

NORWEGIAN SMALL AND MEDIUM-SIZED ENTERPRISES AND THE INTELLECTUAL PROPERTY RIGHTS SYSTEM: EXPLORATION AND ANALYSIS

Study prepared by: Eric Iversen*

The study was guided and overseen by a Steering Committee
composed of representatives from the following institutions:

The STEP Center for Innovation Policy
The Norwegian Ministry of Trade and Industry
The Norwegian Patent Office
The Norwegian Confederation of Industries
The World Intellectual Property Organization

Disclaimer: The views expressed in this study are those of the author and do not necessarily represent the position of the Norwegian Ministry of Trade and Industry, the Norwegian Patent Office, the Norwegian Confederation of Industries or the World Intellectual Property Organization.

*Eric J. Iversen, STEP Center for Innovation Policy, Sintef Industrial Management, Hammersborg torg 3, N-0179 Oslo, Norway

TABLE OF CONTENTS

PREFACE	22
FOREWORD	22
EXECUTIVE SUMMARY	22
1. Background	22
2. Structure of the Report	22
3. Primary Findings	22
4. Recommendations	22
4.1. Measures to improve knowledge about the inter-relationship between SMEs and the IPR system	22
4.2. Measures involving general 'attitudes' towards, and knowledge of, intellectual property rights in Norway	22
4.3. Recommendations targeting the operative form and function of the IPR system as a whole	22
5. Conclusions for conducting similar studies	22
STUDY BACKGROUND	22
1. What the mandate says	22
2. Definitions	22
2.1. Intellectual property rights: analytical definition	22
2.2. Small and medium-sized enterprises: analytical definition	22
3. The question and how we address it	22
3.1. Preliminary Considerations	22
3.2. The structure of the study	22
4. Why conduct such a study?	22
SECTION 1: CONCEPTS AND ISSUES	22
1. General observations	22
Chapter 1: The Big Picture And The Small Firm In A Small Country	22
1. A small country characterized by small enterprises	22
2. Changing international business environment	22
3. General shifts in the economy	22
4. Current conditions involving IPRs	22
4.1. The value of an IPR	22
4.2. The use of IPRs	22
4.3. The internationalization of IPR regimes	22
4.4. IPRs and the challenges of emerging technologies	22
4.5. Conclusions	22
Chapter 2. National Systems of Innovation and the IPR component	22
1. Background	22
1.1. Basic ideas	22
1.2. What is innovation? What is systemic and why is the creation of innovation seen in national terms?	22
1.3. Advantages of the NSI Approach	22

1.4. The meaning of "competition" and competitive position	22
1.5. Competitive position	
1.6. The link between firm size and competitiveness	
1.7. The link between IPRs and competitiveness	22
Chapter 3. What does the literature tell us about firm size and intellectual property rights?	22
1. The link between intellectual property rights and competitiveness	22
2. SMEs and intellectual property rights	22
2.1. General empirical evidence	22
SECTION 2: THE NORWEGIAN IPR SYSTEM AND NORWEGIAN SMES	22
SUBSECTION 2.1. SMEs AND THE IPR SYSTEM IN NORWAY	22
Chapter 4: The anatomy of the Norwegian IPR system	22
1. Norwegian Innovation Infrastructure: General Anatomy	22
2. Mapping the Norwegian IPR system	22
2.1. General Legal and Regulatory Framework	22
2.2. IP Authorities and Administration	22
2.3. Public and semi-public financing and advisory agencies	22
2.4. Publicly-funded investment companies	22
2.5. Research environments	22
2.6. Patent Agents	22
2.7. Other organizations	22
2.8. Enforcement framework	22
Chapter 5. Characteristics of Norwegian SMEs	22
1. Types of SMEs	22
1.1. OECD typography	22
1.2. Rizzoni typography	22
2. What do we know about Norwegian SMEs?	22
3. SMEs and Innovation	22
SUBSECTION 2.2. IPR USAGE IN NORWAY	22
1. Preliminary observations	222
Chapter 6. Introduction to patent usage in Norway	222
1. General	222
2. General patenting patterns	222
2.1. Norwegian propensity to patent in an international comparison	222
2.2. Patenting in Norway	222
3. What do we know about the way SMEs approach the IPR system?	222
3.1. STEP interviews with innovative SMEs (Isaksen, 1999 and the SND evaluation)	222
3.2. The Norwegian Patent Office awareness campaign	222
3.3. Survey-based information on the use of IPRs	222
3.4. Use of Patent information	222

Chapter 7: The utilization of the patent system by Norwegian SMEs

1. Preliminary issues	22
2. Norwegian Applications	22
3. How are applicants distributed across size-classes?	22
4. How does the number of patent applications an entity applies for reflect its size?	22
5. Number of patent applications by activity and size-group	22
6. How is size reflected in enterprises' industrial activities?	22
7. Applications and applicants as percentages of all Norwegian Enterprises	22
7.1. Size-Groups	22
7.2. Industrial Activity	22
8. Applicant-size by the area of application	22
9. Patenting by district of origin	22
10. Status	22

Chapter 8: The use of the trademark system by Norwegian SMEs

1. Strong growth in the number of Norwegian trademark applications	22
2. Stronger than average growth of SME applications	22
3. Total number of individual entities, by size class	22
4. Degree of involvement	22
5. Norwegian trademark applications by applicant's industrial activity	22
6. The increase in applicants, by area over two periods	22
7. Number of applications (1995-1999) per firm (1998)	22
8. Size-classes by district of origin	22
9. Registered Trademarks	22
SECTION 3: GENERAL ASSESSMENT AND RECOMMENDATIONS SECTION	22

Chapter 9 General Assessment

1. Interviews	22
2. General observations	22
3. Use and awareness of IPRs among Norwegian SMEs	22
4. A brief appraisal of the Norwegian Support System	22
4.1. Preliminary observations	222
4.2. Interview-based observations	222

Chapter 10 Final Recommendations

1. Measures to improve knowledge of the inter-relationship between SMEs and the IPR system	222
1.1. Recommendation to extend the analytic basis of this study to other countries	222
1.2. Recommendation to improve the analysis of IPR questions in Norway	222
1.3. Recommendation to improve Norwegian IPR databases	222
2. Recommendations involving general 'attitudes' toward, and knowledge of, intellectual property rights in Norway	222
2.1. Measures to improve the visibility of IPR questions in the policy arena	222
2.2. Measures to promote the coverage of intellectual property matters in the national educational system	222
2.3. Recommendation to monitor and nourish outreach activities of the Norwegian Patent Office	222

3. Recommendations targeting the operating form and function of the IPR system as a whole	
3.1. Measures to promote greater practical knowledge of the IPR system among SMEs	
3.2. Initiatives to improve the IPR policy and strategies of central institutions of the support structure	
3.3. Measures to improve IPR system awareness among SMEs	
3.4. Initiatives targeting use of design rights	
3.5. Certification of patent agents	
3.6. Measures to improve SME security in litigation cases	
3.7. Measures to activate idle patents and design rights	
3.8. Recommendation to evaluate the inclusion of petty-rights/utility patents	
3.9. Recommendation to evaluate the University-Industry link	

CONCLUDING OBSERVATIONS

1. General observations	
2. Recent foreign policy discussions	
2.1. Aspects of the general international policy discussion	

SELECTED LITERATURE

ANNEXES

Annex 1: The compilation of the databases and their analysis	
Annex 2: Acronyms for the Norwegian System of Innovation	
Annex 3. Functional Institutional Matrix (Ørstavik, 1998)	

PREFACE

It is a primary goal of the Norwegian Government that Norway is placed at the forefront of the development of international technology, competence and knowledge. Our Government is promoting an economic policy that aims to bring about increased entrepreneurship, greater individual freedom, continued development of a welfare society, and sustainable growth. The existence of a competitive business market place is a requirement in order to attain these goals. More than 95% of Norwegian industry consists of small and medium-sized enterprises (SMEs). This means that our main efforts must be concentrated on improving conditions and services offered to SMEs.

The findings of this report mean that we can now seriously consider the intellectual property rights (IPR) system as an integral part of the policy framework for SMEs. The findings also indicate that we can place IPRs on the political agenda as a strategic measure towards increased competitiveness of Norwegian SMEs.



Mr. Ansgar Gabrielsen
Minister of Trade and Industry
Norway

FOREWORD

Small and medium-sized enterprises (SMEs) form the backbone of most national economies; therefore, responding adequately to their needs and concerns, especially in today's knowledge-driven, highly competitive business environment, is high on every government's agenda. There is a growing realization, in relevant circles, that a vital part of that response is improving awareness of, access to, and use of the intellectual property system within this sector, as these elements are key in enhancing the competitiveness of SMEs in the domestic and export markets.

Planning, implementing, monitoring, and measuring the success of national intellectual property-related policies, institutions, programs and initiatives, requires access to reliable, up-to-date information on the way SMEs actually use the intellectual property system. Therefore, an efficient, cost-effective, national information-gathering process, coupled with sound and rigorous analysis of the resulting data is needed to achieve well-informed, appropriate, and balanced decision-making about the nature and scope of the assistance given to SMEs on intellectual property issues.

It was against this background that a pilot study was undertaken by the Government of Norway and the World Intellectual Property Organization (WIPO), to examine how SMEs are adapting to the new business environment and the extent to which their intellectual property needs and concerns are being met. This publication is the result of that collaborative effort and provides an excellent, comprehensive overview of the Norwegian national innovation system with a special focus on SMEs and their use of the intellectual property system. The methodology and analysis used in the study and its conclusions and recommendations, while focusing on the Norwegian situation, will be of great interest to all those concerned with ensuring that SMEs are able to make the most effective use of the tools available to them through the intellectual property system.

I would like to thank the STEP Group of Norway and, in particular, Mr. Eric Iversen, for the excellent work they have carried out and for the exemplary thoroughness and clarity with which they have dealt with the inherent complexity of the issues involved. I would also like to thank the members of the Steering Committee who provided invaluable support in the the preparation of the report. This has, in many ways, been a pioneering exercise and its insightful and informative results will be of great value to WIPO and its Member States as well as to the private sector, national and international institutions, and academia.



Kamil Idris
Director General of WIPO

EXECUTIVE SUMMARY

In 2000, WIPO commissioned a study to explore how Norwegian small and medium-sized enterprises (SMEs) currently use the intellectual property rights (IPR) system and how they might be better assisted by it. The idea originated at the Norwegian Ministry of Trade and Industry which had started to focus on the concerns of the large population of very small Norwegian firms. It concretized into a proposed pilot study when Mr. Lars Sponheim, Norwegian Minister of Trade and Industry, and Dr. Kamil Idris, Director General of WIPO, met in Oslo in May 1999. There was mounting concern that Norwegian SMEs, as a population, are not proficient users of intellectual property rights and that the IPR system could perhaps be better geared to their needs. WIPO agreed to fund the project as a pilot study in order to explore this area and lay out a methodology that may be used in other countries, including developing countries and countries in transition, for similar studies.

The study has resulted in this report, which the STEP-Group¹ designed and produced in consultation with the appointed steering committee. The study provides valuable material that may be of assistance for decision-makers in other countries and contexts who find themselves addressing similar concerns. The methodology used, the literature review and the general conceptual analysis of the issues are useful tools for conducting similar studies in other countries, including developing countries and countries in transition.

1. Background

The study was prompted by concerns that Norwegian SMEs remain poor users of the IPR system in today's environment. This was seen as particularly disquieting as markets are globalizing, economies are becoming more knowledge-oriented, and technologies are evolving ever more rapidly. The premise is that it has become increasingly important in this context to understand how SMEs currently use the IPR system and, on this basis, to try to determine whether its use — and the conditions for it — can be improved. This is seen as a ripe area to address as policy-makers seek to improve the conditions for SME competitiveness.

Norway feels unsure and vulnerable about how changes associated with globalization and a “pro-patent era” elsewhere will impact its many small and medium-sized enterprises. In Norway, several characteristics that heighten concern can be noted: Norway is characterized by a small domestic market; it has traditionally been a commodity-based economy (fish, lumber and more recently oil), and it is still characterized by traditional industries such as basic engineering. The study concerns general IPR-related issues today and highlights some aspects of how the situation is changing and what this might mean.

Furthermore, some policy-makers are concerned with the way the Norwegian IPR system is structured and whether it is evolving adequately to meet the changing environment characterized by globalization and new technologies. The IPR system comprises not only the legal framework. It also includes a set of institutions and agencies that are involved in administering the IPR system as well as those that are involved in advising or otherwise assisting SMEs to make use of IPRs. A proper understanding of how this infrastructure works is important as it directly influences whether and, ultimately, how enterprises utilize and leverage intellectual property rights in a given business situation.

The study makes the case that the structure and functioning of the IPR system is very important for the competitiveness of SMEs. As a result of their more limited resources, in terms of time, money and expertise, SMEs are generally most dependent on the advisory and financing support on IPRs that is available to them domestically. The changing environment emphasizes the importance of a well-built, competent infrastructure that can help SMEs decide whether and how best to use the IPR system as a tool in their business strategies.

¹ <http://www.step.no/>: 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 unsolved problems regarding how the processes of scientific and technological change actually occur, and how they have a social and economic impact.

2. Structure of the Report

Before describing the structure of the report, a brief note on the overall approach of the study. There are four levels, namely:

1. a conceptual level to highlight out the main issues involving the relationship between SMEs and IPRs and to present the National Systems of Innovation as a useful approach for analyzing it;
2. a survey level to explore the relevant empirical evidence in the literature, to present existing empirical information about Norwegian SMEs, and to map the Norwegian IPR system;
3. an analytical level to explore and analyze statistical evidence about IPR use by SMEs and to conduct a round of expert-interviews of a number of key actors in the Norwegian IPR system in order to supplement the statistical picture; and
4. a recommendation level to formulate recommendations to improve the way in which SMEs use the intellectual property system in Norway.

These levels are found in the three main sections of the report, which are summarized here.

Section 1 explores relevant concepts and issues. The study provides an accessible survey of approaches used hitherto to understand key relationships involving IPRs. It surveys some of the main findings of the existing literature, pointing out some of its main limitations. This allows national policy-makers an accessible presentation of what the relevant literature says. In addition, the extended bibliography provides an avenue to look further into the relevant literature (see particularly chapter 3).

Section 2 is a descriptive section that presents detailed information about the Norwegian IPR system and about Norwegian SMEs. It describes the anatomy of the Norwegian IPR system in the framework of the National Innovation System. Relevant information about Norwegian SMEs is then supplied to help get a grip on how this group of enterprises uses or might use the IPR system.

The compilation and analysis of formal data about how domestic SMEs utilize the IPR system is a centerpiece of the study. In Section 3, the report presents an analysis of how Norwegian SMEs are already using the patent and the trademark registration systems domestically. This section is based on the laborious merging of patent and trademark databases from the Norwegian Patent Office with firm-level information from Norwegian registry-data. The resulting datasets give firm-level information on all Norwegian enterprises which apply for patents and trademarks domestically. This has made it possible to study the size of the enterprises that apply for patents and trademarks, their geographical location and turnover.

Section 3 reports on a round of expert-interviews that were designed to obtain insights into how Norwegian SMEs approach the IPR system and how the wider IPR system caters to their special needs. These observations allow us to conclude the general assessment of the Norwegian situation and to recommend possible ways of improving the use of IPRs by SMEs in Norway.

3. Primary Findings

The general conclusion from the database work is that SMEs are, in absolute terms, big users of the domestic patent and trademark systems, and that they use these types of rights to an increasing degree. At the same time, however, this work shows that larger enterprises are much more intensive users of both systems and indicates that they are much better users as well.

These findings are corroborated by the results of the expert interviews. Together, the empirical material suggests a number of concerns and problems, and it allows a vantage point to forward a set of recommendations to address them. Some of the specifics relating to current use of IPRs by SMEs are summarized below:

The report shows that:

- The number of patent and trademark applications has risen strongly during the 1990s: the strongest growth has in fact been among SMEs.
- In relative terms, large enterprises apply for patent protection on average 40 times more often than micro-enterprises; 20 times more often than small enterprises; and eight times as often as medium-sized enterprises. The propensity to apply for trademark registration was also highest among the largest firms, with over 104 applications per 100 firms.
- A major difference between smaller and larger applicants relates to the 'success' of their patent applications. The study shows that the level of non-grant — especially cases in which the applicant withdraws his application — is dependent upon size. SMEs withdraw one in three applications while independent inventors withdraw more than half of their applications.
- Larger entities tend to file more than one patent and trademark application to a much larger degree than smaller firms. In general, the smaller the firm size, the smaller the average number of applications made.
- Patent applications from large firms differ from those of smaller applicants in terms of technology. While 40% of Norwegian applications for chemistry and pharmaceutical-related technologies were from large enterprises, more than 85% of the applications for electrical engineering were from the other size-classes.
- The propensity to apply for patents and for trademarks is fundamentally related to the key product of the applicant.
- There are major differences in the geographical distribution of patent applicants. Large applicants tend to be concentrated in urban areas. Trademark applications are first and foremost an urban phenomenon. Oslo and the surrounding areas, Trondheim and Bergen account for nearly three-quarters of the total number of Norwegian trademark applications.

4. Recommendations

The database work, the expert interviews and the literature survey helped identify apparent concerns, needs and problems in the relationship between IPRs and SMEs in Norway, and suggests what can be done to improve both the use and the conditions of use of the IPR system for this population. Based on this work, the report makes three sets of recommendations containing a total of 15 recommendations. These range from the general to the more specific.

4.1. Measures to improve knowledge about the inter-relationship between SMEs and the IPR system.

The first set of recommendations addressed the lack of reliable and relevant data, and the scope for improving analysis in this area. The literature survey exposed a limitation of the literature to patenting and to selected advanced countries, with only a small set of studies dedicated to the size-based propensity to patent. The report recommends that the Norwegian study be extended and adapted to other WIPO member states, including developing countries and countries in transition (1.1.); that the basis for analysis in Norway be improved, and that more detailed analysis be supported in Norway (1.2. and 1.3.).

4.2. Measures involving general 'attitudes' towards, and knowledge of, intellectual property rights in Norway.

The second set of recommendations addresses measures to improve central aspects of the IPR system, including industrial IPR policy and education. In Norway, there is a need for a more unified policy on questions that involve the strategic use of intellectual property rights. A vitalization of the national discussion of IPR issues and the development of a more unified policy on questions that involve the strategic

use of intellectual property rights would invigorate awareness of IP issues, not least among small and medium-sized enterprises; it would serve to heighten consciousness of the IPR system within the wider innovation system; and it would help deepen the understanding of the IPR system both in institutions and enterprises (2.1.).

There is also an expressed need to try to integrate IPR issues more actively into the national education system (2.2.). Today, IPR issues are isolated in Norway to parts of legal education. Balanced exposure to the IPR system within the existing educational framework is seen, in the long term, to be the best way to promote more sophisticated use of the system. The study therefore encourages initiatives to study and implement the best ways of accomplishing this.

4.3. Recommendations targeting the operative form and function of the IPR system as a whole

The third set of recommendations presents a number of basic recommendations that target individual parts of the Norwegian IPR system. At the top level; it challenges the institutions of the IPR system to explore how they can together improve their efficiency in helping SMEs. It is recommended to explore initiatives that encourage greater exchange of experiences and know-how across institutions in the IPR system. There is also a need to nourish the current outreach activities undertaken by the Norwegian Patent Office. It is recommended that this work be systematically followed up and that the experience of other countries be actively monitored in order to ensure the use of best practices on this front (3.3., 2.3.).

The study encountered several indications that the overall workings of the IPR system in Norway could be improved. One major concern that emerged is that the considerable number of smaller entities which already use the patent and trademark systems have significant problems in doing so effectively. The database work especially raises the question (via high withdrawal rates) of how skillfully SMEs use the system. The study recommends that the national IPR system should aim to reduce the number of withdrawals that result from misconceptions of the system or poor competence in dealing with it (3.1.).

The recommendations address other more specific areas where it is important that the underlying problem and possible solutions be further understood and addressed. In general, it is recommended that this work be initiated by the responsible and competent institutions. It is recommended, for example, that greater attention should be directed to IPR issues by the central institutions of the support structure, especially the Research Council. Other initiatives to be considered include targeting use of design rights (3.4.); whether petty-rights/utility patents should be introduced into the Norwegian IPR system (3.8); and whether patent agents should undergo formal certification (3.5).

The report also encourages the IPR system to explore emerging issues. These include studying the ramifications for the infrastructure of the increased emphasis on the commercialization of academic research in Norway and elsewhere (3.9). Other topics requiring attention involve evaluating initiatives developed elsewhere to address more established problem areas. One such area involves measures to activate idle patents and design rights to the best advantage of small and medium-sized enterprises (3.7).

Finally, the report finds the improvement of SME security in litigation cases of vital importance (3.6). The study indicates that this is a central underlying concern for small and medium-sized enterprises. Insurance schemes are seen as a way to deter indiscriminate infringement proceedings leveraged against weaker parties, whose enforcement capabilities are limited. Insurance schemes under consideration or implemented elsewhere should therefore be evaluated for their relevance in the Norwegian context.

5. Conclusions for conducting similar studies

The Norwegian study stands as a pilot study which will hopefully be followed by other WIPO member states, including developing countries and countries in transition. As such, it has gathered a lot of conceptual and theoretical background which need not be duplicated by other studies, but which might be added to. As a general course of study, researchers in other countries can examine how this study is compiled and executed in the Norwegian case. Hopefully this will provide the inspiration as well as the basis for analysis that can be adapted to the particular conditions of individual countries.

Most countries, as in Norway, have a large number of small and medium-sized enterprises. Such firms generally have difficulties mustering resources both in the form of finances and expertise to come to grips with the potential benefits afforded by the IPR system. In general, the study offers other countries, including developing countries and countries in transition, a conceptual understanding of the special position of SMEs, and what the literature tells us about their use of IPRs.

For a country that has no experience with this type of study, the first step is to look beyond the raw patent-counts that have become widespread and to focus on analysis of IPR use. On this score, the Norwegian study provides an accessible survey of approaches that have been used to understand key relationships involving IPRs. Some of the main findings of the existing literature are surveyed, pointing out some of the limitations of this literature. One fundamental problem is that the analytical literature tends to focus on the situation in a few countries, such as the US and Japan and tends to focus only on patenting. This study has surveyed a large amount of literature in order to help subsequent studies, to find their bearings.

The selection of approach essentially shapes the type of study that will be conducted. It is therefore important at the outset to widen the focus on the IPR system from a stringent focus on legal or formal economic dimensions to include the institutional framework of the IPR system. The National Systems of Innovation approach allows us to do this: it allows us to orient the discussion of IPRs and their use to the existing infrastructure and, secondly, to identify interviewees that can then provide expert points of view on how Norwegian SMEs approach IPRs and the way the IPR system functions in the country. This means that important information can be integrated into the study, information that might otherwise be excluded by more traditional approaches (see chapter 2, section 1 and the bibliography for more information).

The compilation and analysis of formal data about how domestic SMEs use the IPR system should be a centerpiece of the study. In the Norwegian case, the study concluded that two sources of statistical information were available. It was noted, furthermore, that, by combining these, it was possible to present a detailed picture of the size-classes that actually apply for patents and trademarks and look at them over time, according to industrial activities, etc. The details of these databases (the Norwegian Patent Office patent and trademark databases combined with the Registry data of Norwegian enterprises) are found in Annex 1. In addition to this annex, the approach is also described in the text (specifically chapters 7 and 8, section 2).

This combination of databases is the main innovation of the Norwegian study. It rests on the availability of registry data that provides firm-level information. Obviously, the availability of relevant statistical material in the different developing countries and countries in transition will vary a lot. If we assume that this type of information is not available, then there should be other routes to find out something about the attitude to IPRs and how SMEs currently use the IPR system. One avenue is the interview-approach already mentioned. This should be supplemented with a carefully designed survey of different size-classes of domestic enterprises.

In conclusion, it is worth highlighting the recommendation to extend the type of study to other countries. In this context, the Norwegian study indicated that one of the fundamental stumbling blocks in addressing how SMEs may be better assisted by the IPR system is the lack of reliable and suitably detailed information about how SMEs use different IPRs in different IPR systems. As already indicated, patent data dominates the analytical basis of the "IPR studies" and these studies are limited to individual countries. Very little is known about the practical use of other rights such as trade secrets, designs, copyright and trademarks by SMEs. Also, very little is known about the situation on use of IPRs by SMEs in the vast majority of countries. Further, it was noted that the specific use of intellectual property rights should be related to the specific institutional set-up of the IPR system in a given country, as these differ considerably from country to country.

Therefore, it is recommended that this type of pilot study be undertaken in other WIPO member countries. At this stage, studies that map the IPR systems of individual countries, explore how the IP needs and concerns of SMEs enterprises are addressed by those systems, and investigate how SMEs in those countries approach and utilize the IPR system, are seen as the best way forward. In order to ensure a reasonable degree of continuity and comparability, such studies could be coordinated, for example, by WIPO.

STUDY BACKGROUND

1. Objectives

The purpose of the study, is twofold:

- to evaluate systematically the relationship between Norwegian SMEs and IPRs in terms of needs, concerns and problems;
- and to provide useful recommendations for enabling Norwegian SMEs to make better use of the intellectual property system so as to improve their competitive position.

The study utilizes the analytical framework of Norway's National Systems of Innovation in order to present results that policy-makers at a variety of levels could use for initiating specific activities for helping small and medium-sized enterprises in the area of intellectual property rights.

The objectives build on some fundamental assumptions. They assumes that:

1. The IPR system is potentially beneficial for reaping the benefits of innovative activities at the firm level;
2. SMEs underprotect their innovative capabilities and/or underutilize the IPR system; for example, as a major source of information about technology and their markets;
3. Norwegian SMEs underutilize the possibilities inherent in the IPR system to further their competitive position.

In short, it is assumed that IPR utilization is specific to firm size and to national context. In addition, there seems to be an assumption that this imputed lack of awareness on the part of Norwegian SMEs is made all the more dangerous in the present situation of globalization, a changing IPR system and new technologies.²

2. Definitions

In terms of the objects for analysis, the focus of the study is very broad for the purposes of detecting broad tendencies. We should make some opening remarks about what is meant by "SME" in this study and what intellectual property rights we focus on in relation to this population.

2.1. Intellectual property rights: analytical definition

The study uses a definition of IPRs, which encompasses seven of the eight categories³ of the TRIPS agreement. For practical reasons, it was agreed that the focus of this study shall be especially on the first five:

1. Patents
2. Trademarks
3. Copyright and related rights
4. Industrial Designs
5. Trade-secrets and know-how
6. Circuit topographies
7. Geographical indications
8. Control of anti-competitive practices in contractual licenses.

In practice, however, patents, and to a lesser degree trademarks, dominate the discussion here, as they have done in the literature,⁴ despite a conscious effort to open the discussion to other rights. One reason that we risk carrying on this traditional bias in our context is structural. In our empirical section, the available databases cover patents and trademarks, while in our interviews these two areas were generally what were most familiar to the interviewees.

² Such an assumption was the basis for a 1995 Seminar. See Iversen (1995).
³ Control of anti-competitive practices in contractual licenses is directed at the State-level signatories of the TRIPS Agreement and is not relevant as an IPR used or potentially used by SMEs in the meaning of this study.
⁴ Economically-oriented literature on "IPRs" tends, with very few exceptions, to be limited to a discussion of patenting.

2.2. Small and medium-sized enterprises: analytical definition

The Norwegian definition of small and medium-sized enterprises is not the same as in other countries or regions of the world. Using the number of employees as the key, the accepted definition in Norway is:

Small = 1-19
Medium-sized = 20-99
Large = 100+

In larger economies, the sizes are correspondingly larger.

3. The question and how we address it

This study addresses the question of how small and medium-sized enterprises in a country like Norway might make better use of the intellectual property system so as to improve their competitiveness in the marketplace. The object of the study is therefore to examine an interrelationship. It involves examining the way the IPR system functions in relation to Norwegian SMEs and the way these enterprises approach and utilize the system. This study will address whether the variety of IPRs on offer to small and medium-sized enterprises, the way they are offered to these enterprises, and/or the way these enterprises are apt to approach these instruments leave the potential of IPRs for this particular population significantly unrealized in a country like Norway. The study will describe and evaluate current use and awareness of IPRs on the part of Norwegian SMEs and — against the background of apparent concerns, needs and problems — provide recommendations that may help to improve the contributions of the IPR system to this population.

