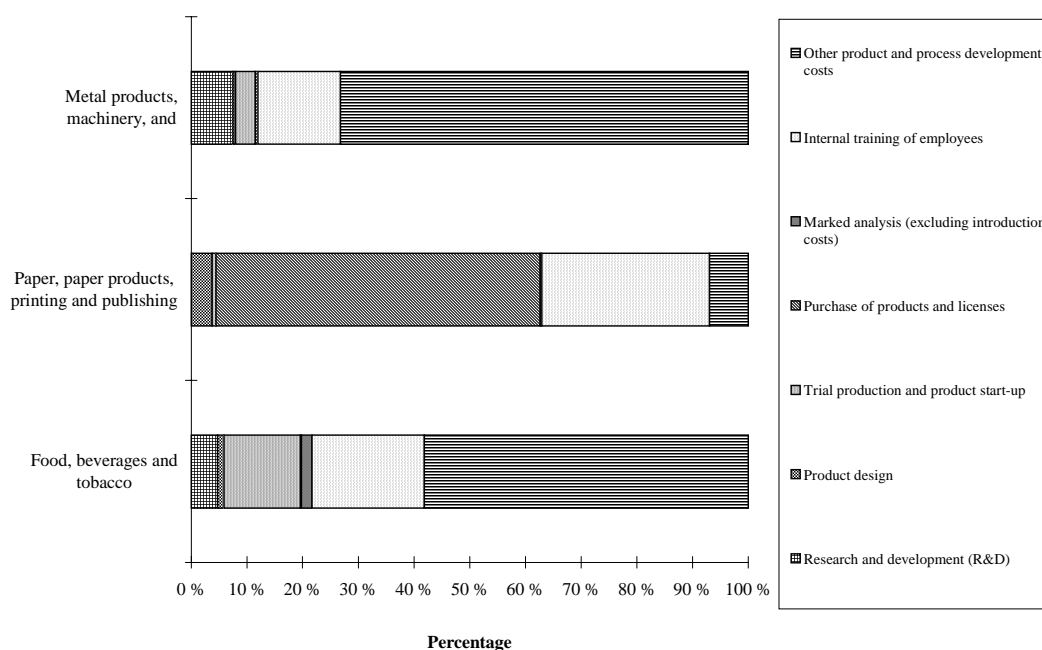
The distribution of costs indicate that we still have more to learn about what kinds of product/process activities are important in firms' innovation process, since 38% of the innovation costs is categorised as 'other product and process development costs'. This also indicates that the innovation in the firms might be a result of 'learning by using' 'learning by interacting' and 'learning by doing'. Interviews with firms in the region confirm that many of the innovations are incremental, with a high degree of adaptation of machines from related industries. Much developmental effort was put in adjusting new machines and techniques to their own use. A fish industry firm had examples of machines they had found in the chicken industry in Denmark, and in the local dairy, both now operating within the firm.

Only 4% of the innovation costs are used on market analyses. Interviews with firms in the region revealed problems with market contacts due to large distance to major markets, and lack of internal strategies towards new markets. Firms tend to be more occupied with resource and production constraints than the market side of the chain. There seems to be a lack of emphasis on marketing, even though studies show that greater contact with the market stimulates internal processes of development in the established enterprise, as well as their own demand for external assistance to build up

competence (Onsager & Eikeland 1992). Effort should therefore be made to increase firms' resources in market analyses.

Firms that are independent and firms that are owned by another company, have very different inputs in the innovation process. In particular the share of innovation costs used for 'trial production and product start-up' differs between the two. Independent firms have an average share of 20%, dependent firms have an average of 44%. Dependent firms have a smaller share used on R&D activities (4% vs. 18%), indicating that dependent firms often rely on mother companies' R&D departments, often located in core regions. The innovation costs also differ between size of firms, with 'trial production and product start-up' taking a greater share the larger the firm. Firms with less than 10 employees use the greatest share of their innovation costs on 'purchase of products and licences' indicating an adaptive strategy as opposed to pursuing internal research activities.

Figure 9. Innovation costs in 3 different industries (N=40)



Innovation costs also differ between industries, with different industries having different knowledge bases and obstacles to their activity. The figure shows the three dominant innovative industries in the sample. 'Metal products, machinery' and 'food beverages...' have very similar distributions of innovation costs, dominated by 'other product and process development costs' and 'internal training of employees'. Internal training of employees is regarded as important by all three industries in the figure, ranging from 15 to 30% of total innovation costs in the different industries. Because of constant development and use of information technology in different processes in the industry (especially within the fishing industry where there has been a remarkable development the last years) it has become a necessity for firms to engage in internal training of employees.