In approaching this study, a preliminary observation must be made here. That Norwegian firms, in general, and SMEs, in particular, are too lax or oblivious to the importance of the IPR system is a subject of discussion that emerges periodically, e.g. in newspapers and popular literature (cf. Knudsen, 1995). Much of the evidence in this regard is anecdotal. There is less empirically sound evidence, but there is some that argues that a careful study is needed to understand the dynamics (cf. Iversen, *Hvorfor så få norske patenter?* In *Forskningspolitikk*, 1998).

3.1. Preliminary Considerations

A set of preliminary considerations needs to be taken into account before addressing this question. In general, the approach followed in this study has been to combine a complement of different sets of empirical evidence with an inclusive theoretical understanding. For example, while looking at patent-counts, it is important to look at their quality before making broad generalizations about increasing the extent of their use and the potential for their use. There are also contextual aspects to be understood, both about the firms themselves and about the IPR system that caters for them. This is important, as often there is a tendency to jump to conclusions on the basis of uncritical readings of what is actually happening.

More specifically, this study was designed and executed, bearing in mind the following considerations while approaching an analysis of this interrelationship:

- First, it is important that the study examines the assumptions critically. When addressing the question of how the IPR system can **better** help SMEs, there is a tendency to interpret “better” to mean “more often.” The assumption that SMEs should use the system more frequently, and that this alone will boost their competitive positions, is far too simplistic a prescription. Furthermore, it is potentially misleading to the SME and counter-productive in promoting the real benefits of the IPR system. At issue is how the firm can integrate intellectual property rights into its business to greater effect.
- Second, it is important to avoid the danger of assuming that all small and medium-sized enterprises are the same. This category contains a full 98 per cent of Norwegian enterprises and encompasses all activities ranging from the service to the manufacturing sector, from bars to software development firms. Obviously, the specific IPR needs of such a diverse population will be at least as diverse.

- Third, it is important to think of IPRs not as stand-alone legal instruments with isolated cost-benefit functions. The Intellectual Property Rights system is indeed based on the array of different types of rights, such as those pertaining to patents, trademarks and industrial designs. But in a broader sense, it includes legal, advisory and other supporting services that help an SME to use the rights in order to manage and develop its own intangible resources in competitive markets in a better manner.
- A fourth consideration is that it is important for the study to utilize an approach that provides a realistic picture of the situation facing both the SMEs and the policy makers. A theoretical understanding is necessary, but it should not lose sight of the reality it attempts to interpret. It is, therefore, important to base recommendations on an understanding of the national situation and its context, but also with a wider understanding of theoretical considerations and international trends.
- A final consideration involves the importance of collecting reliable information with which to diagnose the actual situation. One of the main challenges in this type of study is to find reliable information about the small and medium-sized enterprises under study, their present use of the intellectual property rights system, and their actual attitudes towards it.

This study is comprehensive in several respects: the study pursues a broad understanding of Intellectual Property Rights and the Support System that is relevant to it; the study presents an inclusive conceptual approach to the issues; the study conducts a thorough literature survey that considers the direct and indirect bodies of the literature; the study identifies elements in the Norwegian Innovation System that make up the “IPR system,” broadly speaking; the study interviews representatives at key points in this system to understand better current concerns and problems; and the study compiles and analyzes new datasets on both trademarks and patents. The importance of the subject and its complexity are hopefully reflected in the study’s thorough approach.

3.2. The structure of the study

The study is divided into three sections:

- the Concepts and Issues Section introduces important issues in the use of the IPR system by SMEs in helpful analytical terms that stress the role of the IPR system in the Norwegian *National System of Innovation*. Further, this large introductory section surveys what the literature tells us about the relationship between IPRs and SMEs.
- the Descriptive Section presents a first outline of the Norwegian IPR system. It goes on to present relevant information about Norwegian SMEs. This prefaces the database analysis that describes current use of IPRs by Norwegian SMEs and suggests their general awareness;
- the Evaluation and Recommendation Section draws on the above sections in light of the information from a round of expert interviews. On this basis, the final section evaluates the relationship between SMEs and the IPR system in Norway, and identifies special concerns or problems. These are then used to present recommendations designed to improve the contribution of the intellectual property rights system to Norwegian SMEs.

4. Why conduct such a study?

First, it is worthwhile considering why such a study is important, especially in today’s competitive, knowledge-driven environment. Indeed, there are general aspects of the present climate that suggest a careful assessment of how small and medium-sized enterprises in a country like Norway approach IPRs. Some are general and grow out of the overwhelming importance SMEs have in this small, open economy, or out of the shift in economic importance from the manufacturing to the service sector. Others have to do with the manifold changes permeating today’s business environment. The evidence (anecdotal and otherwise) of globalization certainly suggests that SMEs should actively assess the challenges and the possibilities posed by increased international competition. In this climate, it would behoove many to start considering (if they have not already done so) the potential contribution of intellectual property rights to their business strategy.

Further, there are several other streams of change that accompany globalization: these insist on increased attention from both policy makers and SMEs alike. The types of change witnessed in (certain) new technologies pose new challenges and supply new possibilities for economic actors, not least those working in niche markets. New technologies are among the factors that are changing the way the IPR system is shaped, administered and used. The surge of patenting we have seen especially in the US, but also in other countries, suggests that the question of IPRs should not be ignored, as Norwegian SMEs are often accused of doing. A third current is that business strategies are changing, so as to address the emerging challenges and possibilities in today's climate. One aspect of this, which is visible in the US example, is strategic utilization of IPRs.

Some general characteristics of the current economic situation include:

- the important role of SMEs in the economy;
- the changing variety of new technologies and the implications this has for the way IPRs can and are being used internationally;
- the changing business strategies internationally, and the challenges and opportunities they pose for SMEs;
- other general features of globalization that can adversely affect smaller companies, or that can provide them with new opportunities.

Some of these trends might not be new: some may be blown out of proportion by the popular press. And they do not in themselves automatically necessitate SMEs to use the IPR system more often. But they should suggest both to SMEs and policy-makers *in the national system of innovation* that there is a need for a more active assessment of technological capacity building in relation to the patent system, and of strategic business issues in relation to trademarks, trade secrets, industrial designs, and other IPRs as well, on the road to commercialization. As one of the interviewees aptly noted: SMEs that ignore the IPR system also make a choice. The fact remains that it is best that they make the choice in a conscious and informed way.

SECTION 1: CONCEPTS AND ISSUES

In order to create a foundation on which to formulate recommendations, the study first puts into perspective the relationship between SMEs and intellectual property rights. In this first section, we introduce the relationship and sketch how it has been treated in the literature. We then present a conceptual framework for approaching it. The section is designed to clarify the conceptual dimensions implicit in the study and allows the reader a practical and accessible way to come to grips with the issues the study raises.

This Section is divided into three chapters as follows:

Chapter 1 introduces current events and issues. This helps to orient the discussion and illustrate the importance of the subjects.

Chapter 2 introduces general concepts and issues, and indicates how the National System of Innovation (NSI) approach can be applied to better our understanding of the IPR-choices facing SMEs and how they make them.

Chapter 3 surveys the general relationship between firm size and IPR utilization, and briefly surveys how it has been treated in a selection of the literature.

1. General observations

The relationship between SMEs and the IPR system involves a complicated set of issues in the general field of economics:

1. What is competition and what does competitive position mean?
2. How does firm size influence competitive position? (Sabel & Piore, vs Acs & Audretsch) How do R&D and innovation vary as a factor of firm size?
3. What role do intellectual property rights play in competition (focus on patents, focus on the relationship between patents and R&D, focus on the situation in the US and in Europe, focus on short time-spans)?

Each of the strands involves many issues: some are more thoroughly investigated than others. None can reasonably be said to be exhausted or totally conclusive. Many areas remain disputed by different approaches and different perspectives. Several preliminary observations are in order as we consider what is at work here.

- The analysis of how SMEs utilize the IPR system is actually very limited in the literature. Very few studies exist that directly address the relationship and few have robust empirical findings. Those that do exist are limited in a number of ways. We lack evidence that is reliable over time, embraces different national settings, provides reliable and robust empirical evidence, and is not limited solely to patenting.
- Another factor that is lacking is a conceptual approach reflecting on the conditions surrounding SMEs, and that can usefully embrace country-level differences. We will make the case for the use of a National Systems of Innovation approach in addressing the complicated set of issues raised by the relationship between SMEs and IPRs. This approach provides a framework of contextual detail necessary to understand the way small and medium-sized enterprises use IPRs, for example in Norway.
- However, there does exist a body of diverse and developed literature that focuses on the components of the relationship between competition, SMEs and IPRs. This literature has much to teach us, and it should be consulted for the insight it can provide into the complex intersection of issues.

CHAPTER 1
THE BIG PICTURE AND THE SMALL FIRM IN A SMALL COUNTRY

The purpose of this first chapter is to take a closer look at some of the general trends that appear to be shaping the current competitive environment, and to expand a little on why they make the topic of small and medium-sized enterprises and intellectual property rights one which is ripe for appraisal, not least in Norway. Several factors suggest that both decision-makers in the SMEs and those in the relevant government bodies should (re) consider the possibilities of the IPR system in broad terms. These include:

- the growing globalization of markets,
- a shift to a “knowledge economy,”
- changes in international IPR systems and strategic uses of IPRs,
- and shifts in ways of doing business.

This chapter will present such trends and discuss some of the issues they raise in terms of IPR use.

1. A small country characterized by small enterprises

There are many aspects of the Norwegian economy that should be understood in order to assess the way IPRs are used in this country. Some basic factors that (potentially) affect the general competitive position of the country, and thereby condition the use—potential and actual—of IPRs can be alluded to here. The first is size. The Norwegian population and, consequently, the size of its home-market are very small indeed. Moreover, Norwegian firms are overwhelmingly small, tiny even, in comparison with potential international competitors.⁵

The fact that Norway is a small, open economy typified by a small home market has obvious implications in a state of pervasive globalization. This is often considered to be especially the case in light of a second, less easily supported, observation: Norwegian firms are often seen as traditional. They are, like the majority of firms in many countries, distributed predominantly in traditional industries (e.g. basic services and basic manufacturing). Moreover, Norwegian firms are often seen as traditional in terms of their business strategy. The protection of intangible assets is an area of business strategy where Norwegians are not known for being most innovative.

2. Changing international business environment

The picture of Norwegian firms as small traditional but inventive firms that are patent-skeptics is a popular caricature that the empirical work of the study moderates considerably. Its validity aside for the moment, the popular picture highlights several trends of today's business environment that underscore why a review of IPR use among a country's small and medium-sized enterprises is timely and important.

The anecdotal evidence of such changes is reflected in some of the business strategy literature, as well as in the growing policy literature on SMEs. The latter is dedicated to a large degree to such changes and the consequences they may have on the competitive position of small firms (cf. OECD, EU, US).

The business strategy literature suggests that a “new competitive landscape” is emerging in (parts of) the economy. This is especially held to be the case in the field of information and communication technologies, but it is not isolated to it. The familiar buzzwords for the complicated and variegated set of phenomena are the digital economy and the knowledge economy.

The “knowledge-based economy” assumes that the key condition underlying wealth creation is innovation through the generation, exploitation and diffusion of knowledge.⁶ In this framework, the protection of innovation through intellectual property (patents, trademarks, copyrights) is gaining in importance.

Accompanying such changes are shifts in market strategies, not least with respect to the utilization of intellectual property rights. One noted change is an increased focus on organizational capabilities, especially in relation to technological capabilities. These include the strategic management of knowledge in terms of development, maintenance and renewal of firm-level competencies. Also the management of knowledge outputs is important. Here, intellectual property rights have a role to play.

5 Distances within the country, however, are large, as are those to its export markets.
6 See Foray and David (1995) “Knowledge Systems.”

One seminal dimension of the changing environment is the emergence of new technologies. These have been accompanied by new strategic uses of intellectual property rights. Quickly moving technical areas like ICTs and biotechnology are areas that hold challenges and opportunities for the way IPRs are used in certain markets. Heightened activity will tend to make room for start-ups and spin-offs where IPRs may play critical roles. It also opens up increased competition, but also increased cooperation between all actors.

Another noted trend is thus new configurations which combine cooperation and competition. “Co-opetition” alliances are based on knowledge complements rather than, or in addition to, complements in physical resources. These changes have definitive implications for how enterprises secure these intangible assets. Intellectual property rights can be instrumental as a way to create security and transferability of such assets.

3. General shifts in the economy

Such current trends interact with more established changes in the economy. Nelson and Winter (1982) point out that since the 1970s the economy has been typified by increased R&D, greater technological change, and more extensive technological alliances. One important shift involves SMEs themselves. Beginning at least in the 1970s, there has been a shift in firm-demographics and the general orientation of the economy. One aspect has been a movement towards a “Service Economy.” Together with this shift, the position of SMEs has risen in the economy. While the importance of manufacturing dominated by large companies started sinking in the 1970s, the emergence of more diversified activities dominated by small and medium-sized enterprises expanded in many OECD countries.

There is thus a growing economic importance of small and medium-sized enterprises as well as a more active role played by multinational corporations. The growing importance of the service sector and of SMEs has implications for the study. The service sector uses the IPR system in a different way to manufacturing, and small and medium-sized enterprises tend to have different needs and approach intellectual property rights differently to larger corporations.

The argument that small and large firms live in a state of “rapid, relentless change” in a knowledge-intensive environment entails a change in how they think about competition. The conclusions from some of the more colorful business literature suggests the need (for some firms) to think in terms of a state of “hypercompetition,” of competing “on the edge,” or of “perpetual innovation” (Hitt, Duane, Hoskisson, 1997).

4. Current conditions involving IPRs

Several changes in the IPR system accompany these shifts and trends. One is structural and involves attempts to internationalize and harmonize the IPR framework. A second relates to changes in their scope and utilization. Here, there is the claim that, because patenting is a way to formalize knowledge assets, we are moving towards an era of “intellectual capitalism.” (Granstrand, 1999). At the same time, there is some evidence that certain leading economies, notably the US, have entered a “pro-patent era.” The rise in patenting in the US has been used to argue for this, but the reasons for and the degree of this phenomenon are disputed as to its cause (Kortum and Lehrer, 2001), its extent, and the underlying significance of increased volumes of patent applications (Arundel, 2000).

Let us consider some basic issues and concepts surrounding intellectual property rights. We introduce the question of (i) the value of an IPR, (ii) the uses of IPRs, (iii) the internationalization of IPR regimes, and (iv) IPRs and the challenges of emerging technologies. This will introduce some of the underlying concepts and issues considered in the rest of Section 1.

4.1. The value of an IPR

The question of what value different forms of intellectual property rights have for different actors is a central question for policy-makers, enterprises, innovators, patent and trademark offices and researchers alike. And, of course, this question has many facets, ranging from the fundamental issue involving the assignment of exclusive rights by society to private persons, to more immediate questions involving the interpretation of patent statistics.

7 See Hauknes, J.(1998) Services in innovation, Innovation in Services. R 13. 1998. STEP Report.

Most generally, there is the issue of what value IPR regimes hold for society and what costs they entail. In terms of patents, this has traditionally been phrased in terms of a trade-off between granting limited monopoly rights to individuals in return for the publication and dissemination of details of the invention (i.e. through the publication of patents). Measuring the social benefits against the private benefits is difficult to do with any confidence. One thing that does become quickly apparent from such a hypothetical treatment, however, is that there are different types of “value.” The individual rights holder and society as a whole will have different ways to tally their benefits. Further, each might have a variety of different ways to account for the benefits and costs.

Different ways to appreciate “value” of course influence the willingness to seek IPR protection, so this deserves some attention. So let us consider the case of an innovative enterprise. One expects reasonably that this agent is primarily interested in converting IP into commercial profits. However, this conversion — and the role of IPRs in securing it — is itself not a clear-cut phenomenon. An individual IPR holder will be able to assess the market value of an IPR only in retrospect and, even then, not with any accuracy. The “value” derived by IPR holders will necessarily vary from case to case and over time. “Value” will be more or less unique for the nature of the intellectual property right(s) involved, the dynamics of its market(s), the ability of the licensee/assignee to realize the potential value, and not least his strategy *vis-à-vis* IPRs or his ability to enforce his IPRs, etc. Nonetheless, certain types of IPR protection show strengths and weaknesses in conjunction with different types of technology and different types of IPR strategies (e.g. combining trademarks in conjunction with patents) work better than others for given cases. As technology changes and markets with them, so do these relationships.

But there will also be other ways in which IPRs hold “value” for the IPR holder which do not immediately involve dollar signs. Signals to the market, for example, are one important function with no immediate price-tag (although it might affect stock-market prices). Another is that strong fences make good neighbours in R&D collaborations: IPR portfolios help keep such fences strong (though a group of IPR lawyers is a complementary asset). Within an innovative enterprise, IPRs are valuable for reward schemes which are not necessarily linked to the ability of the company to capitalize on the inventions covered. In many companies, researchers, R&D managers etc. are graded, in part, by the number of patents applied for and granted. Another area where IPRs have value that is at least a step away from the market is in academic institutions. Some universities (mostly in the US) consciously build up patent portfolios and brand-names. Here, there are many motives that need to be understood.

In brief, there is no short answer to the question: what value do different IPRs have for small as opposed to large agents? What is clear is that more empirical material is needed.

4.2. The use of IPRs

Another important question involves what role intellectual property rights play in the transfer of technology and to what extent this role is changing in train with increased “globalization.” It is often observed that technological capabilities are becoming increasingly international, for example, through the operations of transnational corporations. This internationalization process, in turn, suggests that the strategic importance of patents and other IPRs is also on the increase. On the one hand, IPRs can be effective in establishing and asserting one’s technological capabilities in emerging technological and geographic markets (or protecting them against those who try to freeride). On the other hand, IPRs can be effective in promoting collaboration in these new markets with actors having complementary capabilities.

In brief, the rationale is that one effect of the globalization phenomenon is that technological capabilities at the firm-level are both becoming increasingly competitive and increasingly co-operative.⁸ In terms of mounting competition, patenting and other industrial IPRs can assist firms in:

- cultivating and protecting proprietary technological capabilities at home in the face of foreign competition;
- entering new geographical markets and asserting/adapting their technological capabilities there;
- acquiring detailed technical information about changing markets in different areas of the world.

8 See above. The so-called “co-opetition” environment, particularly apt for certain markets like those related to ICT.

In terms of the simultaneous rise in the importance of technological cooperation, IPRs are further useful in laying the ground-work for technology transfers and R&D collaborations. One aspect of this is that the patent portfolio of one firm acts as a signal to would-be collaborators. The more essential reason is that, theoretically, patents serve to translate (certain) technological capabilities into discrete units of economically useful knowledge that can then be transacted. Such transactions can involve:

- simple licensing relationships;
- collaborations and other alliances between firms with complementary technological capabilities.

Some of the questions this raises are:

- how in fact do IPRs condition inter-agent (also intra-agent, for MNEs) behavior;
- what roles do IPRs play in different types of contractual arrangements;
- how are different types of IPRs (patents and trademarks for instance) used together in transferring technology (for example through franchising);
- how are IPRs used in the transfer of academically developed technology;
- how does this new scope for the use of IPRs internationally bring with it new scope for their abuse.

4.3. The internationalization of IPR regimes

The above discussion of changing strategies and their bearing on the uses of patents and other rights assumed that all IPR regimes are stable, similar and effective. IPR regimes are, however, evolving, extremely heterogeneous and not always as effective as many would like them to be. This is the case for all the aspects of the institutional framework, from the legal basis that underpins intellectual property rights to the advising of prospective users; from processing applications to the publication and distribution of information; from the recognition of breached rights to their equitable enforcement.

An interesting set of questions is how these functions vary across countries, how they change over time (are they divergent or convergent), and what effect their shaping has on the innovative capacities of the relevant economies, either in the generation of novel ideas or in their absorption. One visible set of changes involves attempts to standardize the different legal bases for IPRs, as can be seen among countries that are members of the European Patent Office (EPO) and between the triad (USPTO, EPO and JPO). The 23 international treaties administered by WIPO as well as the WTO treaties also point in the direction of an attempt to establish a common set of rules for intellectual property issues. Individual sets of technology — for example the Internet — make common sets of rules, or at least common understandings, desirable. Arriving at common ground, however, is no mean task, and it raises important issues about balancing interests of the diversity of agents.

The conscious drive towards convergence, however, must fight against the persistent drift towards greater diversity, which is inherent in the IPR regimes. In fact, as countries react to changing conditions there seems to be increasing diversity.

Questions arise about:

- how to evaluate the role of the IPR regimes in an economy;
- how the role and functions of patent and trademark offices (PTOs) are changing;
- what the general effects of internationalization are;
- whether one can identify best practices from among the different types of institutional frameworks;
- how different actors relate to the different frameworks in different settings;
- what conflicts are visible within and between different types of institutional frameworks (for example, between formal standardization and IPR regimes).

4.4. IPRs and the challenges of emerging technologies

It is clear from the recent history of intellectual property rights that emerging technologies affect the way IPRs are formed, how they can be used and how they in fact are utilized. Software, databases, copyright on the Internet and genetic engineering technologies have all called into question what IP protection is available and whether it is adequate. Technology adapts and this puts pressure on the regulatory framework to adapt (despite its institutional conservatism). In turn, the changing regulatory framework affects the strategies involved that again affects (to some degree) the types of technologies that emerge. In general, there is a co-evolution of these conditions, which in theory can be studied at the level of individual technologies.

Computer-related patenting: in 1998-99, about 40,000 grants for "software patents" were issued in the US, up from zero in 1988. This case highlights a considerable difference in how software is treated in different regimes and how this can construct barriers between countries. It has been suggested that outside actors, for example Europeans, have not realized the potential barriers these software patents pose to entrance to the US market, even if the grants do not hold up in court.

Gene manipulation technologies: gene manipulation technologies pose unique problems for the provision and enforcement of intellectual property rights. Differences have developed in the way novelty is interpreted by different PTOs. The desire to appropriate returns for biotechnological research increases tension with existing interests in other economies, especially on questions of how traditional medicines are to be viewed as prior art. The question of 'biopiracy' has in turn led to demands for the legal recognition of knowledge, innovations and practices of indigenous peoples (cf. the COICA organization). There are many important issues involved here which will take time to clarify.

Internet and copyright protection: there are many difficult issues related to copyright in the "digital age." The WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty (WPPT), generally referred to as the "Internet treaties," both of which have recently entered into force, lay down the legal groundwork to safeguard the interests of creators in cyberspace.⁹

4.5. Conclusions

There are thus shifts in the business environment, some of which raise fundamental questions about the IPR system at the level of technologies, strategies, and not least, geography. The next section presents a conceptual framework in which to evaluate the IPR system, and its relevance at the national and the firm-level.

9 For more information on the "Internet treaties" see the WIPO website at www.wipo.int

CHAPTER 2
NATIONAL SYSTEMS OF INNOVATION AND THE IPR COMPONENT

The IPR system is after all a system. Not only in the immediate sense; i.e. that it systematizes a set of different rights and that it connects national with international legal frameworks. The IPR system means more than that in the eyes of the firm. It is a system of the external factors in the firm's economic environment that help the firm to manage its intangible resources. What is important for the firm is not the laws in themselves, but how these can help the firm leverage certain areas of its expertise or knowledge in the market. In practical terms, the system includes, but is not limited to, how the laws are administered by the national patent and trademark office (PTO). Further, the IPR system extends to include a variety of external support agencies that provide various types of advice and/or support to help the firm make the most out of its intangible resources. It is the quality of IPRs in a broad sense, not the quality of the legal framework per se, that makes IPRs relevant for firm-level economic performance.

In looking at the way small and medium-sized enterprises approach intellectual property rights, it is helpful to consider the IPR system in a broad sense as an integral part of the wider "system of innovation." In this study, the "National System of Innovation" or NSI (Lundvall, 1992) approach is used in order to focus on the complement between the individual small or medium-sized enterprise in Norway and the institutional environment in which it lives. This will help us identify the agencies and organizations that make up the "innovation-infrastructure" that surrounds Norwegian SMEs, including entities such as the Norwegian Patent Office, inventors-organizations, patent-bureaus etc. In addition, other framework conditions that are important to the way Norwegian SMEs address the IPR-market can be identified: such as the rules and regulations that condition R&D collaboration or access to research results from universities.

1. Background

NSI is a set of conceptual approaches that addresses the complex role innovation plays in the economy and the role policy-makers can play with regard to it. The approach germinated during the 80s and early 90s when it significantly advanced the understanding of the relevance of innovation to economic performance and the understanding of its nature. The approach persuasively argued that innovation is much more complex than a sequential development in which (factor) inputs are put in at one end and new technologies come out of the other onto the market. In doing so, it helped to debunk the "linear model of innovation" and to deny the exclusive relevance of standard (neo-classical) economic theory that had dominated policy discussions. In their place, the basket of systems-approaches together with more formal heterodox economics¹⁰ has provided the basis for a more sophisticated appreciation of the complex, sometimes chaotic, nature of firm-level economic performance, especially in the context of innovation.

1.1. Basic ideas

Systems literature starts from the premise that economic agents are not discrete actors but that they and their activities are linked in a variegated and dynamically structured system with other agents in the economy. In this context, innovation involves implicitly more than the inventor alone. The concept of innovation takes into account not only the market impact of new products and processes but also changes in terms of organizational and strategic functions. Innovation is a process that involves complex interaction between firms, "knowledge institutions" and public sector organizations.

The systems approach therefore makes explicit the importance of "framework conditions" to the performance of individual firms. One important aspect of these conditions is indeed the IPR system. However, it is not simply the legal framework that is of importance. It is also how patents, trademarks and other rights are administered by the national patent office, how other agencies such as public support institutions or universities, financial institutions and banks approach IPRs as well as how other relevant support services (such as legal and registration services) function that is important.

In brief, the NSI framework essentially highlights the importance of *innovation*¹¹ for the economy, while attempting to trace the complexity of general factors that shape the emergence and spread of new ways of doing economically-relevant things. In other words, it studies the innovation performance of an economy in terms of, "how formal institutions (firms, research institutes, universities etc.) interact with each other as elements of a collective system of knowledge creation and use, and on their interplay with social institutions (e.g., legal frameworks)."¹²

10 Especially evolutionary economics but also institutional economics.
11 "Innovation is a process of interactive learning, characterized by continuous internal and external feedbacks, which initiate steady changes to products, processes, services, ways of organising and distributing items etc. Interactivity in the innovation process refers to internal co-operation between several departments of a company (R&D, production, marketing, distribution etc.) as well as to external co-operation with other firms (especially with customers and suppliers), knowledge providers (like universities and technology centres), finance, training, and public administration." (Smith, 1994)
12 Smith, K. STEP-REPORT #10. (1994).

1.2. What is innovation? What is systemic and why is the creation of innovation seen in national terms?

In terms of this approach, the economic performance of a (small) firm is fundamentally affected by its “innovative performance.” In turn, this performance is conditioned by the fertility of its interaction with organizations (other firms, educational centers, etc.) and institutions found in its (national) economic context. A few words are in order concerning the idea of innovation.

The term “innovation” suggests to many an exclusive activity vaguely associated with a process that somehow yields new, often “high-tech,” products. Innovation is usually associated with tangible, complex things like the airplane, the locomotive, the transistor, about which nations subsequently boast. Obviously, innovation is far more complex and far more wide-ranging a process than this set of complex technologies indicates. But how much so?

- a. Innovation is more than technical advance. It also includes organizational adaptation, marketing innovations, and new combinations of existing ways of doing things.
- b. Innovation is not uniform: it varies between firms in different sectors, different size-classes (also different levels of maturity) and different circumstances
- c. Innovation is rooted in processes of interactive learning between the firm and other interconnected institutions in the economy.
- d. The scope for interactive learning depends on the economic structure and (formal and informal) institutions. These help determine the rate and direction of innovative activities. “Institutions define how things are done and how learning takes place (informal institutions include: the time horizon of agents, role based on trust, actual mix of rationality, the way authority is expressed).”¹³

The focus is not therefore on the artefact but on the knowledge component. This is important to help give substance to the idea of the “knowledge economy.” The NSI promotes a diversified concept of firm-level capabilities, it stresses the importance for the firm to interact with its economic environment to complement and update these capabilities. Such an interaction can occur at many levels, from using new technologies to conducting search activities related to science and technology. (Patent searches can reveal currents in the firm’s markets) Further, the NSI suggests that a firm’s “learning capability” may be more important than its existing information/knowledge (especially in markets typified by rapid change). The emphasis is rather on the importance of system-wide learning of different descriptions in and between firms and their environment.

In this sense, innovation is clearly an international pursuit, and recent decades have illustrated that innovations, like the markets on which they will be sold, are increasingly becoming “global.” The NSI does not argue for technological nationalism in the face of these currents. Instead it emphasizes the important roles factors rooted in the national contexts have on the way innovation processes actually work. One of the important support structures in this context is that related to intangible assets and their strategic management, for example through the IPR system.

1.2.1. The Importance of Interaction in the Economy

“The creation, storage and transfer of the knowledge skills and artefacts which define new technologies constitute a system of interconnected institutions.” (Metcalf (1995) Thus:

- interaction between institutional and organizational elements influence innovation processes;
- this interaction is systemic in nature;
- the elements of institutions and of organizations have some degree of national specificity;
- also appeals to national policy makers who have been looking for alternative ways of considering the relationship between technology and economics.

The prevailing economic structure and the institutional set up (understood as socially shared routines, norms and modes of problem solving) is at the center of NSI analysis. A variety of institutions including the IPR system provide an important infrastructure for the firm. This infrastructure includes a range of resources including the following (Galli and Teubal (1997)):

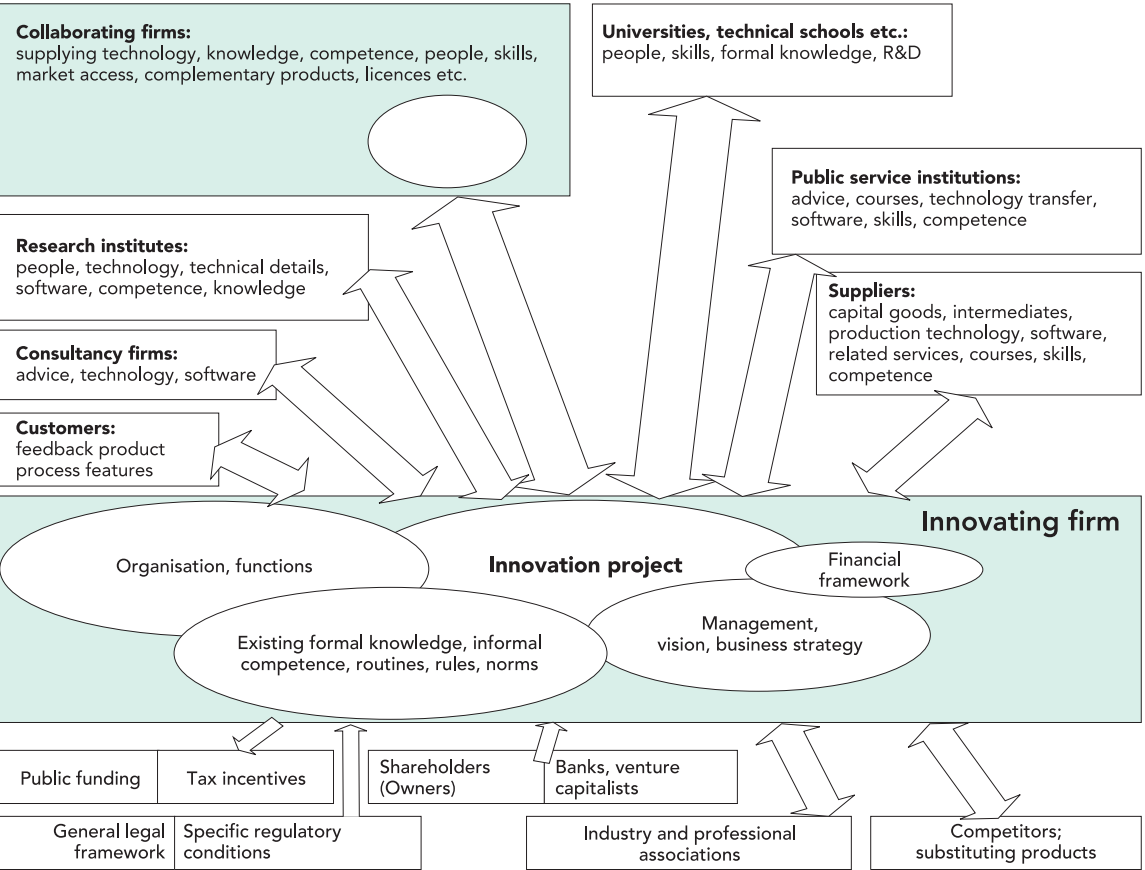
13 Lundvall, 1998.

- a. the business R&D sector;
- b. public R&D sector;
- c. the university R&D sector;
- d. a fourth layer, including patent offices (and standards organizations, etc.), forms a basic infrastructural subsystem.

Such components link up with firm-level capabilities and provide the basis for an important type of interaction. The approach focuses on factor interdependencies and on promoting matching, as opposed to mismatching, of elements or subsystems.

The following figure provides a notional view of the interaction and interdependencies between the firm level and the institutional level. The IPR system is here baked into the general legal framework but also the public service institutions. Further, this is important to many of the links (arrows) connecting the firm with its environment. This interaction in the Norwegian case is explained in more detail below.

Figure 2.1. General Interaction in a National System of Innovation



Ørstavik, Finn & Svein Olav Nås (1998). Institutional mapping of the Norwegian national system of innovation. Step WP A_01: 1 1998. ISSN-1501-0066. <http://www.step.no/Notater/A-01-1998.pdf>.

1.3. Advantages of the NSI Approach

One primary advantage of the approach is therefore its relevance. The national systems of innovation approach can be used to explain the importance of the IPR regime to the firm, not only how it is formed but how it functions. Therefore, the approach invites not only the legal IPR framework but also how it works into an analysis of firm performance. The approach also views the firm in relation to IPRs, the system that administers it and the ways in which IPRs can have importance (for funding, in the university system, etc.) in dynamic terms. This is important in a changing context of increased international competition and increased pace of innovation.

In this context, the approach helps us to identify areas in which small and medium-sized enterprises are at an implicit disadvantage. The particular importance of this in the case of SMEs is both suggested by intuition and by empirical study.¹⁴

- (i) finance/risk sharing;
- (ii) technology/technical know-how;
- (iii) qualifications/personnel;
- (iv) market access/information;
- (v) time-constraints/organization/strategic planning.

In the next section, we consider the question of competition and the competitive position of SMEs more closely.

1.4. The meaning of "competition" and competitive position

It is important that factors internal to the firm and those external work together to promote its competitive position. We move ahead now to consider what is meant by "competitive position" in the terms of the study. This will allow us to understand some of the general forces facing SMEs and, thence, how intellectual property rights can be understood to affect their competitive position. This subsection is designed: to qualify what is meant by "competition," and to make some general observations about the position of SMEs.

An understanding of the apparently uncontroversial topic of competition is essential: the way it is viewed will shape the direction that the analysis takes (cf. Metcalfe). Whereas the concept of price-competition in the prominent neo-classical economics is fundamental to the strong internal logic implicit in this theoretical approach, such an approach is not necessarily very helpful in conceptualizing the broad role IPRs play in the economy.

Indeed, in orthodox terms, IPRs and competition are antithetical because the former entail monopolies: as a result, IPRs are generally approached with some distrust by orthodox economists (see Taylor & Silberston for this observation). The notion of "technological competition," which is germane to the NSI approach to be presented in the next section, is also more germane to an understanding of the economic importance of IPRs. This subsection will provide a general introduction to these approaches, and what is meant by competitive position.

The basic premise of firm-level competition is fairly straightforward. Competition entails a process of rivalry among firms in a given (geographical and/or product/service) market. In it, the firm competes at any given time against existing rivals and potential entrants in order to capture as much of the *profit potential*, inherent in the market(s) in question, as possible. The firm's competitive performance is traditionally seen in the short-run, in terms of its market share, in the long run, in terms of its share of the profit potential of the industry as a whole, and ultimately in terms of long-run return on invested capital.

The idea of competition is, however, broader than this picture suggests. Since competition involves a contest, it is important to consider also the wider context in which the contest takes place. Metcalfe (1998) applies the following attributes of contests to firm-level competition:

1. A set of rules of the game:
 - a. a code of conduct for the game;
 - b. awarding points or rewards;
 - c. elimination from the contest.
2. The contestants themselves are characterized by skills and other attributes.
3. There is an inherent unpredictability in the outcomes.

So how do firms compete? The answer to this question is of course far less straightforward, and the literature is split as to just how to conceive this complex process. In a strict economic sense, competition depends on structural issues related to the market in question (e.g. capital intensity, labor intensity, etc.), it depends on the shape and intensity of demand, as well as on the number and orientation of real and potential competitors, to name but a few important factors. Ultimately, however, the answer is basically the same: it boils down to a question of how you sell more of what you are selling today at a higher profit than others and ditto for what you sell tomorrow.

Broadly speaking, textbooks offer two main ways of answering the question of how firms compete. The first is the classic case of *price competition*. This case is characterized by almost laboratory conditions in which firms compete essentially on price. In this setting, rival firms undercut each other's price on what they sell by producing and bringing it to market more efficiently than the competition.¹⁵ What they sell is to all intents and purposes identical and there are only a certain number of buyers. In this context, firms sell more by distinguishing what they sell from the competition in only one way: how much it costs. In order to be able to sell at a lower price and still make a profit, the firm has to be more efficient in how it makes what it sells than its competition.

The second main way textbooks address the question of how firms compete can be placed under the heading of "*technological competition*." (Schumpeter, 1942,1975) Broadly speaking, this mode of competition involves the various ways firms attempt to distinguish what they sell from rivals in ways other than price in markets that are less than perfect.¹⁶ For example, firms develop products and/or services that are new and stand out from those of rivals: firms develop new processes and new techniques that improve the quality of what they sell: or firms explore new channels of distribution or new ways to influence consumer demand. Instead of focusing purely on efficiency, firms take risks by investing in distinct and new products/processes/services which, if successful, will allow them to charge more for what they sell without the direct threat of competition.¹⁷

The underlying difference between these two ideal types of competition is that one involves doing the same things more efficiently than competitors (potential or current), while the other involves doing things in new ways or doing new things. Evidently, these types of competition will coexist in many markets while competition in individual markets may be associated more with the one than the other. Consider the different ways firms may compete in primary, secondary and tertiary-type markets.

One's success in selling a commodity like coal will be different from that of selling a product like diapers, and both will be different from that of selling a service like interior decoration. If you sell coal, your basic sales-argument may well be price. This commodity market approaches the case of price-competition sketched above. On the other hand, if you sell diapers you appeal to the buyer's sense of quality/function as well as to price considerations. Diaper manufacturers therefore tend to make their products physically and functionally distinct from those of their rivals. The third example is one from the increasingly important service sector. It does not depend on 'product attributes' per se. If you sell interior-decoration services, your success will also depend on appeal to the taste of the customer. Thus, the way the firm wins market-share in each of these markets will be fundamentally different.

Using these three examples, we can generalize in terms of three modes of competition.¹⁸ In competitive markets, you can attract buyers by making what you sell:

- distinct in terms of price,
- distinct in terms of technological performance,
- distinct in the eyes of the consumer,
- distinct in a variety of ways that overlap with the above categories.

These factors will become important when considering the role of intellectual property rights in promoting the competitive positions of SMEs. To anticipate this discussion, one salient point is that IPRs have limited applicability in cases where the "exertion of selling efforts" is not important or where the importance of technical alternatives do not play a role. In other words, intellectual property rights are less relevant in markets in which one competes solely on price, as in the example above. IPRs have that much more importance in cases where these factors do play a role, as in cases of "technological competition." Distinguishing between the three factors will also help to illustrate how the competitive position of small

15 In a perfectly competitive economy, however, firms are price-takers, which means they attempt to keep up with price-level on the market while changing output. In this context, rates of return tend towards a floor-rate of marginal cost.
16 For a discussion, see e.g. a. "In such industries firms compete not just by lowering price or increasing output but by developing or otherwise acquiring technologies that can dramatically enhance product and process performance" (Hartman et al, 1994)
17 In this context, risk-taking agents compete, through an expensive search process, in order to commercialize new technologies on unsaturated markets with correspondingly high profit-margins.
18 Of course, many markets tend to blend the cost component, the technological component and the taste component. The importance ascribed to each will differ not only according to the main type of market (commodity, product or service) but also, to a certain degree, according to the maturity of the relevant product or service market. Mature markets characterized by little innovation will tend to behave more like commodity markets in which rivals compete principally on price (i.e. price-oriented competition), while the innovative aspect will be more important in emerging markets (technology-oriented competition).

firms can be seen as qualitatively different from that of large firms, especially when it comes to their ability to compete on price. First, we should consider more closely the issue of “competitive position.”

1.5. Competitive position

In dynamic markets, the firm’s competitive position manifests itself most clearly in several key relationships. Its position can be seen:

- in relation to existing rivals in home markets,¹⁹
- in terms of its bargaining power with suppliers and consumers,
- in relation to potential entrants and substitutes,
- in relation to new and emerging markets.

What determines its position in these relationships is far harder to put one’s finger on. What is clear is that a whole variety of factors that are particular both to the firm and to the particular circumstances surrounding it will play a role, and that competitiveness will therefore take on different meanings in different markets. In this situation, it is helpful to distinguish between (i) factors internal to the firm and (ii) factors external hereto.

The internal component of competitive position involves the basic qualities of the firm and how well it does its business. The firm’s competitive position is in standard economic analysis grounded in its capital and labor endowments. Factors internal to the firm include the capitalization of the firm, the size of its workforce, but also less quantifiable issues. The National Systems of Innovation approach, as we will show in the next section (2), emphasizes the importance to economic performance (especially via innovation) of aggregate firm-level *capabilities*, and the firm’s ability to adjust and “learn.” The current environment — which by all accounts is becoming increasingly global and increasingly competitive —²⁰ places a special premium on capabilities, in terms of skills but also knowledge more generally.

In instrumental terms, competitive position depends on the firm’s internal capabilities related to purchasing, finance, manufacturing, conducting R&D, marketing, distribution, sales and other functions important to its business. Organizational elements are also important, not least the firm’s competitive strategy. After all, “competitive strategy involves positioning a business to maximize the value of the capabilities that *distinguish* it from its competitors.” (Porter, 1980) Both in the short and the long run.

Internal factors that are important include:

- capital endowment;
- size of workforce;
- professional qualifications of workforce;
- general capabilities at the level of the organization (purchasing, finance, manufacturing, conducting R&D, marketing, distribution, sales and others. Cf. Porter, 1980);
- “corporate culture” (Cr  mer, 1993);²¹
- behavioral requirements for technological advantage (Guerrieri and Tylecote, 1994),²² including interaction between different layers of management and with the rest of the organization;
- various kinds of technological effort that induce further accumulation of knowledge capabilities, including formal and informal R&D, formal and informal (on-the-job) training, technological licensing, etc.;
- and, instrumentally, the firm’s ability to learn and adapt.

Internal capabilities are necessary but not sufficient to establish and defend a firm’s competitive position. Since competition is essentially a relational phenomenon, there will necessarily be factors outside the firm that will condition its position. Let us distinguish between two general types of external factors. First, there are general aspects about the firm’s competitive environment that are important and to which it has to be

19 For an influential book on the issue of “competitiveness,” see Porter (1980) *Competitive Strategy: techniques for Analyzing Industries and Competitors*. The Free Press, New York.
20 The view that markets are increasingly “global” and increasingly competitive needs some qualification. While it is undoubtedly valid as a general assumption, it is obviously more a reality for some actors and markets than for others. See also “the knowledge economy.”
21 *Industrial and Corporate Change*, Vol 2, No. 3 1993.
22 Interindustry differences in technical change.

attuned and responsive. These are aspects that confront the firm. They include aspects of market structure both on the supply and demand side, aspects such as the dynamics of demand, cost conditions, the existence of economies of scale,²³ the size of capital requirements, etc.

A second set of external factors involves potential links the firm can develop with its surroundings. One important element is the role that access to public infrastructure and aspects of the regulatory framework play in shaping the competitive environment.

Guerrieri and Tylecote (1994) indicate some of the external factors that are important:

1. availability and quality of the “economic infrastructure”:
 - a. the Science base (SB),
 - b. technically trained manpower (TM),
 - c. financial systems (FS),
 - d. the role of government;
2. the availability/proximity of relevant university R&D;
3. the availability/proximity of other relevant industrial R&D;
4. regulatory conditions and climate;
5. nature and extent of institutional support:
 - a. institutions to reduce uncertainty by providing information,
 - b. institutions to manage conflicts and to provide incentives (cf. IPR regimes).

1.6. The link between firm size and competitiveness

Traditional economics literature has typically treated the importance of firm size in terms of market power. One section of the literature has for example tried to identify optimal size in different market situations (cf. J-I. You, 2000 for an overview). Other sections of the literature have tested the proposition that economies of scale are attendant upon large firms, for example in the production and marketing of goods. An especially relevant line of study of so-called scale-economies involves the question whether large firms enjoy scale advantages in the pursuit of R&D, and in the wider pursuit of innovation. There are three aspects of this literature to note before our general presentation of size-level issues.

First, there is no standardized definition of “small firms.” Much of the economics literature uses definitions related to annual sales, while other literature uses the number of employees. When employment size is used, there are different standards: fewer than 500 in the US, as opposed to less than 100 in Norway. This makes cross-country and cross-temporal comparisons difficult.

Second, there is relative ignorance about the subject matter. “Though the SMEs are a very important part of the industry in both EC and EFTA countries, only little is known of their innovation activities to date.” (Hyvarinen: 154)

The third observation is that there is an ongoing debate on whether big is beautiful when it comes to R&D and to innovation (see Scherer, 1965 for a valuable contribution on this issue) or whether smaller entities are relatively more important. In short, the consensus has shifted over time. On the one hand, many studies have over time supported Schumpeter and Galbraith’s hypothesis that large companies should be more innovative (see Cohen, Levin, and Mowery, 1987, for a summary). On the other hand, a more recent streak of literature (Acs and Audretsch, 1988 and 1991, Pavitt et al., 1987, Rothwell, 1986) has indicated that the opposite position is correct. For example, Cohen and Klepper (1996) found that the number of innovations per R&D dollar decreases with firm size when firms are broken down into industries.

With these observations in mind, let us proceed to a general discussion of firm size.

1.6.1. General features of the competitive position of small firms

In the context of competition, it would be an oversimplification to believe that factors internal to a particular firm are the only ones which affect its innovative capabilities and thus its competitive performance. The

23 Unit costs are reduced as output increases. See next section.

quality of the environment in which a firm lives, in particular the links to other entities that can supplement and develop its own body of knowledge, and those that can provide other types of support, must also be seen as a set of major determinants for the economic performance of all firms. The importance of interaction with factors external to the firm is especially important for small and medium-sized enterprises.

Although competitive position is essentially context-related, the position of small and medium-sized enterprises is, in many cases, qualitatively different from that of larger firms. Firm size plays a role quite simply in cases where size-related factors make firms more effective on the market. In cases where there are such economies of scale, large companies will hold a competitive advantage over small firms, other factors being equal. But there are also examples where small and medium-sized enterprises can hold an advantage over larger companies because of their size (Priore and Sabel, 1984).

In economic terms, such factors go under the heading of supply-side "economies of scale." Economies of scale generally imply that the unit cost of what a firm produces decreases the more it makes. The root is that there are upfront costs to the manufacturing of a product or a service that are not directly dependent on how many products are made or how many times the service is performed. The cost of developing and designing a car is a classical case. No matter how many cars a firm produces and sells, the costs sunk into R&D and retooling, etc., remain "indivisible" in that it is not scaleable to the number of output units. In order to make a profit, a minimum number of cars will have to be sold in order to break even as the unit cost decreases, the more cars that are sold. This situation is advantageous to large firms, which can make the initial investments, and can produce and distribute large volumes. This is why the car industry consists of a small number of very large firms.

Obviously, all markets are not the same as the automotive industry. However, such dynamics underlie many markets, products and services or even activities within the firm. In general, economies of scale can grow out of the size of the firm or the size of the batch (in manufacture), and should be seen in terms of the scale of the industry and/or the national economy. There are two general types of efficiencies that can grow out of economies of scale. On the one hand, there are the efficiencies in production, as in the car example. In addition, there are the efficiencies in the distribution of goods/services.

Economies of scale related to the technology in use form what Penrose (1959, 95) calls "Technological economies." Technologies which allow the production of larger numbers at lower unit cost may permit more efficient division of labor, economies of large-scale production and/or economies of (activity) expansion. There are also "managerial and financial economies" in which there are economies of large-scale operation/distribution.

Pratton (1991:16-18) identifies six variations:

1. Economies of increased dimensions: "capacity of capital equipment, both initial and operating, increases less rapidly than capacity."
2. Economies of specialization: "the larger the output of a product, plant or firm, the greater will be the opportunities for, and advantages of, specialization of both the labor force and the capital equipment."
3. Economies of massed resources: "a firm using several identical machines will have to stock proportionately fewer spare parts than a firm with only one machine."
4. Superior techniques for organizing production: "increased scale may make it possible to use more efficient techniques or methods for organizing production."
5. Economies associated with vertical integration: "there are technical economies of scale for integrating some production processes."
6. And, the learning effect: moving down the learning curve as experience/expertise is amassed.

There are also other less formal areas where size and volume will play a role. A major area that is relevant to competitive position is that size and volume affect the firm's bargaining position with its suppliers and its buyers. In that connection, size may also make the large firm more able to raise financial resources in capital markets and to take chances on new technologies. Such effects, as well as less obvious ones, affect the competitive position of larger firms differently from smaller ones.

One specific area where economic literature has dealt with the relative advantage conveyed by size involves innovation. Acs & Audretsch (1990, 39-40)²⁴ identified five factors that the literature finds favor larger firms. Larger firms are more likely to dedicate resources to formal innovation because:

1. Innovation requires high fixed cost;
2. Only firms that are large enough to attain at least temporary market power will choose innovation;
3. R&D is a risky investment: SMEs become vulnerable;
4. Economies of scale in production may provide scope economies in R&D, entailing greater profit potential for large companies;
5. Cost lowering innovations give higher profit margins to larger firms.

In markets where such forces are active, SMEs will tend to lose in extended head-to-head competition with larger firms. Small firms will simply not be able to compete on price with larger rivals. However, there can also be disadvantages to large-scale operations. Large firms can become slow to adjust in changing environments; large distribution and marketing apparatus can give way to clumsy bureaucracies, etc. Small firms can be better positioned to take advantage of new market opportunities. (Piore and Sabel, 1984). Further, smaller firms may be more suitable due to greater potential flexibility for specialist types of production services and knowledge, such as in niche markets. Indeed, many aspects of firm-level competition may in fact not be size-related at all.

One should not therefore assume that all small firms are necessarily waiting to become large firms nor that larger firms will, by virtue of size, have — and will be able to maintain — an advantage over smaller ones. The fact that a variety of small and large firms continue to exist in many markets, which are characterized by reasonably high levels of competition, indicates that such efficiencies as those noted above do not necessarily move towards an "optimum (large) size" for the firm. There are many forces to take into account. Just as competitiveness will take on different meanings in different markets and in different circumstances, the efficiencies of size will be magnified or reduced in different contexts.

It pays therefore to have a refined idea of the different types of small and medium-sized enterprises in a given population. Size alone will not be the sole determinant of the firm's behavior. The following table from Dodgson & Rothwell (1992) adds some functional detail to the general picture.

24 These authors use the European definition of small and medium-sized enterprises (i.e. fewer than 250 employees).

Table 2.1. Advantages and disadvantages of small and large firms in innovation.
Statements in brackets represent areas of potential disadvantage.²⁵

	Small firms	Large firms
Marketing	Ability to react quickly to keep abreast of fast changing market requirements. (Market start-up abroad can be prohibitively costly).	Comprehensive distribution and servicing facilities. High degree of market power with existing products.
Management	Lack of bureaucracy. Dynamic entrepreneurs react quickly to take advantage of new opportunities and are willing to accept risk (often lack management specialists, e.g. business strategists, marketing managers, financial managers).	Professional managers able to control complex organizations and establish corporate strategies (can suffer an excess of bureaucracy. Often controlled by accountants who can be risk-averse. Managers can become mere 'administrators' who lack dynamism with respect to new long term opportunities).
Internal communication	Efficient and informal internal communication networks. Affords a fast response to internal problem solving: provides ability to reorganize rapidly to adapt to change in the external environment.	(Internal communications often cumbersome; this can lead to slow reaction to external threats and opportunities).
Qualified technical manpower	(Often lack suitable qualified technical specialists. Often unable to support a formal R&D effort on an appreciable scale).	Ability to attract highly skilled technical specialists. Can support the establishment of a large R&D laboratory.
External communications	(Often lack the time or resources to identify and use important external sources of scientific and technological expertise).	Able to 'plug-in' to external sources of scientific and technological expertise. Can afford library and information services. Can subcontract R&D to specialist centres. Can buy crucial technological information and technology.
Finance	(Can experience great difficulty in attracting capital, especially risk capital. Innovation can represent a disproportionately large financial risk. Inability to spread risk over a portfolio of projects).	Ability to borrow on capital markets. Ability to spread risk over a portfolio of projects. Better able to fund diversification into new markets.
Economies of scale and the system approach (scope)	(In some areas economies of scale form substantial entry barriers for small firms. Inability to offer integrated product lines or systems).	Ability to gain economies of scale in R&D production and marketing. Ability to offer a range of complimentary products. Ability to bid for large turnkey projects.
Growth	(Can experience difficulty in acquiring external capital necessary for rapid growth. Entrepreneurial managers sometimes unable to cope with increasingly complex organizations).	Ability to finance expansion of production base. Ability to fund growth via diversification and acquisition.
Legal	(Lack of ability in coping with the patent system. Cannot afford time or costs involved in patent litigation).	Access to legal specialists. Can afford to litigate to defend patent infringement.
Government regulation	(Often cannot cope with complex regulations. Unit cost of compliance for small firms often high).	Ability to fund legal services to cope with complex regulatory requirements. Can spread regulatory costs. Able to fund R&D necessary for compliance.

Source: Adapted from Dodgson & Rothwell (1992). In Isaksen & Smith, Innovation policies for SMEs in Norway. STEP 2/97.

1.7. The link between IPRs and competitiveness

The question then turns to how intellectual property rights might affect competitive position. Some preliminary observations will be provided here. More specific information about how the literature has treated the relevant issues will be addressed in the next chapter.

In most circumstances,²⁶ the firm ultimately competes for market share by asserting the distinctiveness of its products/services in terms of their technological originality and/or in terms of their distinctiveness in the eyes of the customer. The firm is therefore at a competitive disadvantage if this distinctiveness (which will tend to combine the two types) can easily be eroded or appropriated by existing rivals, potential entrants and substitutes. On the contrary, the firm's competitive position might be strengthened if it manages to

25 Source: M. Dodgson & R. Rothwell, "Financing Early-stage Innovation in Small Firms (Flexible and Broad-ranging Support Packages)," in *Enterprise, Innovation and 1992: Innovation Support Services in Europe*. TII, 1989, pp.58-60.
26 Besides those of purely price-based competition

preserve and exploit its distinctiveness in the market, to the exclusion of existing rivals and potential entrants and substitutes. It is further strengthened, if it can use its distinctiveness to strengthen its ability to interact with customers and suppliers, and other potential collaborators.