“Simply relying on educational attainment as a measure of human capital ignores, however, the importance of training on the job and presupposes that there is no mismatch between the level of education and employment. This is not likely to be the case in times of rapid technological change when skills tend to become obsolete at a faster rate” (Lee and Has 1995)

Training of employees through different courses will be an important factor for the employees own development and is a motivation factor, especially within industries that are dominated by repetitive routines.

Within the 'paper, paper products..' industry the greatest share of innovation costs is used on purchase of products and licences, while the two other industries do not have this cost. Of these three industries, only 1 has costs related to market analysis (food, beverage..), and the percentage is only 2% of total innovation costs. The peripheral location of firms in Finnmark indicates that the distance to markets in Europe might be a problem, the low share (or total lack) of market analysis might indicate that firms should make an effort in this activity to be able to raise the export-share out of of sales. Knowledge of markets is a very important factor, and might be a limitation to firms' economic activity. Fish industry firms located in Båtsfjord in Finnmark have created their own trading company to help firms find new markets.

The results show that different industries have very different inputs in the innovation process, indicating different obstacles and ways of developing new products and processes. The results also show that industries that are not looked upon as similar, might have the same kinds of input in the innovation process.

5.3.3 Support and other sources of input in the innovation process

More than half (53%) of the innovative firms in the region receive public financial support for their innovation activity. Public support seems to be an important factor in firms innovation decision making. The region is dominated by small firms that often have limited financial resources, which constrains their product and process development. The share of financial support given these firms varies between 10 and 75% of total innovation costs. The main sources of public support is SND, the Finnmark County Municipality and the Municipalities. More than half (55%) of the innovative firms that receive public support are found in the size category 'less than 10 employees'. It is important to note, however, that it is also this firm size that dominates the industry structure in the region. Looking especially at this category of firms, the data shows that 62% of the firms are 100% self-financed and only 38% receive some sort of public support. This hold also for the size categories 10-49 employees and 50-99 employees. This indicates that the smallest innovative firms (<10) do not have more firms that receive public support for innovation, relative to other size categories.

Looking more closely at the three main industries we see that there are firms within all industries that receive public support for innovation activities. All firms in 'metal products...' receive public support, in the food industry 15% receive public support, and for 'paper, paper products..' the share is 47%.

Turning to more general forms of innovation support, such as information and expertise, we find that there are several institutions in the region that can give such support to the firms located there. These institutions may play an important role in aiding firms to see their potential, and help them find technical solutions and market possibilities. We listed 10 such institutions located in the region. The question is then, do firms use these institutions? 62% of the firms had been in contact with one or more of the institutions we listed. In particular small firms (< 10 employees) and firms that are independent (not owned by another company) had contact with

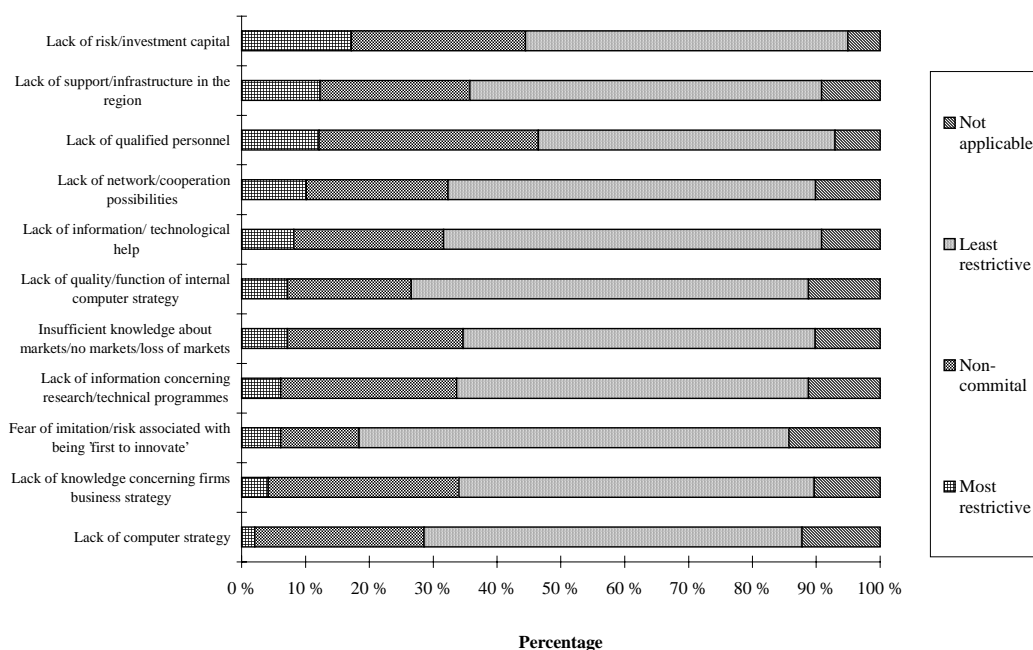
regional institutions. A larger share of the innovative firms (65%) have been in contact with regional institutions than non-innovative firms (57%). The local institutions that provide financial support for innovation, also seem to give firms information and expertise to help them in their activities related to product- and process development. These institutions are SND, Finnmark County Municipality and the Municipalities. Overall, innovative firms have a larger share of firms contacting these institutions than do non-innovative firms, suggesting that local institutions do play a role in firms innovation activity. We do not know, however, how well this support is perceived by firms.