Intellectual property rights can be effective in markets characterized by technological and design-based competition. In very general terms, the different mechanisms represented by the IPR system are designed to protect and promote different types of novelty. Taken as a whole, the legal regime of IPRs provides the opportunity to exert some control over intellectual or non-tangible assets, whose value might otherwise be dissipated in the market.

In terms of competitive position, we noted that the firm attempts to improve its position *vis-à-vis* existing rivals, *vis-à-vis* potential entrants and substitutes, and in terms of its bargaining power *vis-à-vis* its suppliers and buyers, by controlling and building up the strength of this "distinctiveness." IPRs can be an important element in such a strategy. IPRs can improve a firm's position by helping it to protect the distinctiveness of its products and/or services both in terms of the underlying technological originality — notably through patents and utility models — and in terms of their distinctiveness in the eyes of the customer — notably through trademarks and industrial designs. The use of relevant types of IP protection can potentially aid the competitive position of the firm by affording it the room to cultivate its distinct qualities, with no threat of direct competition from imitations. In the words of Porter, IPRs can help the SME "maximize the value of the capabilities that *distinguish* it from its competitors" (cf. Porter above).

The IPR system can be seen in terms of how it generally affects firm-level competition based (i) on technological originality and (ii) on distinctiveness in the eyes of the consumer. The IPR system offers a set of legal instruments to protect different modes of novelty or originality as they are engendered in products or processes. The following five classes of protection address protection concerns that emerge in general as well as more specific areas of what can be broadly called technology:

- 1. patents (and utility models);
- 2. trade secrets/know-how;
- 3. layout designs for integrated circuits;
- 4. copyright, related rights and *sui generis* protection of databases;
- 5. software covered by copyright (and patents).

"Trademarks" and "industrial designs" are two types of intellectual property rights that allow firms to protect recognition-related aspects associated with their identities, and their products and services. Trademarks are especially important to markets where the identity of the product/service is important to the buyer. That is, in cases where "the production opportunity of the firm is changed by the demand-creating process itself" (Penrose, 117).

CHAPTER 3: WHAT DOES THE LITERATURE TELL US ABOUT FIRM SIZE AND INTELLECTUAL PROPERTY RIGHTS?

How can Norwegian SMEs be better aided by the intellectual property rights system? The question posed by the study involves a complicated cross-section of issues and discussions found in the economics literature. This section will size up some of the key issues about the relationship between firm size and the use of intellectual property rights, and it will indicate how these issues have been treated (or ignored) in the literature.

This chapter provides a brief survey of the economics literature that deals with the link between the economic position of small and medium-sized enterprises and intellectual property rights. The portion of the literature that in any direct way addresses the whys, hows and wherefors of SME behavior in their contact with the IPR system remains very limited in a variety of respects, not least in terms of its volume. It is, however, a topic which shows some encouraging signs of attracting contemporary interest (cf. Arundel 2001).

However, there is a body of literature that focuses in one way or another on SMEs, IPRs, or competition. In this sense, our question crosses a complex intersection of important issues in the economics literature. These include what determines firm size, what the economic importance of small firms is in an economy vis-à-vis larger firms, what the economic effect of the IPR system(s) is/are, how firms in fact use the IPR system, etc. These are relevant to the subject of the study and should be considered, although there are obvious limitations in the scope of doing so within the present study.

1. The link between intellectual property rights and competitiveness

As noted, IPRs can be seen as antithetical to competition on the basis of some approaches. Beyond that, the literature has taken great pains to understand the economic role played by "IPRs." The ways in which it has done so have some substantial general limitations.

1. First and foremost, the literature on IPRs relates, almost without exception, to patent regimes. There are several reasons for this, one of which has been the relatively easier availability of patent data.
2. A second limitation is that economic studies of IPR regimes — that is, patent regimes — focus first and foremost on the US system, followed by other OECD countries. Do studies of the economic importance of IPRs exist for the majority of other countries? Some probably do, but very few are even hinted at in the mainstream literature. This is an important omission: without a broader understanding of how different national IPR regimes function in different contexts, the understanding of the system's economic importance remains limited.
3. A final general limitation involves perspectives on why IPRs matter. Analyses of patent regimes have by and large worked on the assumption that the patent motive is primarily or exclusively related to the appropriation of profits (see Schumpeter, 1950; Kenneth Arrow, 1962).

Still, a lot of sophisticated work has been done in this area despite such limitations. A review that could do justice to this vast and varied literature is obviously beyond the scope of the present study.²⁷ Before turning to what the literature tells us about the relationship between firm size and IPR use, we provide some general observations about how IPRs can be seen in terms of competitiveness.

In short, the literature indicates that there are many factors, including firm size, which condition the firm's choice when it comes to patenting. Some of the key areas of study and the key observations can be alluded to:

- General technological appropriability: Levin *et al.* (1987) showed that patents are not considered by business respondents (see below) to be the most important mechanism for protecting intellectual property. Lead-time, moving quickly down the learning curve, and complementary sales or service efforts are more important. Secrecy is also considered a better appropriation mechanism for manufacturing firms²⁸ than patents for process innovations. An update of this seminal study fifteen years later indicates that the importance of patents has decreased even more, although it might have increased for the largest firms (Cohen *et al.*, 1997)!

27 see Griliches (1990) for a renowned overview of some of the central work and figures in this field. See Ernst (2001) for an updated survey of the literature relating to patenting and economic performance.

28 Levin *et al.*, 1987; Rausch, 1995; Cohen *et al.*, 1998 for the US. Arundel *et al.*, 1995 for Europe in general; Harabi, 1995 for Switzerland; and McLennan, 1995 for Australia.

- Sector specificities: the role of intellectual property protection varies considerably between industries. Firms in different sectors evaluate the benefits of patenting differently. Firms in the chemical field (inorganic or organic chemicals, pharmaceuticals, etc.), for example, consider product patents to be much more effective than those who produce motors and generators (Levin *et al.*, 1987).
- Process versus product innovation: the structural factor that most clearly affects the propensity to patent is whether the innovation in question involves a product or process innovation. Propensity to patent is greater for product than for process innovations.
- R&D intensity: the level of a firm's formal R&D intensity will influence its attitude to intellectual property rights. This is connected to the question of whether small firms are more or less innovative than larger firms.²⁹ There is considerable evidence that R&D productivity (in terms of patents/R&D dollars) may be higher for smaller than for larger firms, although there are some difficulties here (including the definition of R&D dollars).
- Economic performance: patent applications modestly influence the market value of a firm (Griliches, 1991), and affect firm profits via increased sales (Scherer, 1965). Several studies have looked for effects of 'key' patents in specific industries. Ernst (1995) showed, in the (German) machine-tool industry that the number and quality of patents influence the firm's growth in sales and profit-ratio.
- R&D collaboration: the propensity to patent may be affected by whether the firm is engaged in R&D collaborations. Those who are tend to be more active patent applicants than others (Brouwer & Kleinknecht, 1999).
- Cultural differences in IPR-management: the existence of a "corporate patenting culture" affects the attitudes and uses of IPRs. Such cultures vary in different countries. One study (Deiaco, 1993) compared Swedish and Japanese intellectual property management. IPR-management tends to reinforce the positions of companies already at the forefront of technological development.
- Motives to patent: recent firm-surveys have shown, contrary to the received view, that some firms rate other functions of the IPR system higher than pure appropriation of profits (Cohen *et al.*, 1997).
- Intensity of patent-exploitation: a recent vein in the literature is currently debating whether the recent rise in US patent applications is due to a rise in the propensity to patent (Grandstrand, 1999), or to a growth in the volume of patentable technologies (Kortum and Lerner, 1999).

Most of these questions are influenced by firm size. However, many of the studies focus on the larger firms, not least because data are more readily available.

2. SMEs and intellectual property rights

The topic of how SMEs utilize the IPR system is actually very limited in the literature. Indeed, it is the most inadequate studied subject under consideration. One reason is that it combines the limitations already noted in the component literature. A second is that it multiplies the complexity of the issues touched on above.

Therefore, very few studies exist which directly address the relationship with robust empirical findings. Those that do exist are limited in a number of ways. We lack evidence that is reliable over time, embraces different national settings, provides reliable and robust empirical proof, and is not limited solely to patenting. In this section, we survey the existing literature that is directly relevant here.

29 cf. previous section. The salient feature is that the number of innovations per dollar of R&D decreases with firm size, when you control industry. Smaller firms (a relative concept) then account for a disproportionately large number of innovations relative to their size [Bound *et al.* (1984), Acs and Audretsch (1988, 1991a), Pavitt *et al.* (1987)]. Acs and Audretsch (1991b) suggest that small firms contribute 2.4 times more innovations per employee than large firms do.

The studies noted above (e.g. Cohen & Klepper (1996), Acs and Audretsch (1988, 1991), Pavitt *et al*, 1987) are in a sense relevant, in as much as they utilize patent data in relation to firm size. However, the relevance is indirect since patents are used to discuss the relationship between R&D and firm size. Their purpose and focus do not address the question of propensity to use the patent system *per se*. As such, it leaves a lot of questions open about how small and medium-sized enterprises interact with the IPR system. Other literature provides some inklings. Rothwell and Zegveld (1982) is an early study of how SMEs innovate. It indicated that many innovative small firms rely primarily on the technical knowledge of the entrepreneur. The value of the patented knowledge is less important.

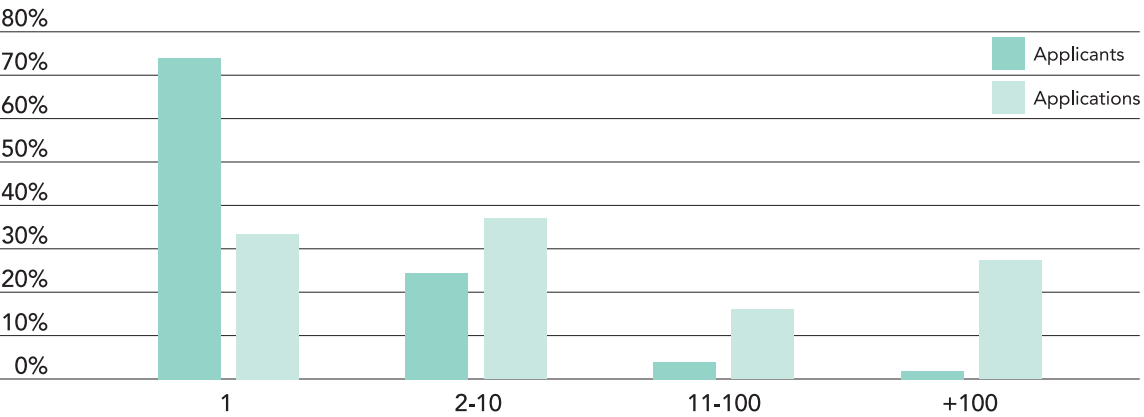
This section will survey the relatively sparse literature that is of direct relevance to how size is related to patenting. In general, this literature can be divided according to their focus and to what source is used to collect empirical evidence. Some is based on surveys (politically-sponsored or academically-oriented), while others rely on patent data, in studies of SMEs in individual industrial sectors or their international patenting.

2.1. General empirical evidence

a. A German Study. DPMA, 1999.

The DPMA Study shows not only that large firms account for a tiny minority of the total applicants but that, despite the fact that large firms patent more frequently than small firms, they account for a little over a quarter of total applications. Around two thirds are from entities with less than 10 man-years. This is an interesting result in a country like Germany, which is one of the few European countries where large firms account for the greater portion of national employment.

Categories of patent applicants by size



Source: German Patent Office (DPMA), 1999
In Germany as in most countries, a large number of patent applications are filed by “big applicants”, generally major firms highly active in R&D. But it also appears that smaller applicants file a majority of the patent applications, which shows that SMEs are also very active in terms of R&D.
http://www.ipr-helpdesk.org/t_en/i_038a_en.asp

One implication is that it is important to focus not only on the small companies which do not utilize the (patent) system, but also on those which do. After all, they do represent the vast majority not only of applicants but also of applications. If one assumes that the larger firms have the wherewithal to use the patent system effectively, it should be a policy concern to make sure that small companies do too.

b. A Derwent Study: Hall, Oppenheim & Sheen, 2000.

This recent study is one of several survey-based studies that exist. Here, the underlying sample is relatively small and spread out across a number of countries and branches. An immediate question that arises is as to whether the results are representative. One indication that this may not necessarily be the case is the surprising result that “over 50 per cent of SMEs in Spain have applied for a patent and 50 per cent in Scandinavia” (Derwent, 2000). This seems at odds both with what one would expect and the evidence from other more thorough studies (cf. the CIS based literature).

Table. Survey by Hall, Oppenheim & Sheen, 2000 (N=974 respondents)

Employees	Involved in patenting activities	Not involved in patenting activities	Total
	%	%	Number
Fewer than 5	9.9	90.1	152
5-10	19.4	80.6	191
11-50	28.0	72.0	339
51-100	46.8	53.2	111
101-250	52.6	47.4	175
TOTAL	30.0	70.0	968

Source: SME Survey, Spring 2000

The Derwent-funded study makes the point that few SMEs are involved in patenting activities. The study indicates that 30 per cent of all surveyed firms patent on average, while only about 10 per cent of those with 5 employees or fewer do.

c. A European Study: The Roland Berger Survey (1994) for the EPO.

A more comprehensive pan-European study commissioned by the EPO provides somewhat richer and more rigorous evidence. It looks both at the awareness, behavior and opinions about patenting among the sample. The basis for the sample is a selection of those companies in the EPO countries for whom the patent system is traditionally considered most relevant. The sample is taken from production industries in the EPO countries with one or more employees: it excludes service and trade industries, as well as a large group of small firms in several fields in which R&D was not expected. This study makes the assumption that R&D is a precondition for patent activities.

In total, 16 per cent of the firms surveyed had applied for a patent during the previous five years. A further 31 per cent reported R&D but had not applied for a patent. The remaining 53 per cent had done neither of the two. The proportion of patent applicants is closely related to firm size: the proportion of applicants accelerates as size class increases. While 11 per cent of firms with 1-19 employees had applied for at least one patent, the equivalent for those employing 500-1000 was 55 per cent. In the size class 20-99, the proportion was an average 15 per cent for the EPO area. In Spain, a much lower proportion of this mid-sized class had applied: only 4 per cent. This stands in stark contrast to what is suggested by the Derwent study.

The study indicated that the level of awareness about patenting is similar despite size-class. Between 20-30 per cent of the respondents claimed either to be familiar or fairly familiar with the patent procedure. This proportion did not vary too much according to size-class. In fact, slightly more of the smallest firms than the largest firms made this claim.

The study indicated that the smaller, especially the smallest, firms have special concerns about the relevance and effectiveness of patent protection. The smallest class (1-19 employees) rated the following factors higher than the average as reasons to refrain from patenting: patents are not effective enough against the risk of being copied, patent costs exceed benefits, there is lack of government support and secrecy is a better alternative. Another major difference is that the largest firms did not find the pace of product development to be a particularly relevant reason not to patent, while the smallest companies felt so to a much higher degree.

These perceptions and opinions might go some way to explaining the apparent differences in the propensity to patent between the smallest and for the largest. Does the patent system in reality provide less protection for the small than for the large? If so, why? Does secrecy work better for SMEs than for large companies? Similarly, do the benefits outweigh the costs more often for large than small companies? Is this merely because large enterprises have more resources, or is it because they manage to extract more benefits from it? And why is the lack of government support a problem for the small? Further study is needed to identify the underlying reason for the ostensible differences in concern and for the real differences separating SMEs’ patent behavior from that of larger companies.

d. An American Study: Koen 1991: Survey of small business use of intellectual property protection (US Department of Commerce).

This study has the most relevant sounding title in the literature, and is unique in that it includes the use not only of patents but also of trademarks, copyright, and even lay-out designs of integrated circuits. It is an early national study based on a limited mail survey. The purpose was largely explorative: its objective was to try to “uncover new relationships and the development concepts for further testing in the areas of small business and intellectual property protection, and to test some very basic hypotheses concerning differences between small and large enterprises” (Koen, 1991:137).

It is worth noting that Koen faced a similar situation to the one we do a decade later. There was a lack, then as now, of reliable empirical understanding of the relationship. Its contribution in this respect is substantial in terms of the breadth of the study (litigation questions are also examined), but is restricted by the sample used and the lack of a conceptual framework in which to interpret the results.

The Koen study compares technical SMEs that already used the IPR system³⁰ with larger firms. There are several aspects of the sampling that limited its applicability. SMEs in the study are rather large and may include as many as 499 employees (a large Norwegian firm). Not all firms of this size are included. It relies on a limited selection of high-tech branches where the firms were known either to use the IPR system in one respect or another, or to be involved in litigation. A stratified sample of 1094 firms was chosen from nine “hi-tech” branches, including pharmaceuticals, computers, telecoms and software.

Another limitation is that the large report is not analytical. It simply presents data from the survey and discusses questions of method. The numbers are left to speak largely for themselves.

Taking into consideration its limitations in terms of framing and sampling, the Koen study suggests that:

1. the involvement of “SMEs” in the IPR system is significantly different from larger firms in the sample.
2. a higher percentage of large firms are using the intellectual property protection system than small enterprises. A table is contained in the annex which breaks down a wider population³¹ into size classes. Without providing corrections for each technological area, this raw table provides a picture of “involvement” with IPRs that progress according to size:
 - 40 per cent of companies with under 50 employees are involved with IPRs;
 - 62 per cent of companies with between 50 and 249 employees are involved with IPRs;
 - 72 per cent of companies with between 250 and 499 employees are involved with IPRs;
 - 82 per cent of companies with over 500 employees are involved with IPRs;
 - 90 per cent of the firms with over 5000 employees are active with IPRs.
3. The choice of intellectual property rights varies according to sectors as might be expected: pharmaceutical companies used the patent system most, while telecoms and software used the copyright system most.
4. Patents and trade secrets are the two main choices for IPR protection for both large and small.
5. A majority of all firms in the sample are involved in strategic alliances.
6. A greater number of large firms (sample N=54) prefer trade secrets to patenting. This was cited as signaling a change toward greater reliance on trade secrets, although this contradicts findings from the more thorough Yale-based study (see below).
7. Small firms had fewer foreign patents than domestic (69 per cent) (cf. Moguee, 2000).
8. There is more formal licensing among larger than smaller firms (73 per cent versus 34 per cent)
9. Small firms, which have been involved in IP disputes, cite licensing violations as a moderate or major problem, while large companies in the same situation cited this as not being a problem or only a slight problem.
10. Small companies complain most often of patent infringement, while large companies do so about copyright infringement (cf. problems associated with sampling).

30 The 322 SMEs and 54 large firms that responded to the random survey either had patents, works protected by copyright, trademarks, ‘statutory invention registrations,’ circuit topography registrations or had litigation pending before federal courts.

31 Using the Corporate Technology Directory.

II. Major survey work

a. The Yale & CM Surveys

Surveys are of course sensitive to questions of sampling and response rates, and not least to the crafting of questions themselves. Given these considerations, the Yale study (Levin *et al*, 1987) set a standard for the survey-based study of IPR utilization, although the object of study was broader than that of the use of patent fields by SMEs. The legacy has been followed up in time (the Carnegie Mellon Survey) and in other countries, e.g. Switzerland (Harabi, 1995). In addition, other large studies like the Community Innovation Survey (CIS) have in part been inspired by certain lines of its questioning.

The Yale-inspired studies have surveyed large manufacturing firms about how they use and view patenting as a tool of appropriation. They ask firms to evaluate the effectiveness of patenting, trade secrets, etc., for the markets in which the firms operate — not necessarily on the basis of the firm’s own experience. This line of business approach is distinct from the CIS firm-level approach. It is meant to analyze the question of sector-based propensity to patent, motives for patenting, and firm views on the effectiveness of the patent system.

The Carnegie Mellon Survey (CMS) acts as a bookend for the earlier Yale study. As such, the CMS provides a later snapshot on the way patents are seen, approached and used in the US manufacturing sector. The CMS is based on nearly 1500 questionnaires of R&D labs (in 1994), meaning the focus is on large companies in which innovation is formalized. The size distribution is very much larger than the scale used in the Norwegian sample, although size is viewed as a factor.

A comparison of the CMS with the Yale Study reveals certain aspects of the ‘pro-patent’ era. Both studies indicate that secrecy and lead time are emphasized most by innovative firms in the majority of industries (apart from pharmaceuticals and similar “discrete product” industries), while patenting is ranked least important by them. The CMS, however, indicates that secrecy has increased in importance for product innovation in most industries.

Patenting shows signs of having increased in importance for the largest companies between the early 1980s and the mid 1990s. In addition, the motives for patenting appear to have shifted. The CMS shows that patenting is often used for reasons other than simply to appropriate profits directly. This suggests that an understanding of firm-level strategies is a significant area for further research. “Patent-blocking” strategies were ranked highly as a reason to patent, followed by using patents in bargaining and preventing lawsuits.

b. The Community Innovation Survey (CIS): a census approach

The CIS, which we will investigate in greater detail in the description section, uses a cross-country, census-based approach to survey innovation. It is a pan-European survey that supplies supplementary data on a somewhat different sample. It is currently the largest and most thorough single study on innovative European firms, and is administered by the public statistics agency, Eurostat. In our field of study, it includes two questions about use of the patent system: it tells us about the propensity of innovative firms³² to apply for patents and it tells us about the use of patent information by innovative firms in gathering information. This information can then be broken down by firm size, although the smallest firms (0-19 employees) are excluded.

Owing to its relative reliability and extensive nature, CIS has been used by several of the most influential studies reviewed below. The CIS provides insight into how innovative firms use and view patenting as an appropriation tool. It also asks about the use of patent information. It has spawned a group of relevant studies that focus on these questions.

In general, the raw CIS results indicate that firms involved in innovation prefer secrecy to patenting: the trend is most distinct with regard to process innovation but this is also the case for product innovation.³³ One relevant finding is that a much larger proportion of “innovative” large manufacturing enterprises than small manufacturing enterprises applied for at least one patent. For the European Economic Area, an aggregate

32 See definition in the description section.

33 Japan is noted as the only case in which firms (in product innovation) rate patenting as more important than secrecy (noted in Cohen, 1997).

share of over 50 per cent of large innovative manufacturing firms had applied for at least one patent, while the share for medium innovative manufacturing firms was around 28 per cent, and that of small innovative manufacturing firms, around 15 per cent³⁴ (the same as for all innovative Norwegian firms, see below).

A rough guide of the raw breakdown is found in this presentation. Most firms cite lead-time advantages as most important, (54 per cent for product, 47 per cent for process). Of the firms involved in product innovation, 17 per cent found secrecy most important, 14 per cent the complexity of the invention, while 11 per cent said patents were most important and 3 per cent design. Complexity was found to be most important for process innovators, after lead-time, followed by secrecy, patents and design registrations.

In a notable study, Arundel (2001) recently looked at how different size groups rate the relative importance of patenting versus secrecy as a method of appropriation. Arundel's approach is to focus on the relative importance assigned to patenting versus secrecy by firms in different size-groups. In addition to the fact that a majority of firms rate secrecy higher than patenting, secrecy is relatively more important for small firms than for large ones. If one takes into consideration the innovative intensity of the firms in the different size classes, there are no great differences based on size. A greater proportion of small intensive R&D firms rank patents as more important than the average for intensive R&D firms.

Arundel (2001) also examined this issue in terms of whether firms said they were engaged in collaboration with other firms. Among those which were, patents were of greater value than secrecy. Other related studies that can be mentioned are Arundel & Kabla, 1998: Propensity to patent, product and process (Europe); and also a Dutch study by Brouwer & Kleinknecht, 1999. The latter is based on the CIS in the Netherlands, where a question about the general attitude of management to patenting was included. This study indicated the following:

- if a greater part of a firm's products are based on innovative products, the firm will be more likely to use the patent system
- the firm will also be more active in the use of patents if it is involved in R&D collaboration;
- given the same innovative intensity, "smaller firms have a lower probability to apply for patents" (p 624);
- the probability of having at least one EPO patent rises faster than the number of workers: i.e. larger firms patent more than smaller firms;
- smaller firms, however, have relatively higher numbers of patents (the number of patent applications rises slower than the number of workers).

III. Other studies in the literature:

a. Litigation and external factors: Mary Seyer Koen (1992) Business Intellectual Property Protection, 253pp.

Other studies show that American SMEs (fewer than 500 employees) which use intellectual property rights protection are more reliant on external factors than are larger patenting companies. This confirms the observations made about the position of SMEs in the context of the National System of Innovation. The American study identifies a problem which is of general relevance but may be particularly pronounced in the US. There, the costs of enforcing IPRs particularly due to the fees of private patent attorneys, are noted as particular problems among SMEs. The fear of infringement (the time and expense) was a central consideration for SMEs when considering whether to protect an innovation. The study indicated further that SMEs were infringed more often than large firms, and that they were much less likely to litigate. Litigation can even affect the SMEs' decisions on where to research.

The question of enforcement is also considered in two studies by Lerner (Lerner, 1995 and Lanjouw & Lerner, 1997). The first showed that trade secret disputes were most prevalent, accounting for 43 per cent of the litigation in the US. Small firms were disproportionately involved in these suits. This suggests that small and medium-sized enterprises indeed rely more often on trade secrets because of the direct and indirect costs of patenting. Lerner (1995) suggested that small biotech companies may avoid pursuing research in areas near active and experienced litigators.

34 In Statistics on Innovation in Europe: Data 1996-1997. European Commission and Eurostat.

b. Study of foreign patent behavior by size: Mogee, 2000

The Mogee study looked at whether firm size affects their propensity to patent in other countries. It should first be noted that, *a priori*, firms are primarily interested in patenting in markets where they themselves are active. Since many SMEs are only active domestically, the tendency to patent internationally would initially be lower than larger multinational companies.

With this in mind, Mogee cites evidence (from 1974) that small firms patent their inventions in fewer countries than larger firms (Putnam, 1991). This suggests either that the value of small-firm inventions is lower (or less frequent) than that of larger firms, or that there are other barriers. The author notes other evidence suggesting reasons why SMEs might well tend to patent internationally. She cites evidence that small firms are more innovative than larger firms (Acs and Audretsch, 1990), and that small firms tend to renew patents for longer periods than large firms (Putnam, 1991), thereby indicating higher value.

Despite such evidence, this indicates that "patented inventions of small firms are more rather than less valuable than those of large firms," and Mogee study shows that SMEs patent less abroad than larger companies. "About one third of the small business patents are filed abroad, compared to about one half of the large business patents" (Mogee, 2000: 162).

c. Studies of patenting in specific sectors: Cordes, Hertzfeld & Vonortas, 1999

Cordes et al. (1999) studied the innovation and competitive strategies of SMEs in high-tech firms. In terms of intellectual property, the study showed that "patents and other formal intellectual property rights appear to be less important than trade secrets and to be first to the market. The costs of the patent system were a frequently-cited reason for not relying on them, and the problems of patent enforcement also contributed to the lack of importance of patents."

d. Use of patent databases by SMEs

A recent area of research in Europe has focused on how firms utilize patent databases as an information source. A forthcoming study sponsored by the EU has most recently looked at the issue (Cf. Technopolis, 2001). However, its results have not yet been released. An earlier study based on the CIS survey was carried out in 1998. (Arundel & Steinmueller, 1998). This study showed that the probability that a firm uses patents as an information source rises with firm size. In addition, it is affected by whether patenting is important to the firm as an appropriation mechanism. This can be compared with the evidence of Norwegian use of patent databases which suggests usage of next to nothing (cf. below).

Arundel & Steinmueller (1998) looked more closely at Dutch SMEs in five high-tech sectors to examine reasons for use and reasons for non-use of patent databases. This part of the study indicated that SMEs seldom use the databases to scan technical information, chiefly because it is expensive in terms of time and other resources. The study concludes that there is a "need for simpler and more efficient methods for searching patent databases" (Arundel & Steinmueller, 1998).

e. Different approaches

There are also several exploratory studies that experiment with different approaches.

(i) Baseline model: Toby E. Stuart (1999).

Stuart's approach indicates that "firm size increases the rate of patenting (the positive size effect remains in the model that includes R&D spending, demonstrating that there is a net effect of firm size even after controlling for investment in R&D). Organizations that grew quickly also patent at a higher rate, although the sales growth variable is statistically significant only at the 10 per cent level."

(ii) Continuous distribution of size class in Danish manufacturing firms. Nielsen, 1997.

The Nielsen study uses registry data that give exact counts of employees for a range of companies. This resembles the empirical basis that we will present for the Norwegian case in the next section. Nielsen uses a sampling technique among manufacturing firms where he looks at firm size and market concentration (how many firms are in a given field). The study “finds that firm size and market concentration have counteracting effects on the patenting activity of Danish manufacturing firms; in particular, the effect of market concentration on patenting activity follows a U-shaped curve” (1997).

SECTION 2: THE NORWEGIAN IPR SYSTEM AND NORWEGIAN SMES

Having introduced the relationship between SMEs and IPRs in conceptual terms in the last section, Section 2 provides a broad description of the Norwegian situation. This descriptive work is divided into two main subsections. In subsection 1, the study explores what are the characteristics of Norwegian SMEs and what IPR infrastructure is available to them in Norway. Subsection 2 then seeks to establish the extent of the current use and awareness of IPRs among Norwegian SMEs.

The tasks of the two subsections are as follows:

SUB-SECTION 1. The characteristics of Norwegian SMEs and the IPR infrastructure available to them.

Chapter 4. An anatomy of the Norwegian IPR system in the context of the wider innovation system.

Chapter 5. This chapter presents a composite picture that highlights relevant aspects of Norwegian small and medium-sized enterprises.

SUBSECTION 2. A snapshot of how different types of SMEs currently utilize intellectual property rights.

To provide a picture of current use and awareness of IPRs, the study compiles a unique set of data showing how Norwegian SMEs apply for patent and trademark protection. This subsection will introduce findings from this unique source of information about current use of IPRs among this population. In addition, we will scan existing sources that can illuminate the present use and concerns of Norwegian SMEs. We note here that this evidence is small and that the patent bias also extends to surveys in which IPRs are included, notably the Community Innovation Survey.

Chapter 6. An introduction to patent usage in Norway featuring existing information about how Norwegian enterprises approach the IPR system in Norway.

Chapter 7. The utilization of the patent system by Norwegian SMEs featuring an analysis of patent applications and grants, by size-class, industrial activity, etc.

Chapter 8. The utilization of the trademark system by Norwegian SMEs featuring an analysis of trademark applications, by size-class, industrial activity, etc.

SUBSECTION 2.1: SMEs AND THE IPR SYSTEM IN NORWAY

CHAPTER 4: THE ANATOMY OF THE NORWEGIAN IPR SYSTEM

The section maps the national institutions that constitute the Norwegian IPR system within the wider National System of Innovation. We noted above the importance for SMEs of collaborating with national institutions that provide IP services. Here we concentrate on a presentation of the system and note special characteristics that might affect the way Norwegian SMEs use IPRs. Assessment of the way it works is made in the Evaluation and Recommendation Section.

1. Norwegian Innovation Infrastructure: General Anatomy

The Norwegian System of Innovation consists of a complex intermeshing of different institutions and functions.³⁵ This complexity can, however, be presented in terms of several interconnecting layers. We consider the general character of these layers, with an eye to prefacing how they involve the interaction between SMEs and IPRs in Norway.

At a fundamental level, the Norwegian System of Innovation revolves around its general policy framework. This layer includes the political leadership of the ministries, the Parliament and, ultimately, the King. It provides the general legal and regulatory framework in Norway, and is therefore ultimately responsible for the formulation and implementation of laws such as those concerning intellectual property rights.

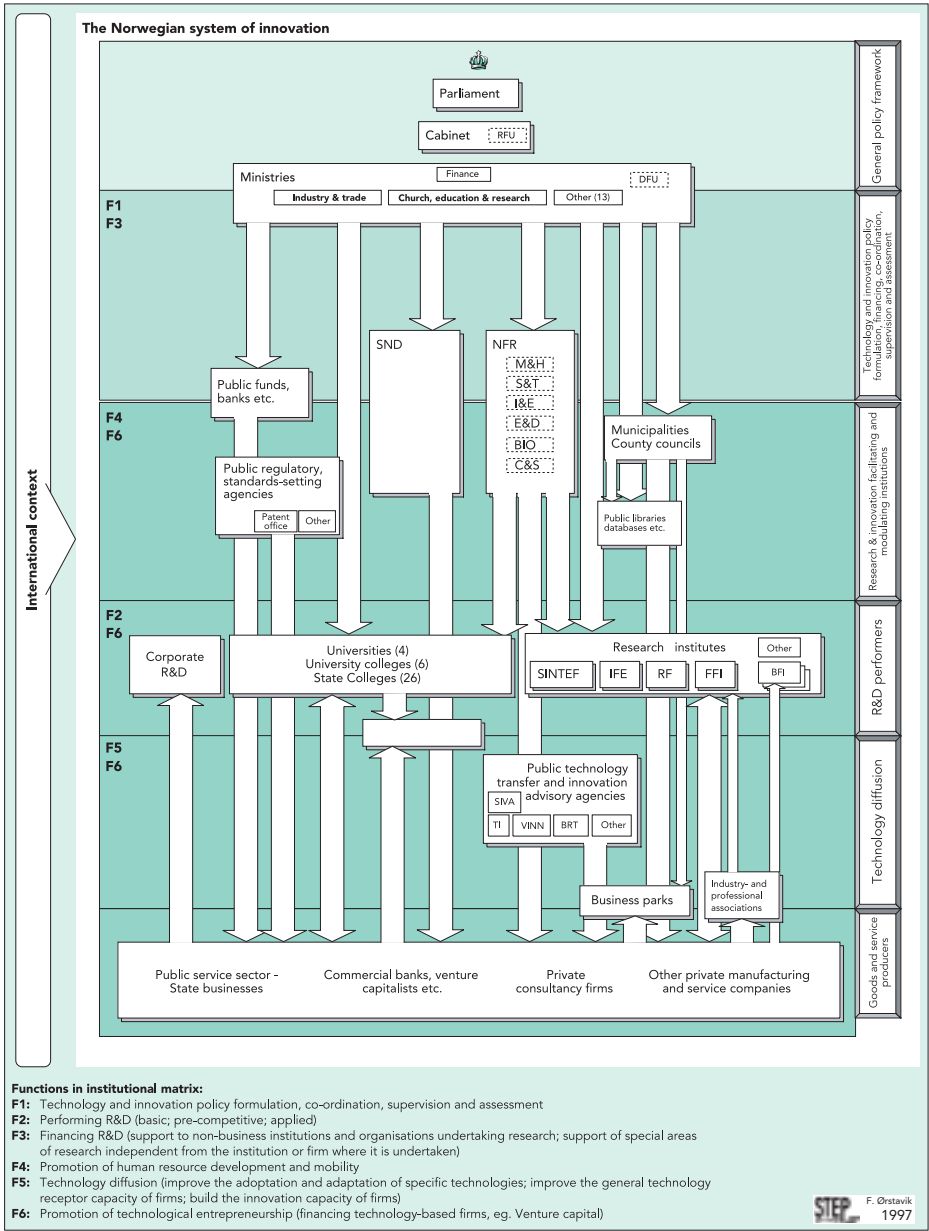
Aligned with the policy framework are the more operative functions of innovation policy, essentially its formulation and administration. There is not necessarily a clear delineation in practice from the general policy framework, but it is helpful to make it here. Key institutions at the national level are the Ministries, especially those of Industry and Trade, and Church, Education and Research, and their operating agents and agencies. The latter includes, most instrumentally in our context, the Patent Office. In addition, it names commissions for policy assessment and recommendation (such as the Bernt Commission on Commercialization of Research) that can have direct bearing on the formulation and implementation of innovation policy.

The financing and advisory agencies immediately beneath the ministries are centerpieces of the Norwegian System of Innovation. The two main national bodies, which are designed to play complementary roles, are the Research Council (NFR) and the Industrial and Regional Development Fund (SND). These are major institutions that provide funding and advisory services for start-ups, existing enterprises, and university and institutionally-based research.³⁶ There is also a series of much smaller organizations with more specific mandates and public funding. Here we can highlight the National Advisory Office for Inventors (SVO) and the Design Council.

The following figure presents these functions in a schematic form, together with key agents that conduct R&D and promote the diffusion of new ideas and technologies. In addition, it highlights relevant components of the private sector.

35 See Ørstavik (1998) for a complete discussion and presentation.
36 See also the SND Evaluation for details of the workings of the Industrial and Regional Development Fund. An evaluation of the Research Council is also under way.

Figure 2.1: A policy-centered organizational map of the Norwegian system of innovation



Source: Ørstavik. Step-Working Paper 1/98.

Ørstavik's Matrix provides a more detailed description of the functional division of labor between the different institutions in this framework. We should, however, note here the fact that, since Norway has a highly distributed but small population, the regional dimension is important to small and medium-sized enterprises in the districts. Accordingly, many of the agencies are spread throughout the country, especially in the larger cities. For example, SND has regional offices and is developing a local presence in the districts as well (Fylker). (See also the REGINN below, administered by NFR).

37 See Annex 1 for a list of acronyms.

2. Mapping the Norwegian IPR system

The Norwegian IPR system is relatively small, and reflects both the size of the country and its current level of IPR use and demand for IP-related services. In a way, the extent and depth of the IPR system provides the best indicator of the intensity of national IP use. In this part of the study, we catalogue the mainstays of the IPR system and provide an indication of how the system addresses the needs of SMEs.

2.1. General Legal and Regulatory Framework

A national IPR system is grounded in its laws. The legal framework, and its halo of regulations, evolves over time, but only very slowly. This conservative force is essential to the continuity of the larger system: it is important that laws do not change every time the political wind changes direction.

Yet, a process of evolution is likewise essential to the vitality of the system. Recent amendments to the Design Act are one instance of incremental changes (mainly superficial) that take place at this level of the system. More fundamental changes may be at hand, if, for example, the recommendations on commercialization of results from university and college research³⁸ become law. This would change the status of inventions by academic researchers, from the present situation in which the researcher owns the rights to one where rights are shared with the inventor's institute.³⁹ Another development specifically directed at SMEs and IPRs has been the reduction of application fees (cf. Norwegian Patent Office).

The basic laws at work in the Norwegian IPR system are presented in the next table. The table presents the general laws/acts and indicates the responsible instance in the innovation system. Further information can be found in Norwegian via the online compendium of Norwegian Law.⁴⁰

Table: Key areas of legislation and regulation in the Norwegian IPR system.

Laws and Acts	Administrative responsibility	Norwegian
Patent Act	Norwegian Patent Office	Lov om patenter LOV 1967-12-15 nr 09
Design Act	Norwegian Patent Office	Lov av 29. mai 1970 nr 33 om mønster
Trademark Act	Norwegian Patent Office	Lov av 3. mars 1961 nr 4 om varemerker
Collective Rights Act	Norwegian Patent Office	Lov om fellesmerker
Semiconductor Topographies Act	Ministry of Justice	Lov om vern av kretsmønstre for integrerte kretser
Copyright Act	Ministry of Culture	Åndsverksloven
Marketing Act	Ministry of Family and Children	Markedsføringsloven

2.2. IP Authorities and Administration

2.2.1. The Norwegian Patent Office (NPO)

"A qualified National Patent Office is an essential framework condition for industrial innovation."⁴¹ In Norway, the Norwegian Patent Office (NPO) plays the central role in the IPR system. In many cases, it is the first point of contact between the SME and the IPR system.

The NPO is an agency under the Ministry of Trade and Industry with responsibility for patents, industrial designs, and trademarks and collective marks. It administers the application and grant processes for these rights, and it is responsible for their publication as well. It also offers related information services such as basic searches. In addition, it is engaged in basic awareness and training activities. Since the mid-1990s, it has offered courses on the use of different rights. In the interest of awareness-raising, it has been active in a variety of seminars and conferences.

38 (NOU 2001:11 Fra insikt til industri: Green paper on commercialization of results from university and college research)
39 More specifically, it would mean a change in the 'lærerunntaket' in the Norwegian law on the right to inventions by employees (lov om retten til oppfinnelser som er gjort av arbeidstakere). See the upcoming European Trend Chart on Innovation. EU Directorate General for Enterprises: Innovation and SMEs program.
40 Lovdata (<http://www.lovdata.no>)
41 Mogens Kring, Director General of the Danish Patent Office.

The Norwegian Patent Office is an anomaly in Europe in that it formally remains outside the EPO system. It is a modest sized national patent office, and receives around 7,000 patent applications a year. In volume, the bulk of its work involves foreign applications. Eight out of ten patent applications originate in a foreign country, first and foremost from the US. Much of the expertise in the Norwegian IPR system is formally or informally linked to the rest of the IPR system. Job mobility from the Norwegian Patent Office to independent patent agents is one important channel for the flow of competences in the system as a whole.

The NPO is currently involved in an active campaign to improve its role *vis-à-vis* domestic SMEs. The first element is the reduction of application fees noted above.⁴² This measure stipulates a 20 per cent reduction in the application fee (to NOK 800) for enterprises with 20 employees or fewer, including independent applicants.⁴³ In addition, this applicant group will be exempt from the examination fee (NOK 2000) that was recently implemented. The examination fee will affect medium-sized companies, but will be refunded in all cases should the application be withdrawn. The application fees for trademarks will be raised by 20 per cent for all applicants.

The second element of the NPO's small-company profile is an intensive awareness-raising campaign currently under way, on a district by district basis. This is the current focal point of the Norwegian Patent Office's outreach activities as they are directed specifically to SMEs. In it, IPR awareness of SMEs is measured, prior to visits to the region in question, and the outreach efforts try to use this information to target specific problem areas. The efforts tend to target technical areas that are seen as growing in Norway. Specific SMEs are also visited. An evaluation of this effort is not possible within the framework of the study, but such an exercise might be conducted when it is finished.

The information campaign complements the NPO's existing information role through its vocal participation at conferences, seminars, and tradefairs. In conjunction with the information campaign, the NPO has also undertaken a formal study of small enterprises with regard to this population's awareness of the IPR system and the patent office's activities.

Furthermore, the Norwegian Patent Office has, since 1995, offered courses on different IPR-related subjects. This activity has grown to include a set of five courses annually in which SMEs have begun to be targeted. About one third of the 9,000 flyers on these courses are sent to SMEs. Although participation has in general increased, the overall levels are still modest. Furthermore, indications of the number of SMEs which actually participate seem to be very small, while many of the participants come from the public support structures, larger firms and law firms. The course framework and the way it targets SMEs is said to be under development, not least in light of the outreach campaigns mentioned above.

A final element of the NPO that is of more general relevance is the current modernization of its application, examination and publication routines. These routines have until now been primarily or completely paper-based. The Norwegian Patent Office's documentation of patents and trademarks is only now becoming available via the Internet. This means that SMEs have had limited access to this information. SMEs (or any first-time or occasional applicant) interested in finding out what has been patented or trademarked in a particular area and by whom, have had to visit the patent office in person (in Oslo or in the library in Trondheim) in order to leaf through the paper copies. Regular applicants, such as many large enterprises, would typically have the information in-house if they subscribed to the published reports (Patent og Varemerke Tidende). In addition, the application and examination processes are to be made more efficient through the implementation of digitally-assisted application process-systems (the SANT-system).

2.2.2. Copyright organizations

The copyright system is a non-registration based rights system and its administration is therefore fundamentally different to the industrial property rights system. Despite this, or because of this, an institutional infrastructure has grown over the decades which helps to administer different aspects of copyright between rights-holders and users. This infrastructure can be said to serve primarily the individual creators of copyrighted works (musicians, writers, painters, etc.), as intermediaries in their interactions with copyright users.

42 kgf.res. 7 april 2000 for endring av forskrift 1 vedrørende avgifter for Patentstyret.
43 The majority of applicants, see below. Note that the fee-schedule for patent applications has been considerably lower than, say, the Danish. In the new system, the combination of the application and the examination fee will, for large enterprises, rise on a par with the Danish. The combined fee for small and independent applicants will at the same time sink to NOK 800.

There are seven key organizations in the Norwegian copyright infrastructure and a rich flora of about 30 Norwegian rights-holders' organizations below the copyright clearance centers. A portal for these Norwegian rights management organizations (BONO, FONON, GRAMO, Kopinor, LINO, Norwaco and TONO) has recently been introduced under the name CLARA (Online Information Centre for Copyright and Clearance).⁴⁴ As with the patent office, the vast majority of the works administered by copyright management organizations in Norway are by foreign rights-holders.

The division of labor for the Norwegian rights-management organizations is basically as follows, although there is some considerable overlapping. For visual artists (1,600 Norwegian painters and rights-holders) there is BONO; for writers (about 2000 Norwegian writers are represented) there is LINO; and FONON represents 80 Norwegian record producers. The boundaries are less clear for the remaining organizations. We will seek to provide an idea of the infrastructure that the "individual creator" meets in Norway.

1. The Reproduction Rights Organization of Norway (Kopinor: <http://www.kopinor.no/>) is a 20-year-old organization that represents the interests of rights-holders. Today, some 20 membership organizations make up Kopinor. These organizations themselves cater for individual activities where reproduction of copyrighted material is central. The members include authors' organizations, publishers' organizations, journalists' organizations but also craftsmen, visual artists, and composers. There are thus large agents (e.g. publishers) and small agents (e.g. authors) represented under this umbrella. The main aim of Kopinor is to administer the national system to compensate rights-holders for the reproduction of copyrighted material, especially that which is photocopied but also material that is digitally copied. Kopinor has collected 1.3 billion kroner during its 20-year life, and claims to cover around 80 per cent of the copyrighted material reproduced by the public sector, schools and companies. It has performed studies of rights' users at the different levels of government, in the school system and in the private sector. (<http://www.kopinor.no/dokumentbank/statnor.html>)
2. Audiovisual material. Whereas Kopinor is traditionally associated with visual presentations of copyrighted works, several organizations cater more specifically for music and film.
 - a. Norwaco is an independent rights manager for performing artists, music and film/video producers. It was established in 1983 and claims to represent some 35,000 rights-holders and/or users through 33 individual organizations.
 - b. Established in 1928, TONO is one of 50 organizations under the CISAC (Confédération Internationale des Sociétés d'Auteurs et Compositeurs) umbrella. It is authorized to administer the copyright licenses of artists whose music is performed publicly, for example, on television. TONO is represented in the districts of Norway and has travelling representatives as well.
 - c. TONO is also associated with the Nordisk Copyright Bureau (NCB). NCB administers licenses for audio-visual recordings, inclusive of recorded music and films, and has representatives in the different Nordic countries. In addition to administering licenses of local artists, NCB administers the automatic rights of international artists in Norway. In Norway the representative is at TONO. <http://www.tono.no/ncb.html>.
 - d. GramArt (http://www.gramart.no/fs_om.html) is a national rights-management organization dedicated to protecting the interests of musicians, whether established or not. It currently has about 2,100 members, representing a broad range of musical styles. The majority of these are small in the sense of this study. GramArt grew out of GRAMO in 1989. GRAMO administers a system of remuneration between performance artists and record labels. GramArt works principally to assist musicians with their contracts and publishing agreements. Interest among its members for assistance with contracts is rising. One dedicated legal expert is employed.

2.3. Public and semi-public financing and advisory agencies

The financing and advisory services that relate directly to intellectual property rights can be divided into two classes (i) major public funding organizations and (ii) specialized funding and advisory services for inventors, entrepreneurs and designers. We will survey these here.

⁴⁴ See the key centers for copyright and clearance. <http://www.clara.no/organisasjoner/>

2.3.1. Major public funding organizations

The Research Council (NFR) and the Industrial and Regional Development Fund (SND) are two central agencies for public funding of innovative activities in Norway. They are central to the public efforts to support new knowledge in Norway, and their networks shoot through the rest of the system. In addition, they have specific programs (cf. joint programs below) directed at SMEs. Their centrality in the overall innovation system alone means that they also have a central role, potential or realized, in the IPR system.

The Industrial and Regional Development Fund (SND) is the mainstay of Norwegian public funding for industrial development. The SND offers enterprises and independent agents an array of instruments, which, in sum, combine funding and advisory services. Support is offered on a general basis both to entrepreneurs involved in setting up a new enterprise or to those developing an existing enterprise. Proposals that involve innovation, competence-building, environment, and internationalization are especially welcome. This role is supplemented by the Industrial Development Corporation (SIVA, see below). In addition, general competence-building in SMEs has been focused through the FRAM Program, a networking scheme which, however, is now being phased out in the current budget. This program has some ties with the TEFT program (see under joint efforts) for promoting technology transfer and sharing experience between enterprises.

SND's Entrepreneurship Center reports that, of SND's 16,000 users nationally, 90 per cent are small and medium-sized enterprises. In general, about a tenth of the small firms themselves have integrated patenting into their business strategies. SND provides advice to applicants on intellectual property rights and the director of the Entrepreneurship Center is himself an expert on IPRs.

The Research Council is a central funding agency both for university and private-sector research. Although its role in promoting the generation of new knowledge may be considerable, its direct role in the IPR system is much less pronounced. The Research Council does not claim any formal competence in this area, and no one is directly responsible for intellectual property rights' policy.

The guidelines for its funding to enterprises, which is granted on a matching-funds basis, in fact discourages the use of intellectual property rights. The policy is to promote publication of results unless the recipient can demonstrate that other outcomes are more desirable. On the other hand, through its programs the Research Council emphasizes the commercialization of research results (for example, see FORNY under joint efforts).

Notwithstanding, the number of patents registered in the Industry and Energy section of NFR grew rapidly in 2000. The raw applications jumped 120 per cent from a cumulative total of 92 in the period unto 1999, to 201 in 2000. In its support of the medical and health sector, research is particularly concerned with the combination of changing technology and the changing IP field.

2.3.2. Joint efforts

A notable program which receives joint funding from the ministries is the BRIDGE program. Its main aim is to promote interaction between various R&D centers, and business and industry. The program caters for companies with little R&D activity, particularly small and medium-sized enterprises. Several large projects run in the BRIDGE framework:

- TEFT is a technology transfer project aimed at SMEs. TEFT is designed both to encourage Norwegian SMEs to undertake R&D projects and to help technical research institutes to become more attuned to the needs of SMEs.⁴⁵
- FORNY promotes the commercialization of ideas emerging from Norwegian universities, colleges and research institutes
- REGINN encourages project collaboration between regional R&D units, mainly regional colleges and research institutes, business and industry, and other entities in the public service system.

⁴⁵ See Remøe, Step working paper A 03 /1999.

2.3.3. Affiliated agencies

A web of organizations that play more specific advisory and/or financing roles supplement these major funding organizations. One category that is important to the IPR system is that of technology transfer (TT) agencies. The Industrial Development Corporation of Norway (SIVA) is the central, permanent TT organization (see also TEFT, above). SIVA is a state-owned, independently operated innovation hub. The 60 innovation centers in which SIVA is involved are designed to bring together commercial, financial, and R&D activities. Each center has an average of 100 participants who facilitate the exchange of industrial and innovative approaches.

The Technical Institute is another organization whose mandate is directed to the needs and concerns of Norwegian SMEs. Its activities are chiefly directed at training and as a competence center for companies.

Another organization, located in the North, is VINN. VINN is a private consulting and contract R&D institute which offers services in the fields of technology, competence and information for industry, and the public sector (see also Research Parks, below). It hosts the publicly supported portal BEDIN (<http://www.bedin.no>) which is designed to help SMEs and entrepreneurs to navigate relevant public information (such as tax rules) and services (support organizations) that may be relevant to a small company.

2.4. Publicly-funded investment companies

A current trend in the Norwegian national system of innovation is the attempt to marry public and private capital to promote start-ups or fledgling enterprises. These cater specifically for knowledge-based companies in the early phases, when IPR strategy is most important.

2.4.1. Startfondet

The START-Fund is the result of a relatively recent joint initiative between public and private interests. The Fund is a registered company (ASA) that provides risk-capital and advisory services for start-up companies. The Fund's capital base is relatively large (compared to that of SVO) at NOK 320 million, half of which is financed by private investors and half through guaranteed loans from the SND.

As such, the Fund competes to a degree with other venture-capital companies that offer seed-capital. Like many venture companies, it targets companies in rapidly changing areas with international growth potential, especially biotech and ICT start-ups. However, its focus group is somewhat wider than that and it is open to a "wide variety of profitable, competence-based companies capable of creating value in Norway."⁴⁶

2.4.2. Plans for a new investment corporation

In addition, SIVA and SND recently announced (on 12/06/01) plans for a new semi-private investment company involving 2.45 Billion NOK of public funds. This investment fund will be independent, and more than 50 per cent of its stock will be privately held. Its intention is to provide longer-term financing for innovative companies. The new company is apparently not directed at start-ups, although it is not immediately clear how it will in practice complement the existing range of (semi-) public activities designed for financing and providing advice on innovative activity in the private sector.

2.4.3. Specialized advisory organizations

2.4.3.1. National Advisory Office for Inventors (SVO)

In terms of its overall size, the National Advisory Office for Inventors plays a disproportionately important role in the Norwegian IPR system. This is a relatively small office that addresses the needs of entrepreneurs and unaffiliated inventors. In view of the expertise, the SVO is an important organization in the IPR system. It receives some 1000 applications per year, of which roughly half are considered more closely. Between 100 and 150 of these projects are then pursued. SVO's budget is small, with approximately NOK 7.8 million available to fund the projects. This means that its role is in many cases primarily advisory rather than financial.

⁴⁶ see <http://www.startfondet.no/english/>

The SVO offers a range of services, from the preliminary evaluation of the inventor's idea to market surveys; from help in navigating the public support system to assistance in locating partners. In addition, it explicitly offers advice on IPR protection strategies and licensing. About 80 per cent of the projects involve IPRs, mostly patents, designs and, in a few cases, trademarks. In approximately 60 per cent of the cases, the successful projects result in licensing, while 40 per cent lead to a start-up enterprise.

2.4.3.2. Norwegian Design Council (NDC)

The Norwegian Design Council was originally an offshoot of the Confederation of Norwegian business. Its charter is to "promote good design as a competitive tool in market-oriented product development and market communication (see website)." In addition to a general awareness function, the NDC advises Norwegian enterprises on questions related to design and offers other support functions. One of the relevant areas is the protection of industrial design through the IPR system. The NDC provides support and design-related services both for SMEs and larger entities. Between 75 and 100 cases handled every year relate to small enterprises, and between two thirds and three quarters of these are individual designers.

The NDC estimates that only about a quarter of Norwegian companies utilize designs in their product-development activities. Until recently, it has not received too much sustained policy attention. However, a commission which was set up to study the improvement of the international competitiveness of Norwegian industry recently highlighted the importance of industrial design. A green paper was published on how the role of industrial design can be improved (including a suggestion of a 125 million NOK investment over the next three years). This development, combined with the revision of Norwegian design legislation, indicates that industrial design is currently a focal area in the Norwegian innovation system.

2.5. Research environments

2.5.1. Universities, regional colleges, public research institutes and hospitals

The research conducted at academic and research facilities leads to ideas which have commercial potential. Some ideas lead to the generation of new SMEs through the help of different institutions which combine funding and advice. These include public and semipublic agencies, research parks and incubators, private venture capitalists, etc.

The question of commercialization of publicly-funded research results is, as indicated above, under review. Today, the university professor or researcher owns his own research results. One consequence of this system is that universities themselves do not have technology transfer agencies, or indeed any formal operational competences in this area. Some hospitals and institutes have statutes and licensing guidelines. In so far as this role is relevant to the research outcomes, it is played by a number of research parks and incubators.

2.5.2. Research parks and affiliated incubators

In addition to the cluster factor of being close to other research-based enterprises, Norwegian research parks offer a range of services, including seed-capital, research facilities, and advisory services, especially those concerning licensing. They are partially publicly-supported, especially to promote the commercialization of university-based research (see the FORNY Program, administered by NFR). There are roughly 20 incubators in Norway, of which about half are formalized in relation to existing universities (for example, the University of Oslo) or district colleges (the agricultural college at Ås, or Agder College in conjunction with Ericsson and Telenor). The remainder are private niche incubators that have survived the fallout after the downturn in the digital economy.