Other local sources for innovation, are other firms. We saw earlier that firms in the sample do co-operate. The question is whether firms look upon this activity as positive for their innovation process, or if collaboration is mainly important for more practical matters, such as sharing of equipment, marketing efforts etc. Network/co-operation is viewed as important by 58% of the firms in the sample. The share of firms that perceive this as important for innovation differs between different size-categories, being more important to firms with 50-99 employees than for other size categories. This size category co-operates more with competing firms than with suppliers. This may indicate that co-operation with competing firms, although it is associated with greater risk, may have a positive effect on firms' innovativeness. Firms that are active in the innovation process are more positive towards the innovation-potentials of co-operating, than firms that do not engage in innovation (65% - 42%).

5.3.4 Restrictions in the innovation process

We were interested in which factors firms perceived as restrictive to their innovation process. Different industries and sizes of firms are challenged by different problems in their innovation activity. This section will look more closely at these factors.

Figure 10. Factors seen to restrict product/process innovation (N=97-99)



The figure indicates that there are few factors seen to be 'most restrictive' to firms' innovation processes: the largest share of firms rate all the different factors to be 'least restrictive' to the innovation process.

'Lack of risk/investment capital' is emphasised especially by firms with less than 10 employees. Firms that engage in the innovation process see this factor as being more restrictive than firms that are not currently engaged in the innovation process.

The following restrictive factors can be related to more place specific factors, like lack of support/infrastructure, qualified personnel, network/co-operation possibilities and lack of information/technological help. Lack of qualified personnel is perceived as a limitation by innovative firms, and firms with more than 50% of sales out of the region. This indicates that these firms demand more know-how, probably due to a modern production that is often based on high-tech machinery. In the fish industry there seems to be particular demand for leaders that work between the production unit and the management in the firm (mellomledere). Such personnel is hard to find, because they need both practical experience from working with fish, and at the same time economic and administrative skills. The fish industry perceives a need to develop an education that could train such leaders.

Lack of network/co-operation possibilities is viewed as the most restrictive factor for a greater share of innovative firms than non-innovative firms, indicating that networking/co-operation is a strategy innovative firms engage in, but the small numbers of related firms in the region and the distance between them might make such activity difficult.

Innovative firms see insufficient knowledge about markets as a relatively important factor that restricts their innovation potential. As we saw earlier, firms use only 4% of total innovation costs on market analysis, indicating that there are potentials for firms to improve their market knowledge if they are able to spend more on market analysis. This kind of activity is particularly important to firms situated in this peripheral area.

This section has showed that lack of risk/investment capital is the factor that most firms perceive as important for innovation. Lack of support/infrastructure is also a limiting factor for innovation, especially for firms with innovation costs, indicating that innovation activity is an expensive process for firms.

5.3.5 Summary

Innovative firms have certain characteristics: they are larger than the average firm, they are to a greater degree independent (not owned by another company), and have the largest share of sales outside the region. The group of innovating firms is dominated by 3 industries in Finnmark; 'Food' (mainly fish industry) 'Paper, paper products, printing and publishing' and 'Metal products, machinery and equipment'. Innovation input, in the form of innovation cost intensity, is greater amongst independent firms, indicating that dependent firms do not put much effort into the innovation process. This is probably often due to their position as a production unit in a company where innovation is centralised in another unit. Small firms have a higher innovation cost-intensity than larger firms, either indicating that for small firms the innovation process is relatively expensive (explaining the low share of small firms actually innovating) or that small firms put great effort into innovation when they first innovate. Firms with different characteristics report having different inputs into the innovation process - probably due to different obstacles and ways of developing new products and process. Half the firms receive public support for innovation, with the share of support ranging between 10-75% of total innovation costs. The large share of firms receiving public support indicates that in spite of the economic upswing over the last years there is still a need for non-material support; firms are not able to undertake all innovation effort themselves.