One relevant example is the Leif Eriksson Nyfotek (LEN), which caters for the area surrounding the Technical University and SINTEF in Trondheim. It promotes the licensing of ideas from universities and institutes in Central Norway. In addition, roughly 40 companies have been generated by it, of which seven have patents.

2.6. Patent Agents

An important dimension of the IPR system is the population of patent agents and attorneys. There are 18 patent agents in Norway, located primarily in Oslo but also in Trondheim, Bergen and the Stavanger areas. They perform functions which in part overlap and complement the services offered by the NPO. They cater for the needs of foreign applicants, as well as advising domestic clients on IPR strategies, and performing searches and other information-based services. At present, this activity is not covered by a formal qualification or certification system.

The 18 patent agents are, according to NOF (<http://www.nof.no/patentbyraer.html>):

1. A B C-Patent, Oslo
2. Actio-Lassen AS, Sandsli and Oslo
3. Bergen Patentkontor A/S, Bergen
4. Bryn & Aarflot A/S, Oslo
5. Berntsen G S Service, Skibotn
6. Bryns Zacco AS, Oslo
7. Curo AS , Trondheim
8. Fortunia Kapitalformidling AS, Oslo
9. Håmsø Patentbyrå, Sandnes
10. Norsk Patentbyrå, Oslo
11. Norsk Varemerkebyrå, Oslo
12. Norske Patentingeniørers Forening
13. Onsagers Patentkontor - Defensor AS, Oslo & Lillestrøm
14. Oslo Patentkontor AS, Oslo
15. Patentkontoret Rudi, Tromsø
16. Tandbergs Patentkontor A/S, Oslo
17. Thorsens J K Patentbureau A/S, Oslo
18. Protector Intellectual Property Cons. AS, Oslo

2.7. Other organizations

2.7.1. The SINTEF Group

The SINTEF Group (Trondheim and Oslo) is among the largest independent research organizations in Europe with 1,800 employees and an annual turnover of NOK 1.5 billion (cf. <http://www.sintef.no>). It consists of eight research institutes, and enjoys close ties both with the technical university in Trondheim and with the University of Oslo. It is a central fixture of the national system of innovation, as a source of research results and competences, and as a collaborator.

2.7.2. Industrial and professional associations

The Confederation of Norwegian Business and Industry (NHO) is a central interest organization for its members *vis-à-vis* policy-makers. NHO has divisions dedicated to SMEs and start-ups. In addition, there is also an association of small and medium-sized enterprises called *Bedriftsforbundet*.⁴⁷ A third association that can be mentioned in this context is the Norwegian Association of Sole Proprietorships (Norsk Oppfinnerforening). It is a member of the International Federation of Inventors Associations (IFIA) and caters for the collective interests of unaffiliated inventors.

2.7.3. Commercial banks

Commercial banks are a prime lender to SMEs. After overextending itself during the late nineteen eighties, banks such as Kreditkassen have considered lending on intangible assets but, in general, require formalized assets as security for loans.

47 [\(http://www.bedriftsforbundet.no/smb/\)](http://www.bedriftsforbundet.no/smb/)

2.7.4. Private companies

Perhaps the organizations with the best operational understanding of the IPR system are the largest Norwegian firms such as STATOIL.

2.8. Enforcement framework

It is important that the enforcement framework for the IPR system is competent and fair. In Norway, the extent of the system is limited. Customs agents and the police are ultimately responsible for enforcing the issues connected to the import and/or marketing of copied goods or services. Moreover, the court system is most important in deciding cases of infringement. Such cases are heard in: City Courts (e.g. Oslo byrett), Courts of Appeal (Lagmannsrett)⁴⁸ and the Supreme Court. Cases are heard with expert witnesses and jurists. There are currently no cases registered either for designs, trademarks, patents or copyright at the Oslo court where most cases are first heard. There are, however, indications that the number of such cases has risen in the past few years, although no exact figures are available.

48 <http://oslo-byrett.domstol.no/>

CHAPTER 5:
CHARACTERISTICS OF NORWEGIAN SMEs

In order to learn something about how Norwegian SMEs can make better use of the IPR system, it is important to be familiar with certain aspects of the population in some detail. The intention of this subsection is to provide some basic information about the main characteristics of Norwegian SMEs, especially as it can be linked to whether they utilize IPRs. Here we survey briefly the following dimensions:

1. the size of the population and its relative importance in the context of the Norwegian economy;
2. the breakdown of Norwegian SMEs by sector, as this is expected to affect the use of intellectual property rights; and,
3. other firm-level aspects that can prove important to the way the firms utilize the IPR system, especially indications of “innovativeness.”

1. Types of SMEs

To begin with, however, it is a good idea to think of SMEs in terms of general categories. After all, Norwegian SMEs account for 98 per cent of all firms in the country. We start therefore with two typographies that can provide us with an avenue through which to understand the varying IPR needs of different firms. A central reason to do this is to achieve a fundamental understanding of the business strategies different firms have. After all, it is the combination of firm-level strategies and resources – and not size alone – which it is important to assess when thinking about how firms could use and do use intellectual property rights.

1.1. OECD typography

This basic classification is helpful in that it distinguishes recognizable firm types while suggesting their potential IPR needs.

Table 2.1. OECD typology of small and medium-sized enterprises

Type	Definition
New technology-based SMEs	Firms successfully pursuing technological advances in specific areas of new, fast developing technologies
Niche market differentiators	Firms successfully exploiting value-added niches in traditional markets
Technological leaders	Firms which have succeeded in becoming industrial leaders with their own products and technologies
Joint developers	Firms working as subcontractors and playing a role in jointly designing or developing products
Efficient classical subcontractors	Conventional subcontractors with no or hardly any products of their own.
Resilient SMEs	Firms having recently successfully reacted after under going serious adverse market conditions
Would-be reactive SMEs	As yet unsuccessful type-6 firms
Quietly passive SMEs	Firms following established tracks without much growth and change
Barely surviving SMEs	Firms where very existence is threatened

Sources: In OECD DSTI/STP/TIP(98)6: originally from JCL, OPTEM and Helsinki University of Technology, report of EIMS protect, European Commission (1997).

The table features nine types of small and medium-sized enterprises, and was developed for the EU and used by the OECD. The types span differences in age (new to mature), differences in development strategies (niche developers, collaborators, market-leaders, subcontractors) and differences in what might be called business-culture (reactive versus passive).

These different archetypes will necessarily have different IPR-related needs: the typology suggests that some types would derive little or no obvious benefit from IPR protection while others will rely heavily on them. It also suggests that IPR-related needs will vary depending on the stage of development of the SME concerned.

1.2. Rizzoni typography

This second typography is richer: it explores six generic types of SMEs against eight types of firm-level factors important to innovation and competition in broader terms. This presentation allows us to consider how these recognizable but stylized types of firms might be expected to approach IPRs.

In general, the importance of the IPR system, at least in a traditional sense, would increase from left to right across the matrix (see table 2.2), not only for patents but also trademarks, copyright and industrial designs. On the left, SMEs are likely to see IPRs purely in terms of costs: the benefits of the IPR system are not clear to such firms and may indeed be largely irrelevant to them. This would typically be the case with firms characterized as “static small firms” in the matrix. The combination of living from hand to mouth in commodity and small-scale markets, with severely limited strategic and innovative activities, does not suggest any pre-existent basis for actively using the IPR system. There may, however, be outside forces such as those associated with “globalization” or emerging technologies that might directly affect their competitive position and force such firms to move towards the right in the matrix. These would, however, be longer term developments.

The matter becomes more immediate and considerably clearer as we move towards the right in table 2.2. Here, in the right-hand columns, we find firms oriented toward differentiated, knowledge-based content. Especially in cases where this content is expensive to produce but relatively cheap to copy (see biotech, software and pharmaceuticals), it is likely that IPRs figure prominently in the overall business strategy. This column includes firms for which it is natural to consider not only whether to use the IPR system but also how it can be exploited in a variety of ways.

Table 2.2. Small firms and technological innovation: Rizzoni (1994) taxonomy

	“Static” small firms	“Traditional” small firms	“Dominated” small firms	“Imitative” small firms	“Technology- based” small firms	“New technology- based” small firms
A. Factors of Success	Low manufacturing costs	Flexibility and product Differentiation	Specialization economies	Flexibility and product customization within market niches	Highly distinctive competence; skilled human capital	Scientific entrepreneurship ; general and abstract knowledge
B. Sectoral Patterns	Mature sectors; local markets	Mature and fragmented sectors	Mature or growing sectors, dominated by large firms	Stabilized sectors; coexistence between large and small firms (in niche markets)	Rapid-growth sectors; non-standardized consumer demand	New science-based sectors with great technological opportunities
C. Type of Technology	Old or new but simple, unskilled labor-intensive technologies	Low capital-intensive, simple technologies	Low or medium capital-intensive technologies	Sophisticated, sufficiently stabilized technologies	Advanced technologies, skilled, labour-intensive	New “soft” technologies, skilled labor and knowledge intensive
D. Types and Sources of Innovation	Only innovations contained in machinery	Design modifications, incremental and “imported” innovations	Incremental innovations, machinery procurement and agreements with large firms	Incremental product innovations. Acquisition of patents and know-how	New products (still, no radical innovations); various sources of innovation	Radical innovations. In-house R&D; intensive relations with universities and large firms
E. Innovative Strategy	Absent	“Traditional” strategies; technical change comes from outside	“Dependent” strategies; upstream-led or downstream-led innovation	“Imitative” strategies. Crucial role in diffusion process	“Defensive” or “offensive” strategy	“Offensive” external monitoring; highly specialized “core” competence
F. Corporate Strategy	Targets : survival in the short-term; non-growth	Like Static SFs; inter-firm productive relations	Short-term objectives; more autonomy	Medium-term objectives; search for interaction and cooperation	Development of distinctive competence; inter-firm agreements	Focus on innovation and networking activities; growth is a strategic goal

	"Static" small firms	"Traditional" small firms	"Dominated" small firms	"Imitative" small firms	"Technology- based" small firms	"New technology- based" small firms
G. Organizational Structure	"Elementary" organization; central figure: owner - entrepreneur	Like Static SFs; occasional resort to consultants	Technical entrepreneurship	Entrepreneur is still important, but organizational structure is expanding	Good balance between technical entrepreneurship and managerial skills	High and diffused technical-scientific skills; dynamic management and "organic" system
H. Factors of Weakness	Weak entrepreneurship and management; limited financial and human resources	Like Static SF's.	Lack of internal resources and limited skills.	In-house R&D is limited ; lack of financial resources	Unplanned innovative activity; lack of financial resources	Planning deficiency in product development and growth

Source: Rizzoni. *Revue d'économie industrielle*, 67. 1994.

For "New Technology-Based Companies," the focus is much more on the benefits of the system. However, costs associated with IPRs are still a real concern, especially if the firm shows weakness in long-term planning. A recent study of the software industry in Europe indicates how smaller firms in fact approach IPRs: "Patent databases are rarely used by SMEs as sources of information. Within SMEs, innovative ideas are generally produced from a combination of generic professional knowledge with client-specific requirements. Protection of such creations is based on trust and contract."⁴⁹

Firms in the central area of the table will have more varied needs, attitudes and actual practices. The so-called "dominated" small firm will need to define and perhaps protect their intangible rights in their relationships with their partners, even where contracting is the major mode for defining their interrelationship.

Imitative companies will need to monitor the markets in which they operate. They will also have to make sure that their strategies do not bring them into conflict with existing actors. Patent-related information may be one tool that will help these firms to navigate the technical end of such a strategy. Furthermore, a firm will not necessarily remain in the same niche throughout its lifetime. They may move from one category to another as they mature.

2. What do we know about Norwegian SMEs?

SMEs absolutely dominate the Norwegian onshore economy in terms of their numbers. Using a raw count of firms with under 100 employees, they comprise 98 per cent of Norwegian enterprises. In our analysis, it became clear that this definition was too crude, and that it in fact included a number of very large companies. We have therefore adapted the definition of SMEs to provide a more realistic picture of small Norwegian enterprises, and thereby lower the proportion by one percentage point to 97 per cent.

The basic definition of an SME is an enterprise with 100 employees. In addition, smaller enterprises are considered "large," if:

1. they have more than NOK 99 million in annual turnover (an average of one million/employee);
2. they include more than 15 establishments; and/or,
3. they are registered holding companies (NACE 74150) with at least 30 employees (most will also qualify according to criterion 1).

The employment register data we use in this study (see Annex 1) indicate that there are approximately 130,000 enterprises with salaried employees in Norway (1998). Over 96 per cent are small and medium-sized enterprises according to the definition used here. A mere 3,718 Norwegian enterprises are large, meaning

49 Tang et al, 2001.

they employ over 100 employees or fulfil one of the other criteria.⁵⁰ The bulk is to be found in the smallest size-classes, where over 60 per cent are micro (one to four employees) while 90 per cent are either micro or small in the Norwegian classification.⁵¹

Table 2.3. Number of Norwegian enterprises by size-class and field, 1998.

Ind_act	MICRO	SMALL	MEDIUM	LARGE	UNKNOWN	TOTAL	PERCENTAGE
Basic services	37 074	17 557	2 915	1 201	233	58 980	45,8
Business services	13 708	3 834	853	277	169	18 841	14,6
Electrical equipment	436	232	102	58	3	831	0,6
Ict and postal services	1 299	476	148	84	9	2 016	1,6
Machinery & equipment	674	374	154	55	10	1 267	1,0
Manufacture	4 234	3 115	1 385	503	29	9 266	7,2
Natural resources	7 390	872	252	77	199	8 790	6,8
Offshore oil and gas	45	22	14	45	56	182	0,1
Public & uih services	7 160	3 358	1 544	1 095	45	13 202	10,2
R&d services	42	29	48	28		147	0,1
Unknown	9 399	4 090	1 049	295	537	15 370	11,9
Grand total	81 461	33 959	8 464	3 718	1 290	128 892	100,0
Percentage	63.2	26.3	6.5	2.9	1.0	100.0	

Source: AA Register data: STEP

This table also shows how size-classes are broken down according to general industrial activities. The enterprise's principal product or service is used to assign an industrial activity. The breakdown of the Norwegian economy in this way indicates that a large majority of Norwegian enterprises operate in the services sector (including wholesale and retail), while less than 10 per cent are found in manufacturing. Public administration, defense, and other services such as health and education (but not R&D services) account for a further 10 per cent of Norwegian enterprises registered by NACE (*Nomenclature générale des Activités économiques dans les Communautés Européennes*) in the database. The breakdown by total number of employees in the register indicates that the public sector accounts for about 30 per cent of employment.

3. SMEs and Innovation

The question of how enterprises innovate is central to considering their current and potential use of the IPR system. In the Norwegian case, a range of material is available, and the interested reader is directed to the Step homepage. (<http://www.step.no>). Here, we can highlight the results from the pan-European Community Innovation Survey (CIS), which we will also consult in looking for relevant information about how Norwegian SMEs use the IPR system.

The Community Innovation Survey (CIS2) was conducted for the second time in 1997. It can be used, for example, to demonstrate differences in "innovativeness" among Norwegian firms based on size and industry, as well as between Norwegian enterprises and those of other European countries. There are essential limitations. In general, the CIS leaves out enterprises with fewer than ten employees, which is a large percentage of the Norwegian population.

The "innovativeness" concept used is fairly technologically oriented: it means that the firm has either introduced a technologically new or improved product in 1995-1997, or it has integrated a new or improved process into its activities during this period. The survey also distinguishes between new products/services that are new only to the firm and those that also are new to the market.

A. National propensity to innovate: comparative view

The CIS2 can be used to compare different aspects of Norwegian innovation with that of other European countries. Importantly, as a result of this comparison, however, Norwegian SMEs take on the definition currently used in Europe. We highlight some of the findings from this study.

50 The use of the above-mentioned criteria increases the number of large firms by an extra 1,000.
51 A sizeable, additional population (over 30 per cent according to Spilling) register no employees and are not included here. An additional one per cent could not be associated with industrial activity

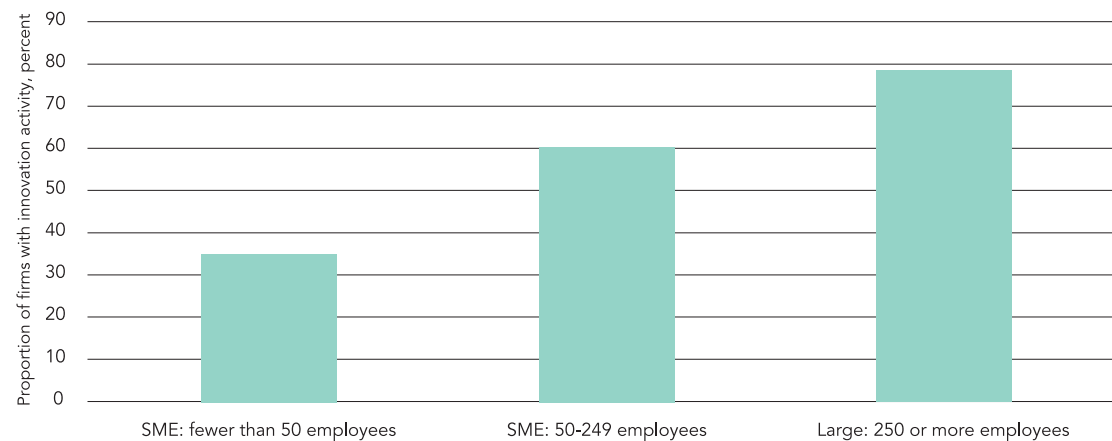
1. In terms of innovations “new to the firm” for all size classes, Norway is in tenth place out of 15 with about 35 per cent reporting new product innovations. It is in front of Finland, but considerably behind Denmark (65 per cent) and Sweden.
2. Norway’s total reporting of “market-wide innovations” is much more modest at 15 per cent. This puts it on a par with Belgium and in front of Spain (11 per cent) and Portugal (8 per cent).

B. Firm size and innovation

How do Norwegian small and large firms fare in cross-European comparisons (Eurostat: 24)? On average, roughly 80 per cent of the large manufacturing firms in the EEA report that they introduced innovations during the period. The Norwegian average is slightly below this: 75 per cent of large Norwegian firms registered new or improved products in the period. This is similar to Sweden and Finland, for example, and many other European countries.

Not surprisingly, the largest firms display a markedly higher propensity to innovate than the smaller. This is consistent with the literature. Broken down according to size, 43 per cent of European small firms (here, again, meaning fewer than 250) report product innovations. This size-class of the Norwegian population registers slightly less than 40 per cent. This is slightly less than Sweden, a little higher than Finland, but far behind Denmark which leads Europe with over 60 per cent (see Eurostat: 23).

Figure 2.1. Proportion of enterprises with innovation activity, by size class (N=2261).⁵²



Source: STEP-Group. SMEPOL Part II.

An analysis of the 1992 CIS survey provides an indication of how innovative Norwegian SMEs are relative to larger firms. This study indicated that a strong minority (1048 of the 2261 enterprises) has engaged in innovation activity during the period. While around four fifths of the largest firms are reported to be innovative, a little over a third of the smallest (between 10-49) did so. Based on the wider analysis of the survey, Isaksen & Smith (1997) indicate that:

- “the proportion of innovating firms in a size class rises with firm size. Among the firms with fewer than 10 employees, only 16 per cent engaged in innovation activity, as opposed to 72 per cent for firms with more than 100 employees. This suggests that the scope for increasing activity in SMEs may be large” (Isaksen & Smith, 1997).
- innovation activity (in terms of new product sales) is spread rather evenly across industries in Norway. Further, it suggests that, among firms which have new products in their sales mix, Norwegian SMEs generate higher turnover rates from innovative products than larger firms.

⁵² Figure taken from the SMEPOL Study (<http://www.step.no/Projectarea/smepol/index.htm>). The table includes enterprises in the manufacturing sector (NACE 15-37) and business services (NACE 72 and 74). This results in a sample of 2261 of the 3263 enterprises. Firms with fewer than ten employees are not included.

- “when small firms innovate, they must spend much higher proportions of their total sales on innovation-related activities than large firms; this suggests that if an innovation fails, the result is much more serious for small firms than for large firms” (Isaksen & Smith, 1997).

The sensitivity of SMEs to failure when it comes to innovation would suggest that there is a heightened need for them to protect the results of these projects against imitation. This in turn suggests that SMEs need to be more skilful than larger firms. Are they? Some are, certainly; many are not. Although we cannot provide a more conclusive answer to this question without further study, we can delve into how SMEs do in fact use the IPR system. We do this in the next subsection.

SUBSECTION 2.2. IPR USAGE IN NORWAY

In order to provide a picture of current use and awareness of IPRs, we compiled a unique set of data showing how Norwegian SMEs apply for patent and trademark protection. This subsection will introduce findings from this source of information about current use of IPRs among this population. In addition, we will scan the existing sources for indications about the present use and concerns of Norwegian SMEs. We note here that this evidence is limited and that there is a considerable patent-bias in the available information.

1. Preliminary observations

A major barrier to the analysis of how SMEs approach the IPR system is the fundamental lack of reliable data about how SMEs in fact use the patent system, as well as trademarks, copyright and designs. Indeed, surveys can provide valuable input about the attitudes and motives of firms with regard to IPRs, but there are several clear limitations in the studies we surveyed.

1. Some studies raise fundamental questions about the representative nature of their samples (Oppenheim);
2. Several studies are directed at specific sub-populations, such as high-tech (Vonatas *et al*, 2000) or larger firms with formal R&D (Levin *et al*, 1987 Cohen *et al* 1997, Koen,1992);
3. The large CIS study in Europe is limited as to its sample (innovative firms, more than 10 employees) and the depth (only a couple of questions about patenting);
4. Surveys ask only about patenting (except in Koen) if they ask about IPRs at all.

What has been lacking is reliable analysis of how SMEs actually apply for patents and other rights.⁵³ This study presents such an approach. We compiled full-count databases of all patent and trademark applications in Norway covering the 1990s. The patent and trademark datasets were then linked to Statistics Norway's employment database for all Norwegian enterprises.⁵⁴ This database covers all enterprises⁵⁵ that had registered employees. The link has allowed us the opportunity actually to identify full-counts of SMEs in applications and registered rights. The connexion of these databases will also help us to say something more substantial about the types of SMEs that in fact use IPRs. This link provides a detailed, reliable set of information both about applicants, and about the patents and trademarks they applied for. This gives us the opportunity to look at the following details of applicant firms: the size (# employees), industrial area (NACE), regional location, even the turnover (after 1997) of those which applied for patents and trademarks.

This information can then be linked to various aspects of the applications. Firm-level information can be linked to the number of patents and/or trademarks, technical fields of patents and areas of registered trademarks, the status of the applications (whether granted, withdrawn or denied), and more. In future, the data can also be linked to the educational levels of the firm's employees.⁵⁶

Chapter 7 presents the first results from these databases. After cleaning and linking of the databases, we can provide information about:

1. who applies for patents in Norway? How active (# applications) are the different size-classes?
2. who applies for trademarks? How active (# applications) are the different size-classes?
3. what percentage of the total number of enterprises patent, by size-class and industrial activity?
4. what percentage of the total number of enterprises file trademark applications, by size-class and industrial activity?

But first, we have compiled some existing material about IPR usage in Norway.

⁵³ One exception is known. Nilsen (1998) also uses registry data, based on a sampling exercise among manufacturing firms in Denmark.
⁵⁴ There are a considerable number of methodological concerns. See Annex 4 for how these databases were compiled as well as on methodological questions.
⁵⁵ An "enterprise" (foretak) can comprise several "firms" (bedrift). In this study, we focus on enterprises.
⁵⁶ The databases are, however, not perfect, and the interested reader is referred to the annex for the purpose of understanding the underlying issues behind their compilation.

CHAPTER 6: INTRODUCTION TO PATENT USAGE IN NORWAY

What do we know about the general awareness and use of IPRs in Norway? Information about the direct use of the Norwegian IPR regime is limited, although improving.⁵⁷ Public patent information on a very general level is available through WIPO statistics and through the OECD. The focus in the latter is on patenting. There are a variety of problems with this information, not least that it includes preliminary PCT country designations as applications.

1. General

It is useful to approach the question of the SME-IPR relationship in Norway with more general information about IPRs here. First we should note that a Norwegian (Bjørn Basberg) has done much to advance the theoretical understanding of the relationship between IPRs and innovation (Basberg, 1986). His historical work, for example, on the whaling industry in Norway is internationally known. Otherwise, IPRs are not an area for which Norway is especially well known.

The question "why are there so few Norwegian patents?" is one that emerges from time to time. It periodically accompanies the release of OECD statistics that tend to show domestic patenting in Norway near the bottom of the list. Although this picture is moderated when you adjust for population and the country's industrial structure,⁵⁸ there remains a popular conception in Norway that Norwegians are inherently innovative, but that they are not especially adept at commercializing their ideas. Often, the low patenting figures have in part been ascribed in the past to a "cultural attitude." Although anecdotal, this testimony is worth noting, not least as there is a certain resonance of it in the interviews. These indicate that the tendency is changing and awareness is rising.

2. General patenting patterns

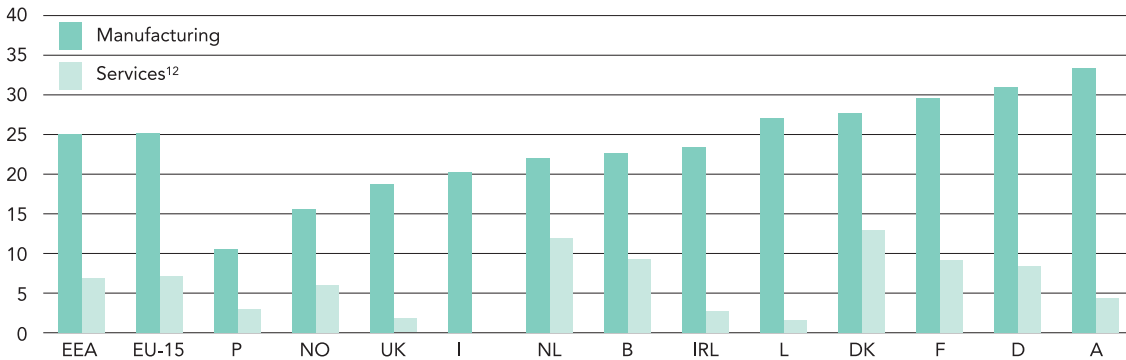
There are three general dimensions to Norwegian IPR use:

1. levels of domestic patent applications are relatively low in volume,
2. foreign enterprises dominate patenting in Norway, and,
3. there has been a moderate rise in domestic patenting during the past few years.

2.1. Norwegian propensity to patent in an international comparison

The popular conception that indicates that propensity to patent is low in Norway is supported by the Community Innovations Survey (CIS). Above, we saw that, according to this survey, 15 per cent of Norwegian firms reported products based on innovations that were "new to the market," and, therefore, potentially patentable. We noted that this was a relatively low level. Here we see that this is reflected in a relatively low propensity to patent.

The following figure is lifted from a raw comparison of the CIS data on how often innovative firms patent in different countries. This thumbnail evidence indicates that "innovative" Norwegian firms, for whatever reason, apply for patents less often than those in any other European country, apart from Portugal. This impression should, however, be treated with considerable caution, as it does not take into consideration a series of factors that will fundamentally affect whether patenting is an option for these firms in these different countries.⁵⁹ These factors should be considered more closely.



⁵⁷ See the Norwegian Report on Science and Technology Indicators: Research Council (http://www.forskningradet.no/bibliotek/statistikk/indikator_1999/4-2.html).
⁵⁸ Iversen, Eric. 1999, Hvorfor så få norske patenter?. Forskningspolitikk.
⁵⁹ We emphasize again that many factors shape the propensity to patent, not just an "attitude." A major consideration in such a comparison is whether the industrial distribution of the respective countries is corrected. In other words, does the result reflect the fact that Norwegians are less involved in industries that are more prone to patent?

2.2. Patenting in Norway

The next table provides a snapshot of Norwegian domestic patenting as compared with that of some other countries. Population differences are corrected for.⁶⁰ The table indicates that domestic patenting in Norway is comparable to the European average, and that it grew considerably during the 1994-1996 period. The level is, however, considerably behind the rest of the Nordic average, although differences in industrial structure may influence this. The Norwegian level is on a par with that of Denmark, in this comparison.

Table 2.3. OECD's inventiveness coefficient (resident patent applications/population) three-year averages

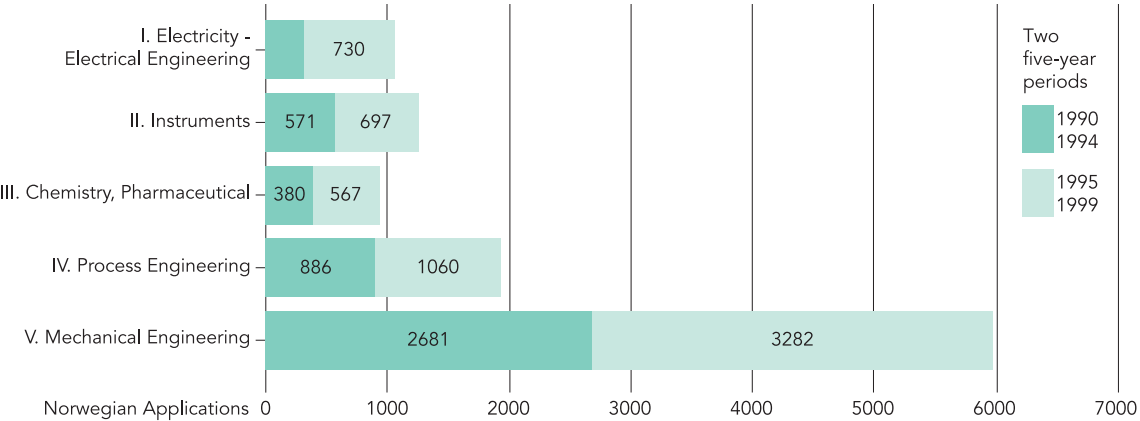
	1991-1993	1994-1996
Austria	2.7	2.3
Belgium	0.8	0.8
Denmark	2.3	2.5
Finland	4.2	4.3
France	2.2	2.2
Germany	4.2	4.8
Ireland	2.2	2.3
Japan	27.0	26.4
New Zealand	3.2	3.6
Norway	2.2	2.6
Sweden	4.0	4.6
Switzerland	4.7	4.3
United Kingdom	3.3	3.2
United States	3.7	4.3
North America	2.6	3.0
European Union	2.3	2.5
Nordic countries	3.3	3.7

Source: OECD, EAS (MSTI database), November 1998,

2.2.1. Technical Spread of applications over time

A total of 12,984 Norwegian applicants were involved in 11,183 patent applications registered by the Norwegian Patent Office. The next table illustrates how this population grew between the beginning of the decade (5,226) to the end (7,358). It also illustrates how Norwegian applications were distributed across five technical fields.⁶¹

Figure 2.3. Patent applications from Norwegian primary applicants (N=11,183), by technical field of patent



60 The coefficient is based on the number of applications per 10,000 people. The differences for patent systems are not. See especially Japan, whose high coefficient is at least partly based on its particular system. The effect of the EPO system for the domestic patenting averages of affiliated countries is not known.

61 These fields are based on primary patent classes in the International Patent Classification (IPC), which have been converted to technical areas by a correspondence key. See Annex for more details.

The number of applications with Norwegian applicants grew by 30 per cent from the beginning to the end of the decade. This growth varied between different technical areas. The figure shows where Norwegians patent most and indicates where domestic patenting is changing. It is in the largest technical groups — process engineering and the broad mechanical engineering classification — where growth has been least marked. These grew by 20 per cent and 22 per cent respectively over the two periods. Process engineering sank from 18 per cent of total Norwegian patent applications in the first period to 16 per cent, while mechanical engineering dropped from 55 per cent to 52 per cent in the second period.

The smallest groups grew most. Electricity and electrical engineering, which includes information and communication technologies, grew by 123 per cent and 50 per cent respectively. The proportion of electricity and electrical engineering rose, therefore, from a modest 7 per cent in 1990-94 to 12 per cent in the last half of the decade. Patent applications for chemicals increased from 8 per cent to 9 per cent. These basic observations provide the basis to go ahead and look at the way Norwegian small and medium-sized enterprises utilize the IPR system.

3. What do we know about the way SMEs approach the IPR system?

There are three existing sources of information that suggest how (some) Norwegian SMEs approach the IPR system. The first is based on a set of interviews conducted among innovative SMEs which received public support; the second is based on a regional study conducted by the Norwegian Patent Office (2001) on IP awareness among small companies; and the third is survey-based information on the use of IPRs.

3.1. STEP interviews with innovative SMEs (Isaksen, 1999 and the SND evaluation)

The first comes from a study of innovative SMEs (mainly enterprises with fewer than ten employees, many of them start-ups) that also receive public support for product innovations. The details of the study are found in that report.⁶²

The interviews which were carried out within the framework of that study indicated that as many as 70 per cent of these firms in fact patented their new products. Others responded by saying that they could not patent because they had already published research articles on some aspects of their idea.⁶³ Software developers did not apply for patents, citing that this is not customary. It is not known whether the software could in fact have been patented or not.

3.2. The Norwegian Patent Office awareness campaign

The NPO study of awareness among small companies⁶⁴ indicates that:

1. Many SMEs are aware of the existence of the patent office (75 per cent) and over 40 per cent claim to have had contact with it.
2. SMEs have a more limited idea of the nature of IPRs and the services NPO can provide: as many as 20 per cent are convinced that the NPO makes sure that registered IPRs are not infringed.
3. Application costs tend in general to be a greater concern for SMEs the smaller their size and the lower their turnover.
4. Many SMEs (46 per cent), both the smallest and the largest, tend to consider the application process difficult.
5. The vast majority of SMEs (over 70 per cent) do not find that the IPR system is better for larger companies, while 40 per cent were at least partially convinced that large companies do what they like, no matter what.
6. The vast majority of SMEs responded by saying that they believe IPRs can provide the basis for economic growth, especially those with more than 20 employees and/or those in the chemicals industry.

62 "The two instruments are "Start-up with new technology" and "the innovation program," which are two national support schemes run by the Norwegian Industrial and Regional Development Fund."

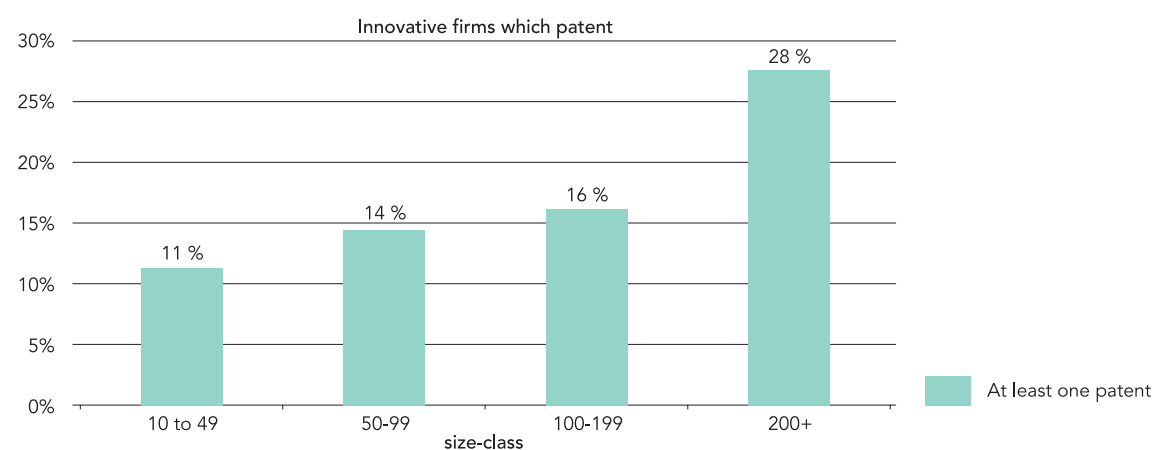
63 See the question of the trade-off between disclosure and patenting, especially in the NFR funding scheme.

64 Based on telephone interviews, for three districts and five industries.

3.3. Survey-based information on the use of IPRs

Above, we used the Community Innovation Survey in discussing the propensity to patent and the propensity to innovate among European countries. The next table illustrates that the propensity to patent among firms claiming to have innovative activity grows with size. We note that firms with fewer than 10 employees are excluded.⁶⁴ The table indicates that 12 per cent of the sampled SMEs claiming to be innovative reported having applied for at least one patent, while this figure rises to 28 per cent in the case of the largest firms (200+ employees).

Table 2.4. Percentage of innovative Norwegian firms (by number of employees) which reported that they had applied for at least one patent during the previous three years. Community Innovation Survey (for Norway) 1997. (N=1,250)

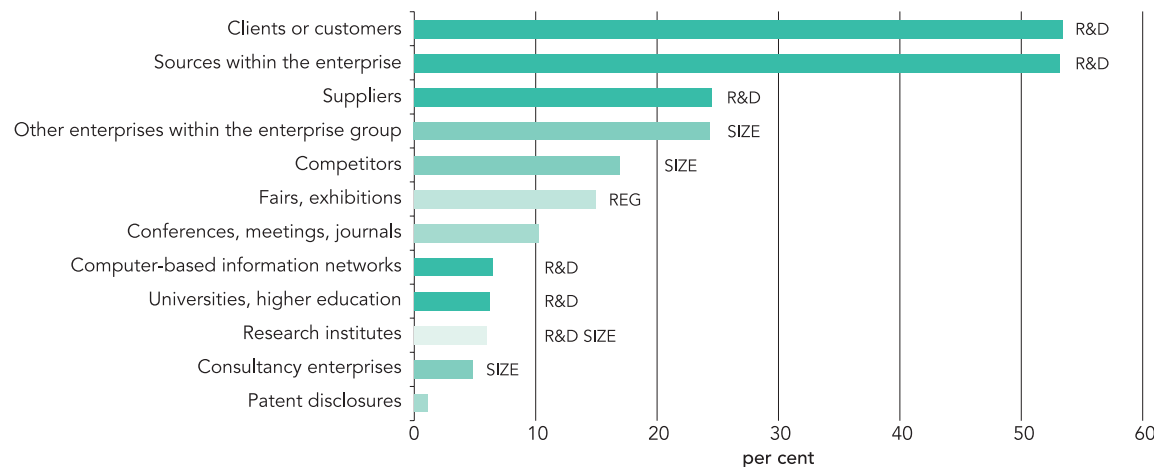


Source: Community Innovation Survey (for Norway) 1997. Step-2000.

3.4. Use of Patent information

The Community Innovation Survey (CIS1) also provided information about where innovative firms tend to access information, including patent databases. It should be noted that the definition includes firms from 10 to 250. Despite this broader definition, the CIS1 evidence shows that only a small percentage of innovative companies reported that patent information was a very important source of information when they innovate.

Figure 2.4. Proportion of innovative SMEs (enterprises with fewer than 250 employees) which say that different sources of information for innovation are very important (N=901).



Source: STEP-Group. SMEPOL Part II.

65 See the qualifications regarding the sample, definitions, and concerns above in the literature section.

CHAPTER 7: THE UTILIZATION OF THE PATENT SYSTEM BY NORWEGIAN SMES

This chapter presents the results from the STEP database covering all domestic patents applied for and/or granted in the ten-year period 1990 to 1999. The database combines data from the Norwegian Patent Office and enterprise-level information compiled by Norwegian Statistics based on the Brønnøysund registry of businesses. We examine:

- Norwegian applicants by size-class
 - "Norwegian applications": total measure of Norwegian participation
 - Total number of individual entities, by size-class;
- Number of applications per individual applicant, by size-class;
- Distribution of Norwegian applications by industrial activity of the applicant, by size-class;
- Number of Norwegian applications (1995-1999) as a proportion of the total number of firms active in the relevant industries in Norway for a given year (1998);
- Distribution of the technical areas of applications, based on applicant size-class;
- Norwegian applications by geographical location of the applicant;
- Status of patents by size-class of the applicant.

1. Preliminary issues

Some preliminary information about definitions used here.

- The enterprise is the unit of analysis. An enterprise is the level above the establishment, or what is commonly called a business. It is the management layer below corporation, which can consist of many enterprises (for example the previously State-run telecoms company Telenor). It differs also from the "kundenr" identification used by the Norwegian Patent Office.
- Size groups are based on the total number of employees in the enterprise (=sum of employees of constituent companies). In addition, holding companies with more than 30 employees, enterprises with more than NOK 99 million in annual turnover (available from 1997) and enterprises with more than 15 companies are included in the "large" category.
- The district is based on the zip-code in the patent application. Enterprises with the same name in the same county are assumed to be the same entity.
- Enterprises are assigned industrial activities by SSB based on their primary product/service group. The underlying classification is based on NACE (*Nomenclature générale des Activités économiques dans les Communautés Européennes*).
- Applications and applicants: unless otherwise noted, "Norwegian applications" refers to Norwegian participation in applications received by the Norwegian Patent Office for the relevant period. Since each application can involve more than one applicant (on average 1.17), the number of "Norwegian applications" here is higher than the number of applications that the Norwegian Patent Office actually receives. This is because the relevant unit of analysis here is the enterprise and how it uses the patent system.

2. Norwegian Applications

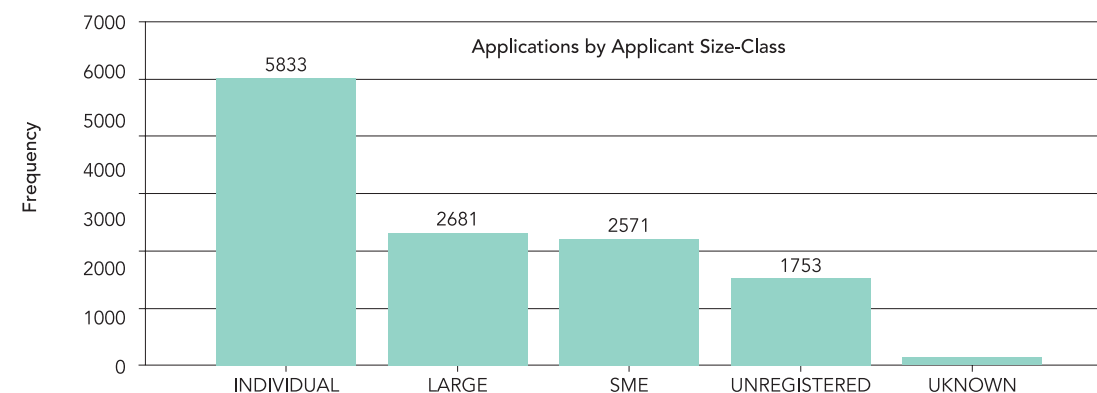
In the ten-year period from 1990-1999, just under 11,200 patent applications were filed with the Norwegian Patent Office, in which at least one of the applicants had a Norwegian address. A total of 13,121 entities — Norwegian or foreign — were involved in these applications, an average of 1.17 applicants per patent.⁶⁶ Of these, a total of 12,984 were Norwegian. In this section, we look more closely at these 12,984 "Norwegian applications" as a total measure of Norwegian participation in the patent system.

Figure 2.5 shows that the largest single group of applicants are individuals.⁶⁷ They make up 45 per cent of the total, while 7,151 are enterprises. Just under 1,900 of the enterprises would not link with the database for one reason⁶⁸ or another.

66 Note that even though some entities were involved in more than one application, this figure (i.e. 13,121), relates to the number of times an entity was involved in an application irrespective of whether the same entity was involved in other applications.

67 Individuals are applicants with "first name and last name" but which do not link with our register of enterprises. They can be one-man companies that do not report any employment.

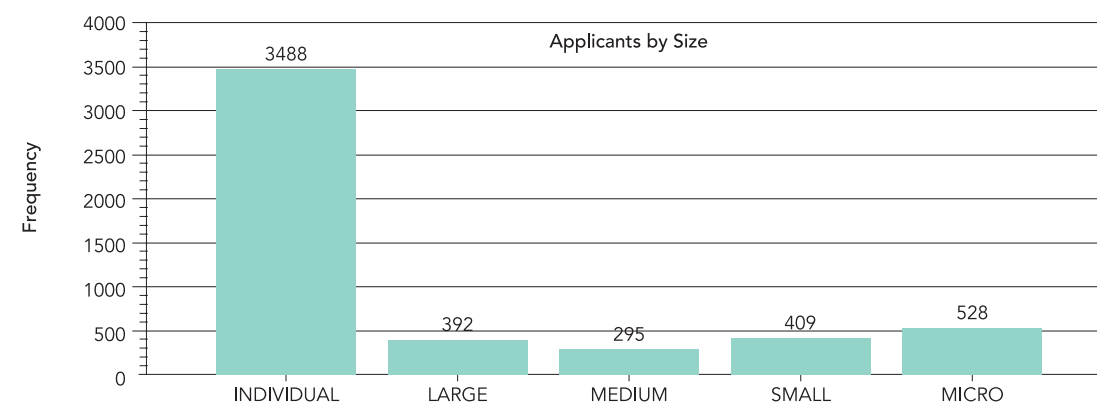
68 The unregistered category are applicants that have an organizational number, but that number is not current in our database. This might mean that the firm has no employment or it might mean a mistake. The "unknown" category are entities with obvious company names, but which would not link to an organization number.

Figure 2.5. Norwegian patent applications during the 1990s, by size of applicant (N=12,984).

3. How are applicants distributed across size-classes?

It is often assumed that large enterprises use the patent system most. If we count the number of times large firms are involved in patent applications during the 1990s, this impression changes. The figure shows that during the 1990s, 21 per cent of the “Norwegian applications” were from large enterprises and 20 per cent from SMEs.⁶⁹ If one includes — as one reasonably might — the group of independent “individuals” among small and medium-sized enterprises, the overwhelming majority of Norwegian applications are from our focal group.

Let us consider the total number of entities that were involved in at least one patent application. Large enterprises that use the patent system tend to apply for more than one patent whereas this is less true for other size classes (see below). If we turn our attention from the number of applications by Norwegians during the nineties to the number of different Norwegian applicants active during that time, the prominence of smaller enterprises becomes even clearer.

Figure 2.6. Norwegian patent applicants during the 1990s, by size. (N=5,888)

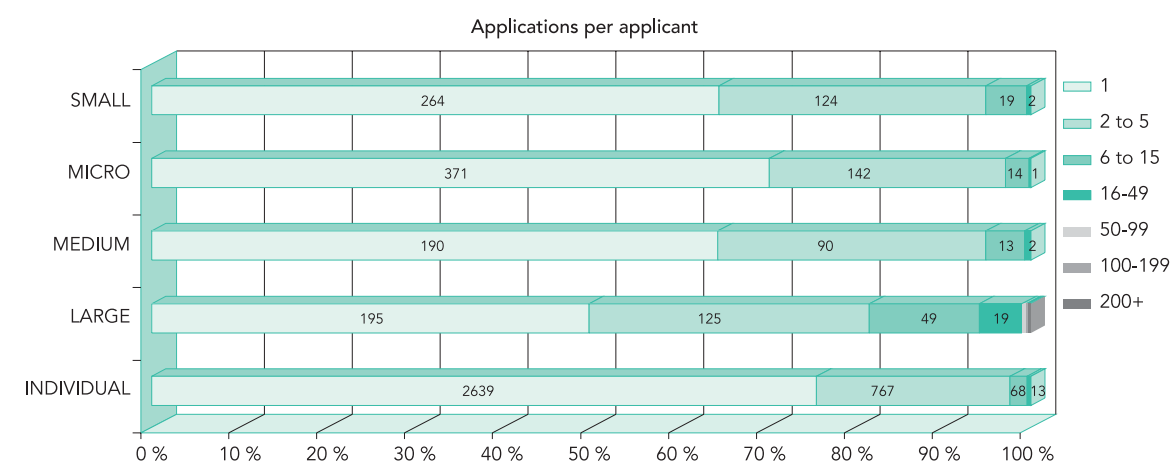
A total of 5,888 Norwegian applicants were involved in the 12,984 applications: this is an average of 2.2 applications during the period per applicant. Figure 2.6 illustrates how these applicants are distributed across more finely-meshed size classifications.⁷⁰ The applicant size-groups are quite evenly distributed, with the exception of individuals or independent applicants, whose relative prominence becomes accentuated in this figure. The number of large applicants is the second smallest population.

⁶⁹ We remind the reader that “large enterprises” are basically enterprises with more than 99 employees. In addition, enterprises with more than NOK 99 million a year in turnover, and/or more than 15 establishments, and/or which are holding companies with more than 30 employees, are also counted as large.

⁷⁰ (Micro =1-4, small=5-19, medium =20-99 employees, and large as noted above. Unknown (108) and Unregistered (688) are excluded from this figure for the purposes of presentation.

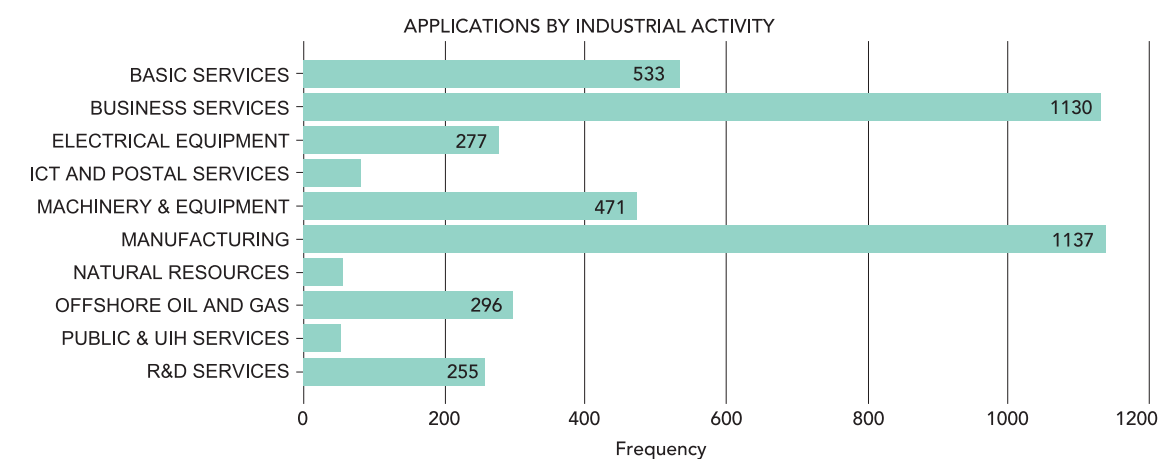
4. How does the number of patent applications an entity applies for reflect its size?

A large enterprise will tend to apply for a greater number of patents than a smaller one. According to figure 2.7, 4,176 (71 per cent) of the applicants filed a single application throughout the 1990s, while a further 25 per cent filed between two and nine.⁷¹ Small and large enterprises demonstrate different behavior. Just over half of the large enterprises filed more than one application, while the proportion is 25 per cent for individuals and 35-40 per cent for SMEs (depending on size-group). See figure 2.7.

Figure 2.7. Average number of applications per applicant, by size-class, 1990-1999. (n=12,984)

5. Number of patent applications by activity and size-group

We have referred to the existing evidence, which shows that the propensity to apply for a patent depends to a considerable degree on the industrial activity of the potential applicant. In this section, we show the breakdown of applications according to the applicant's industrial activity. Here, we see clearly that the number of applications is greater from some areas than others.

Figure 2.8. Norwegian applications during the 1990s, by industrial activity of the applicant (N=4,312)⁷²

⁷¹ Enterprises that change names, merge or otherwise restructure will not necessarily be counted as one firm during the period.

⁷² In this case the unknown are equal to 8,672. These include 5,833 applications from individuals, 1,899 applications from firms for which we do not have information, and an additional 940 applications from firms that did not have NACE classes by which to identify industrial activity. Thus, the 8,672 “unknown” are subtracted from the total number of Norwegian applications (12,984) to obtain 4,312, which is the total number of Norwegian applications for which we have information on the applicant's industrial activity.

Does this simply reflect the relative number of firms that work in these respective industries? Above, we showed how Norwegian enterprises were distributed among the same industries. We noted that the largest number of Norwegian enterprises were registered in Basic Services (46 per cent). The distribution of Norwegian patent applications does not correspond directly to that total population, suggesting that there is a higher propensity to patent in some areas than in others. Manufacturing registered the greatest number of Norwegian applications followed by Business Services. A combined group of electrical and mechanical machinery and engineering (748) would qualify for third place.

We can therefore compare the number of applications for a given area and a given size-class with the total number of enterprises operating in that area. This comparison gives us the opportunity to show how many enterprises in a given field apply for patents.

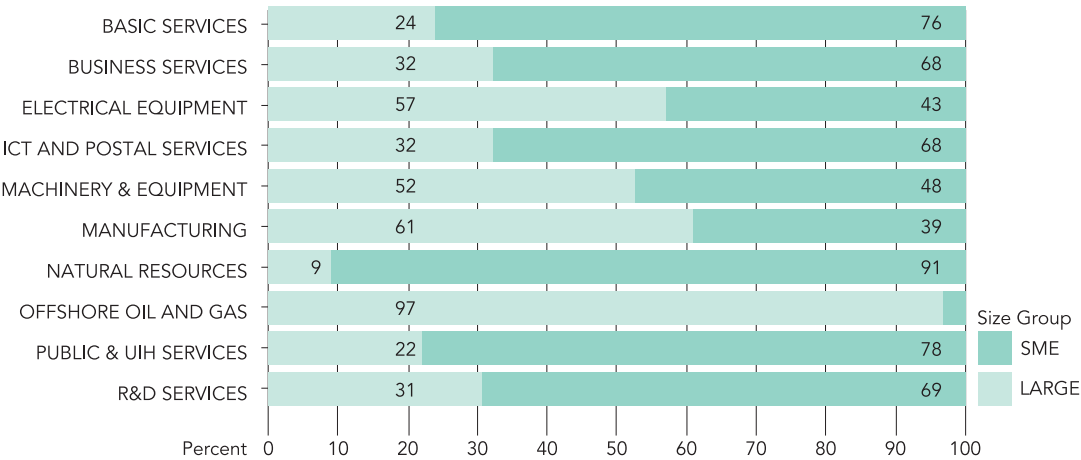
6. How is size reflected in enterprises' industrial activities?

In terms of volume, Norwegian applications during the 1990s were dominated by Norwegian enterprises in the areas of Business Services and Manufacturing. Figure 2.9 illustrates how the 4,312 Norwegian applications for which we have information on industrial activity⁷³ reflect the applicant's business sector by size group.

The figure shows that size-classes are not in fact evenly distributed for the population. Applications from large firms make up the majority only in four of the ten areas. Large enterprises dominate patenting in the Offshore Oil and Gas field (especially through Statoil). In addition, they are over-represented in the large population of manufacturing and electrical equipment applications.

Therefore, although the total numbers of applications are rather evenly distributed between SMEs and large firms for which we have information on industrial activity — with larger firms registering slightly more Norwegian applications, SMEs dominate patenting in a majority of sectors. This is notably the case for Business Services, Basic Services, and R&D Services. In addition, the proportional role of SMEs is remarkable in the fields of ICT and Postal Services, National Resources, as well as Public and UIH Services.

Figure 2.9. Applications by applicant's industry and size-group (n=4,312)



7. Applications and applicants as percentages of all Norwegian enterprises.

But to what degree does the distribution of patent applicants reflect the simple fact that there are many more SMEs in these industries than large firms? When we compare the number of applications, by area and size of applicant, with the total number of enterprises active in a given year (1998), a picture of the relative strength of patenting for different industries and different size-classes emerges. In table 2.8 we present preliminary evidence of the propensity to patent by size-class and sector, based on this full count data.⁷⁴

73 Again, 12,984 Norwegian applications minus applications from individuals, unregistered and unknown.
74 Enterprises whose size we know but whose industrial activity we do not (those without NACE industrial codes= 930) are placed in the Unknown x Unknown cell and compared with the total number of Unknowns in the total population.