Regional institutions that can help firms with innovation support, are also used by firms, mainly small firms and firms that are not owned by another company. This may indicate actors that are active in the innovation process but who lack internal resources to draw upon, and therefore demand external assistance to build up competence. How these regional institutions will actually assist firms in their innovation process is not obvious, but we know that firms that lack internal resources look outside the firm for competence. Co-operation with other firms in the region is also looked upon as being important for firms' innovativeness.

Restrictive factors in firms' innovation processes include lack of risk/investment capital. There are also restrictive factors related to more specifically regional problems, such as lack of support/infrastructure and lack of qualified personnel. The infrastructures in the region are not well enough built for the rough winter climate, making communication impossible from time to time; there is always room to improve the infrastructure. The government has made many efforts to attract skilled persons to the region (low taxes, reduction of students loans etc.), but in spite of this, and in spite of skilled persons already living in the region, industry has problems attracting them. There seems to be a need for stronger links between educational institutions and industry, so that one can overcome the barriers between them.

6. Needs and institutions for the future RIS in Finnmark - Conclusions

The aim of this paper was to establish whether there existed a 'regional innovation system' in Finnmark, based on empirical evidence from a survey based research methodology, together with results from interviews with firms and institutions in the region. The objective was to investigate the main factors influencing the innovation activity of manufacturing firms and the importance of the region as an economic and technological base. Firstly, the findings established the existence of an economic system in the region. Most firms sell some share of sales to the region, and the presence of local markets is the most important regional factor for firms competitiveness. Many firms have their most important supplier in the region, and firms emphasise the importance of presence of suppliers for their competitiveness. Especially small and non-innovating firms have strong economic ties to the region.

As many as 42% of the firms in the survey do not engage in innovation processes. We therefore concentrated on the 58% of firms involved in the innovation process to see how the region influences their innovation and economic activities. Firstly it is important to note that innovating firms differ in many respects from the average firm in Finnmark; they are larger, they sell most of their products outside the region, and they are also independent (not owned by another firm).

Innovating firms report that co-operation/networking (both with suppliers and customers) is important for their innovation activity. The greatest share of co-operation is however with suppliers, suggesting vertical linkages. Horizontal networks/co-operation (presence of related firms) is not perceived as important, indicating that most network/co-operation activities are not undertaken for innovation purposes. The fish industry has during the last few years shared information on technical solutions to the processing of fish, and compared each other's efficiency. This seems to have had a positive effect on co-operation between them. Network bottlenecks have been overcome, and there has been a tendency towards a more positive attitude to networking in this industry. Representatives from the fish industry say the change may have resulted from the entrance of younger, educated managers who have brought with them new ideas and different attitudes to the sharing of information. The younger generation has in this respect had a positive effect on the innovativeness in the industry, but it is still a problem that so few young educated people start working in the fish industry. Most of the fish industry in the region is to some extent dependent on immigrant workers.

Innovating firms maintain contact with regional institutions that can offer information or expertise. As many as two thirds of the companies have been in contact with these institutions. This result indicates that the public regional institutions in the region are actively involved in the regional industry. One must bear in mind that these institutions are important sources of financial support for firms. Over half the innovating firms in the region have received public financial support for innovation, so contact with these institutions may have been initiated by the need for financial support.

When looking at firms' inputs in the innovation process, we find that 'trial production and product start up' is the most important innovation cost for firms. When focusing on support for innovation, it is obvious that firms probably need assistance that is more technically oriented. This indicates a need for institutions or arrangements that can give such support to firms. There is a need for a more technically oriented college in the region (such as an engineering school) to create a technical milieu that firms could approach to obtain support. One of the research institutions in the region (Finnmarksforskning) emphasises technical-natural science, and should therefore be an important institution for firms. Firms in the region report that presence or contact with higher education institutes (HEI's) or research institutions is not important for their competitiveness. Of the research projects started between Finnmarksforskning and regional firms, all were initiated by the research institution and all had public financial support. There seems to be no established culture for firms contacting research institutions, possibly due to lack of capital (which is reported as the most restrictive factor in firms' innovation) and to possible communication barriers. There is also a problem in that the research institutions do not cover all relevant research areas. Research institutions, could however, have the role as 'middlemen' between firms that need to carry out research, and relevant research milieus nationally or internationally.

Lack of risk/investment capital is seen as a factor restricting firms' innovation - this factor is also an important factor in firms innovation decisions. Public support is needed in order for many firms to be able to carry out innovation. Public financial support must be diversified to meet firms' needs. Another restrictive factor in firms innovation, is lack of support/infrastructure. When firms are asked which infrastructural factors they perceive as most important, we find that the more traditional basic factors such as transportation/services/networks are emphasised. These factors provide support for firms' activities, and must be emphasised in regional planning.

The employment of young, highly educated people has been reported as positive for innovation by some firms. It is necessary to motivate young people to start working in traditional industries, since a lack of qualified personnel is reported to be a restrictive factor for firms' innovation. Efforts must be made to attract young educated people to take up positions in the manufacturing sector in the region. Contact between school and industry should be established while pupils are still young, in order to inform them about different industries and career possibilities. Firms in Finnmark report that pupils have very little knowledge of regional industries, often due to the teachers' lack of interest or knowledge. In higher educational institutions there should be arrangements for students to work in industry while writing their thesis. Positive experiences from such arrangements have been reported by the regional college, so effort should be made to establish such arrangements on a permanent basis. Employing persons with higher education is a costly decision for firms. Financial support might be needed for firms to be able to employ newly educated students from the regional college, and such an arrangement might lead to positive results in the regional industry in the long run.

Firms lack resources for innovation, both in the form of finance and in the form of relevant assistance in the innovation process. There is not much contact between firms and/or other institutions for the purposes of innovation. This can be related to the fact that existing institutions/firms do not have the expertise needed, and/or that innovating firms relate to other than regional institutions for innovation help (like

national or international systems of innovation). Innovating firms have economic ties outside the region, suggesting contact with foreign markets and customers which can be an important input factor in firms' innovation process, and a source of relevant information.

The above mentioned issues should form the key focus for public policy. There are obvious lacks in the regional innovation system, and there are regional resources that need to be restructured before it can be called a balanced regional economy. Policy should address current problems associated with the following needs that firms report having.

Firms need:

- contact with relevant research milieus
- technical institutions for innovation support
- financial support for innovation
- young educated people to start in industry
- new subjects at the technical colleges in the region
- to overcome network bottlenecks

The following table (Table 1) will present these current problems that innovating firms experience and possible action for public policy. More policy should be directed to increase firms' innovation activity.

The 'regional innovation system' in Finnmark is limited in scope and extent. There are, however, dynamic elements in the region. The region is important as an economic base for firms, especially for small non-innovating firms. The regional innovation system is poorly developed, there are lacks that make it difficult for innovative firms to depend on the region for innovation support. Innovating firms seem therefore to depend on national or international systems of innovation. There should, however, on the basis of great natural resources and a growing stock of educated people, be potential for endogenous growth in this region that will move the region towards a balanced regional economy. But effort needs to be made by firms, regional institutions and regional government.

Table 1. How to organise the regional economy of Finnmark to make it learn better;

Innovating firms needs...	Current situation	Suggested policy solutions
contact with relevant research milieus	- the regional research institutions do not cover all relevant research fields necessary for the local industry	Research institutions in the region could have the role of 'middlemen' between firms and relevant research milieus elsewhere in Norway or abroad. Regional firms lack information on which milieus to contact when having research to be carried out.
technical institutions for innovation support	- no engineering college in the region, or relevant technical milieus that can give necessary support	Efforts should be made to create a new college in the region, or make much stronger links with the engineering college in Narvik. There should be more emphasis on student exchanges between firms and the college.
financial support for innovation	- half the innovating firms need financial support for innovation	There is a great demand for financial support for firms that undertake innovation, this non-material innovation support should continue and probably be increased, and diversified in relation to firms different innovation input
young educated people to start in industry	- younger educated people do not start to work in traditional industries	There must be established better contact between lower education and firms, to inform young people at an early age what regional firms work with. There is a problem that teachers at lower levels have little knowledge of regional industries. Higher education should have ongoing student exchanges with regional firms, to improve young peoples' knowledge and attitudes towards regional industry. There should also be other arrangements that could bring students and firms together, so they have the chance of looking into each other's 'worlds'
new subjects at the technical colleges in the region	- there are technical colleges in the region (yrkesskoler) but they lack some important subjects firms need	Efforts should be made to start new subjects at these colleges so that there is a supply of young people with relevant background in the region. There should also be offered apprenticeships within all subjects offered at the technical college.
to overcome network bottlenecks	- not all firms participate in networks or co-operation	No firms should be isolated from being in networks, if there is an incompatibility between a firm and existing firms in the region, there should be efforts by regional institutions that the firm have contact with (such as municipality or county council) to be 'middleman' between the regional firm and national or international firms that are relevant. Regional institutions should encourage networking both within and outside the region.

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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.