Table 2.8. illustrates how firm-size⁷⁵ (reading down) and industrial sector (reading across) affect the propensity of Norwegian enterprises to apply for a patent. It is based on Table 2.3., which presented a breakdown of the total number of Norwegian enterprises according to size-class and industrial sector for 1998. Table 2.8. presents the total number of patents applied for by enterprises in these respective size-classes and sectors for a five-year period (1995-1999). For example, table 2.3. identified 55 large firms in the Machinery & Equipment sector in Norway in 1998. During the period 1995-1999, large companies accounted for 139 of the 274 patent applications in that sector, meaning that the 55 large firms⁷⁶ applied on average for 2.53 patents in the five year period. On the basis of this full count data, we can determine that 253 patents are applied for by every 100 large firms in this field.

Table 2.8. Number of Applications (1995-1999) per 100 Norwegian enterprises, by size and industrial activity.

1995-1999	LARGE	MEDIUM	SMALL	MICRO	UNKNOWN	AVERAGE
Basic services	7	1	1	0		1
Business services	72	8	4	2		4
Electrical equipment	166	25	11	3		19
ICT and postal services	15	7	2	2		3
Machinery & equipment	253	34	15	4		22
Manufacturing	89	9	3	1		8
Natural resources	1	0	0	0		0
Offshore oil and gas	227	29	0	7		60
Public & UIH services	0	0	0	0		0
R&D services	164	135	52	121		120
Unknown	125	1	1	1	330	31
Average	40	5	2	1		6

The table provides a unique window on how patenting varies according to size and to industrial sector. Reading down the Average column, we find that for every 100 Basic Service enterprises in Norway an average of 1 patent was applied for the five-year period 1995-1999; for every 100 Business Service enterprises, 4 patents were applied for, and so on. This illustrates the point that some industrial areas patent more intensely than others. Likewise, reading across the Average row at the bottom, the point that patenting propensity varies depending on how large the enterprise is becomes clear. On average, 40 patent applications were applied for by every 100 large companies, 5 applications per 100 medium-sized companies, and so on. These figures will be discussed in the next section.

7.1. Size-Groups

The result is a measure of the patenting intensities for different size-classes and industrial activities. Assuming that the number of Norwegian enterprises did not change radically during this period, we can see several characteristics of the propensity to patent according to firm size.

1. The intensity of patent applications is lowest among micro-enterprises. This size-class applies on average for one patent per 100 enterprises in a five-year period. This rate is strongly influenced by which field the enterprise is in. Micro enterprises (one to four employees), which work in the R&D Services Sector, applied for 121 patents/100 enterprises, which is above the average for that sector. Patenting activity is also near to the industry average in the ICT services sector.
2. The patenting intensity of small firms is on average twice as high. If we remove the unknowns, its two per cent enterprise average is on a par with the total population. It is, however, half the intensity of micro-enterprises in R&D activities and considerably higher in Business Services, where it is on a par with the industry as a whole.
3. Medium-sized firms demonstrate a considerably higher propensity to patent, at five applications per 100 enterprises, or one per year. The relative strength of medium-sized firms is shown particularly in R&D Activities, Machinery & Equipment, and Electrical Equipment.

75 Enterprises whose size we know but whose industrial activity we do not (those without NACE industrial codes= 930) are placed in the Unknown x Unknown cell and compared with the total number of Unknowns in the total population.
76 We assume that the number of firms in each sector does not change significantly during the five-year period.

4. Measured in terms of applications per firm, large firms are the most intensive applicants.⁷⁷ The average propensity is at 40 patents per 100 large-sized enterprises for the five year period. This is eight times that of medium-sized firms, 20 times that of small firms and 40 times that of Micro firms. Its strength is particularly demonstrated in Business Services (13 times the average for the industry), Machinery & Equipment (12 times the industrial average), Manufacturing (11 times the industrial average) and Electrical Equipment (nine times the industrial average).

7.2. Industrial Activity

The R&D Services category shows the greatest propensity to patent, with an average, over five years, of 1.2 applications per enterprise (i.e. 120 applications per 100 enterprises). This is followed by the Offshore area, at 0.6 patents per enterprise, and Machinery & Equipment at 0.2 applications per enterprise. Those areas with the lowest patent propensity are, not unexpectedly, the primary and tertiary sectors, including the public sector.

In short, size and activity do condition patent activity in fundamental ways, when the number of applications is compared to total numbers of enterprises. Large firms show much higher tendencies to patent than SMEs. The picture is more nuanced than this when we break down the applications by industrial activity. Different groupings of SMEs do have their relative strengths.

Since we know that large firms are more likely to apply for multiple patents than small firms, future studies should look at intensity in terms of the number of firms and not the number of applications. Further study of patent applications per employee would also be a reasonable measure of patent propensity and it would change the picture considerably.

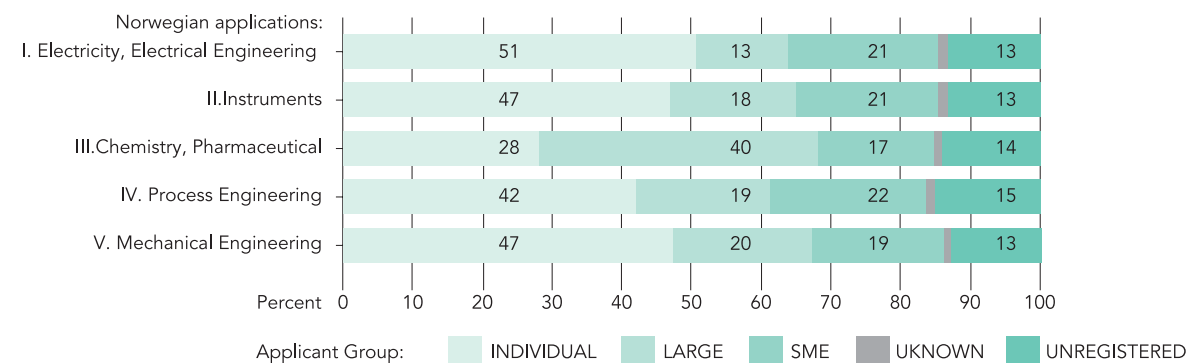
8. Applicant-size by area of application

In the previous section, the large number of independent *individuals* who patent were left out of the analysis. This is an important part of the population and a study which strives to provide comprehensive information on the use of the IPR system by SMEs should attempt to incorporate them into the study. We therefore consider some characteristics of patent applications in order to find out more about the applicants. In this section, we compare the technical areas of the patents (according to patent classes) with the size-classification of the 12,894 Norwegian applications. This gives us a full tally for which we can discuss the distribution of applicants by size and activity.

A note here is required on the patent classes used for this analysis. Patent applications received by the Norwegian Patent Office are categorized according to the International Patent Classification (IPC). This type of classification indicates the technically delimited areas where the applications claim novelty. The IPC is dynamic and currently consists of 120 classes, 630 subclasses, and a large number of sub-groups. In order to make this complicated classification system more applicable to the interpretation of patent statistics, IPC sub-classes are here converted into 5 technical areas consisting of a total of 30 sub-areas. The conversion is made according to the revised OST-INPI/FhG-ISI Technology nomenclature, an earlier version of which has been used in a number of other studies, notably in the work of the OECD. (See: OECD 1989, 1994).

⁷⁷ This changes fundamentally when we compare applications per employee, but that is the subject of a different study.

Figure 2.10. Percentage of size-classes applying by technical area of applications, percentage (N=12,984)



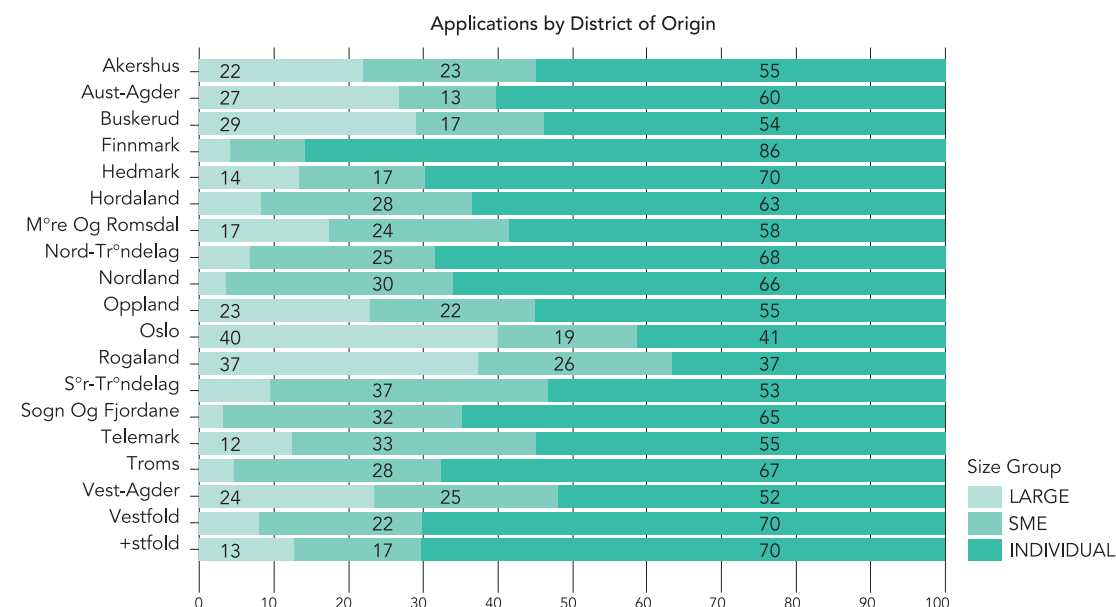
The fact that large firms patent differently from SMEs comes more strongly to the fore in this figure.⁷⁸ Large firms are, in relative terms, most active in Chemical applications, and least in Electricity, which includes ICT patents. SMEs are strongly represented among the applications that come under the heading of Mechanical Engineering. They are also reasonably evenly spread. The patenting behaviour of the large population of independent applicants is most variable and stands in opposition to that of large enterprises. Individuals are most highly concentrated in Electricity and Electrical Engineering, and least in the Chemicals and Chemistry field.

It would be interesting and indeed important to study independent applicants more closely, as this population might for example conceal considerably higher proportions of university-based patenting than otherwise assumed.

9. Patenting by district of origin

The utilization of IPRs also has a regional dimension. Here, we explore how Norwegian applications vary according to regional origin and size-group.

Figure 2.11. Norwegian Applications (N=12,984) by district of origin (=Fylker).



⁷⁸ For full counts for the different areas, see above. It is otherwise reassuring to see that the Unregistered and the Unknown categories are spread evenly across these technical areas.

Almost 80 per cent of the patent applications from large firms (N=2,681) came from four of the 19 Norwegian districts. Not surprisingly, more than a third came from Oslo proper (36 per cent), while nearly a quarter of these large enterprise patents are from Rogaland, where much of the offshore activity is located. A further fifth come from Buskerud and Akershus, which are near Oslo. In addition, Oppland (where Lillehammer is located) and Aust-Agder (where Kristiansand is) are also the origin of more large enterprise patents than SME patents.

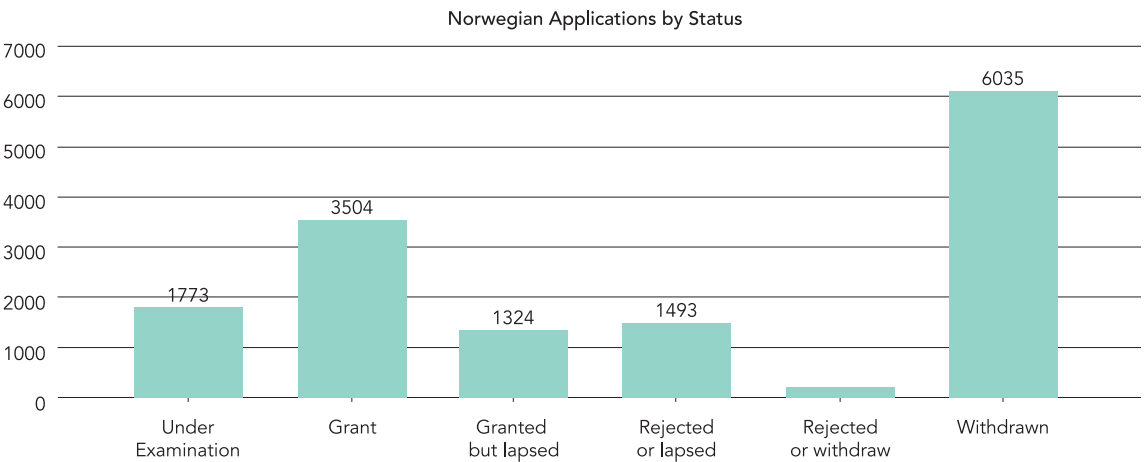
10. Status

In order to understand the way SMEs patent in relation to other economic populations, it is also important to consider what happens to the applications. Applying for a patent is one thing, but if the application never leads to a granted patent, then it may well represent only a cost and not a benefit for the small enterprise.

This section looks at the status of patent applications that were active during the 1990s. By "active," we mean any patent that was applied for and/or granted during the 1990s AND any patent applied for before then but granted during the nineties. In total there were 14,319 such patents involving 6,303 Norwegian entities.

In general, one of three things can happen to a patent application. It can be granted, it can be not granted or it can still be under examination. It should be understood that an application takes over a year to process. There are, however, subcategories. The "Not Granted" category includes cases where the applicant withdraws the application, where he allows it to lapse, or where it is rejected. "Grants" can include those with alterations as well as those that have lapsed.

Figure 2.12. Norwegian Applications (N=14,319) by Status.

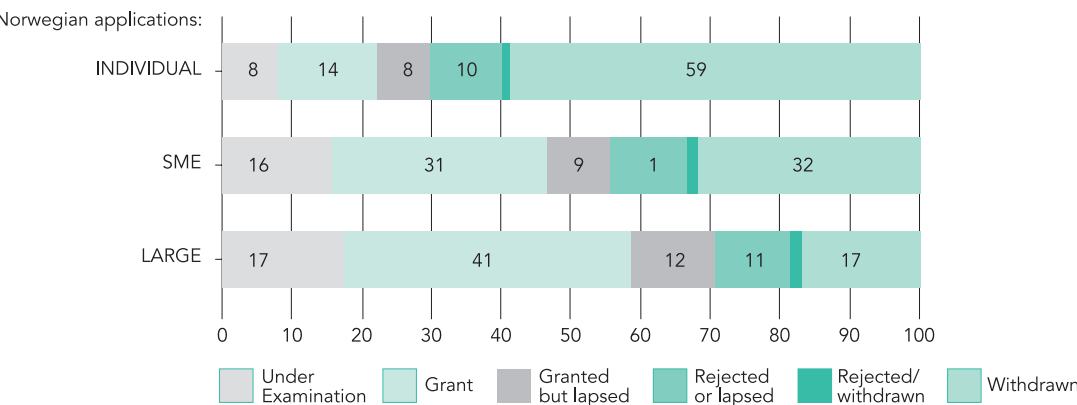


We should note first that more than 40 per cent of Norwegian applications are withdrawn by the applicant. In our population (which has been widened to include granted patents), about a third (34 per cent) have been granted, 12 per cent remain under examination, and the rest have been terminated with a non-grant.

Are SME patents more often withdrawn than those of large entities? The next figure confirms the hunch that the success rate of these applications falls with size. Consider the situation of independent applicants. 60 per cent of their applications are withdrawn! Why is this number so high? Is it because these applicants misunderstood the IPR system far more than other applicants? Or is it another weakness in the strategy of these applicants? The explanation is probably a combination.

There is thus a strong indication that this population could use greater assistance when approaching the patent system. The withdrawal rate of SMEs, while not as dramatic, is still substantial. One in three applications are withdrawn or otherwise rejected. This also means a loss of resources (both time and money) for a population which in general can ill-afford such loss.

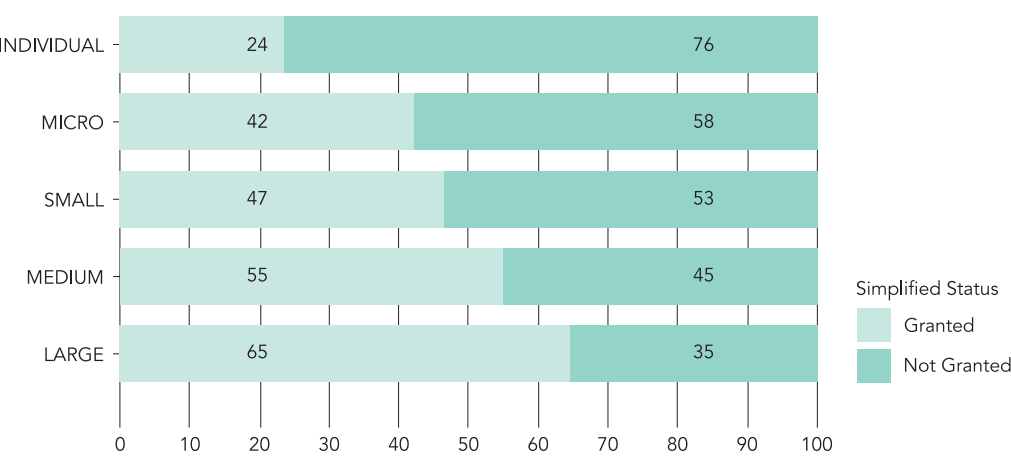
Figure 2.13. Norwegian applications⁷⁹ by size-class and status (N=12277)



The success rate of SMEs is substantial. Forty percent are granted. Large enterprises as a group enjoy a success rate of over 50 per cent and a withdrawal rate that is half that of SMEs and a third of that of independent applicants. There may be many factors behind the differences in success rates, where "success" is measured in patent grants. At least part of the explanation, however, is probably a better working understanding of the IPR system, and the fact that it is more comprehensively built into the enterprise's business strategy. In principle, a national IPR system should aim to reduce the number of withdrawals that result from misconceptions of the system or in poor competences in dealing with it.

The following figure breaks down the SME definition to see if the level of non-grant (especially because of withdrawal) is indeed dependent on size. Those applications that are still being examined are removed, as are the Unknown and Unregistered enterprises. In this way, the size-based trend becomes clearer. Patent grants climb with size, from 24 per cent in the case of individuals to 65 per cent for large enterprises.

Figure 2.14. Norwegian applications according to size-group and simplified status (N=5751)



79 2,042 Unknowns and Unregistered applications are removed.

CHAPTER 8:
THE USE OF THE TRADEMARK SYSTEM BY NORWEGIAN SMES

As noted above, the literature on “IPRs” tends to be synonymous with “patents.” Very few studies indeed employ statistics about trademarks.⁸⁰ To our knowledge, this is the first time such an analysis of trademark data has been done on such a scale.

This chapter presents the results from the STEP database covering all domestic trademarks applied for and/or granted in the ten-year period 1990 to 1999. The basis and the approach are much the same as for the patent database. There are, however, differences. First, trademarks do not have technical fields that we can translate to technical areas. Instead it has 42 trademark classes that are not immediately helpful in an analysis. Second, the status is less refined. We know only whether the trademark has been registered or has not (yet) been registered. Finally, the incidence of multiple applicants is much smaller than in the case of patenting.

In this chapter, we examine:

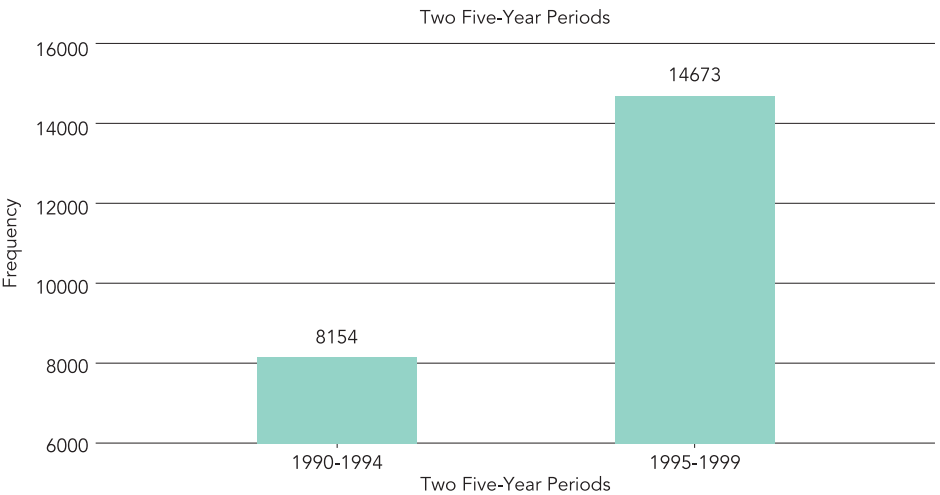
- a. Norwegian applications by two five-year periods;
- b. the distribution of trademark applications by applicant size-class:
 - i. “Norwegian applications”: total measure of Norwegian participation,
 - ii. Total number of individual entities, by size-class;
- c. the number of applications per individual applicant, by size-class;
- d. the distribution of Norwegian applications by the industrial activity of the applicant, by size-class;
- e. the number of Norwegian applications (1995-1999) as a proportion of the total number of firms active in the relevant industries in Norway for a given year (1998);
- f. the distribution of technical areas of applications, based on applicant size-class;
- g. Norwegian applications by geographical location of the applicant;
- h. the status of trademark applications by size-class of applicant.

1. Strong growth in the number of Norwegian trademark applications

During the nineties, the number of Norwegian trademark applications grew significantly. More than 21,000 applications had at least one Norwegian applicant during the decade. In total, Norwegian applicants were involved 22,827 times in these applications, as some had multiple applicants including foreigners.⁸¹ This section looks more closely at the “Norwegian applications.”

Figure 2.13 indicates just how dramatic the increase in Norwegian trademark applications was in the nineties. The volume of applicants grew by nearly 80 per cent from the first to the latter half of the decade.

Figure 2.13. Expansion of Norwegian trademark applications during the 1990s.

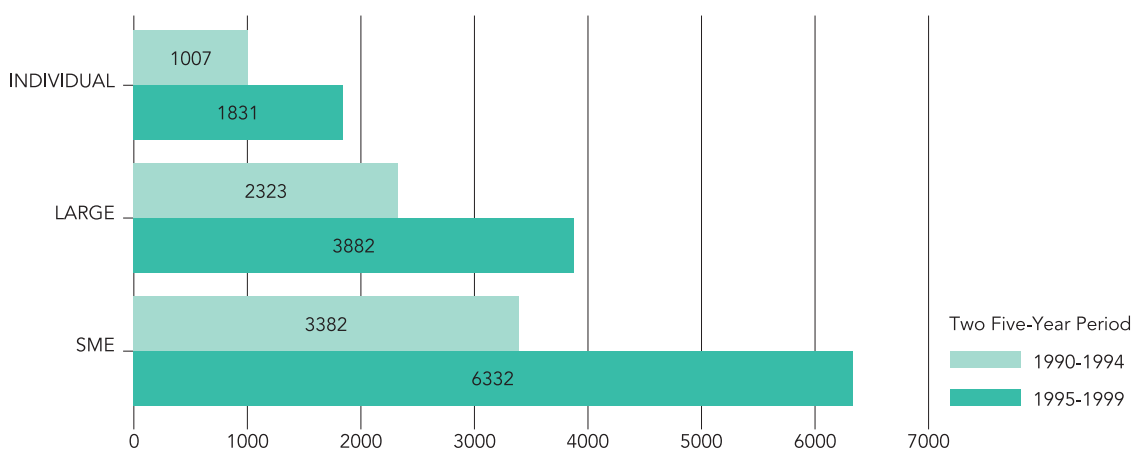


80 For an exception, see Bosworth et al., 1998.
81 Note that even though some entities were involved in more than one application, this figure (i.e. 22,827) relates to the number of times an entity was involved in an application irrespective of whether the same entity was involved in other applications.

2. Stronger than average growth of SME applications

If we look at how the 22,827 Norwegian applicants⁸² were distributed by size class, the picture is remarkably different from that of patent applicants. Figure 2.14 indicates that SMEs form the largest group of applicants (in gross terms), while independent applicants now form the smallest.⁸³

Figure 2.14. Norwegian trademark applications by size-class of applicant, two periods



	1990-1994	1995-1999	% change	Total
Individual	1007	1831	82 %	2838
Large	2323	3882	67 %	6205
Sme	3382	6332	87 %	9714
Unknown	644	878	36 %	1522
Unregistered	798	1750	119 %	2548
TOTAL	8154	14673	80 %	22827

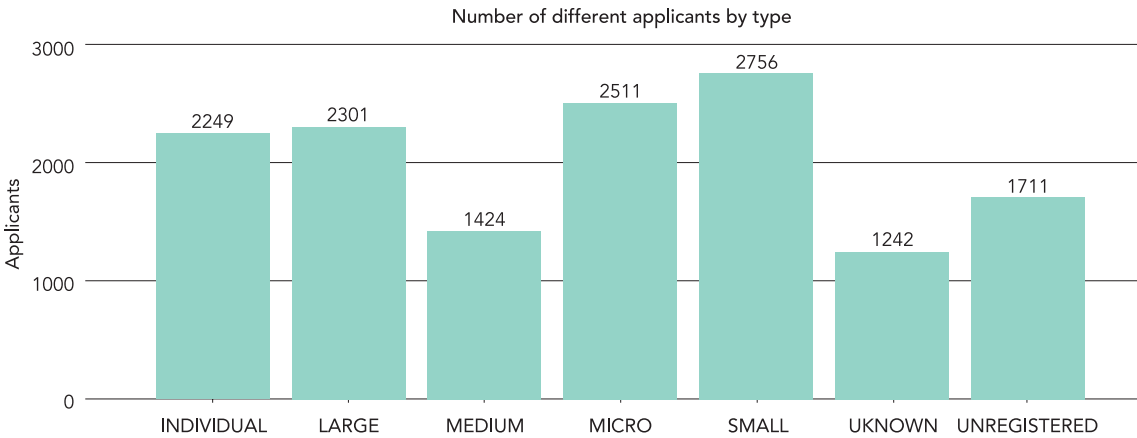
The involvement of SMEs in trademark applications grew even faster (87 per cent) than the total, while the incidence of large enterprises had below average growth, although was still very high at 67 per cent.

3. Total number of individual entities, by size class

Many of the applicants apply for more than one trademark; and each application can include more than one applicant. Let us, therefore, look at the applicants to get a better idea of who uses the trademark system. During the nineties, 14,188 Norwegian entities applied for at least one trademark, such that each was on average involved in 1.6 trademark applications. If we look at this population and break down the applicants according to more specific size-groups, we find a rather even distribution of users.

82 i.e., the total number of occasions on which Norwegian applicants participated in a trademark application during the period.
83 For the purposes of presentation, 2548 of the applicants were not registered in our database, while a further 1522 were unknown. The assumption is that many of the unregistered are enterprises without employees.

Figure 2.15. Applicants who applied for at least one trademark during the nineties (n=14,188).



This figure indicates that there were fewest applicants among medium-sized enterprises, and most among small enterprises. Large enterprises and independent applicants were equally represented in terms of numbers.

4. Degree of involvement

In order to evaluate how the involvement of such different entities varied, we look first at the average number of applications originating from these different size groups.

The vast majority of applicants (64 per cent) had only one trademark application during the period. The occurrence of multiple applications is, as in the case of patenting, related to size. While only 28 per cent of the smallest firms identified were involved in two or more trademark applications, the equivalent for large enterprises was nearly 90 per cent. Indeed, four of the large entities were involved in more than 50 applications. The table illustrates, in greater detail, how size and number of trademark applications correlate in basic terms.

Table 2.9. Average number of applications for each size group

	Average number of applications					Total
	1	2-4	5-19	20-49	50+	
Individual	1867	368	14			2249
Large	1232	852	194	19	4	2301
Medium	1009	377	36	2		1424
Micro	1962	527	22			2511
Small	2047	676	33			2756
Unknown	1049	191	2			1242
Unregistered	1306	375	28	2		1711
Total	10472	3366	329	23	4	14194

5. Norwegian trademark applications by applicant's industrial activity

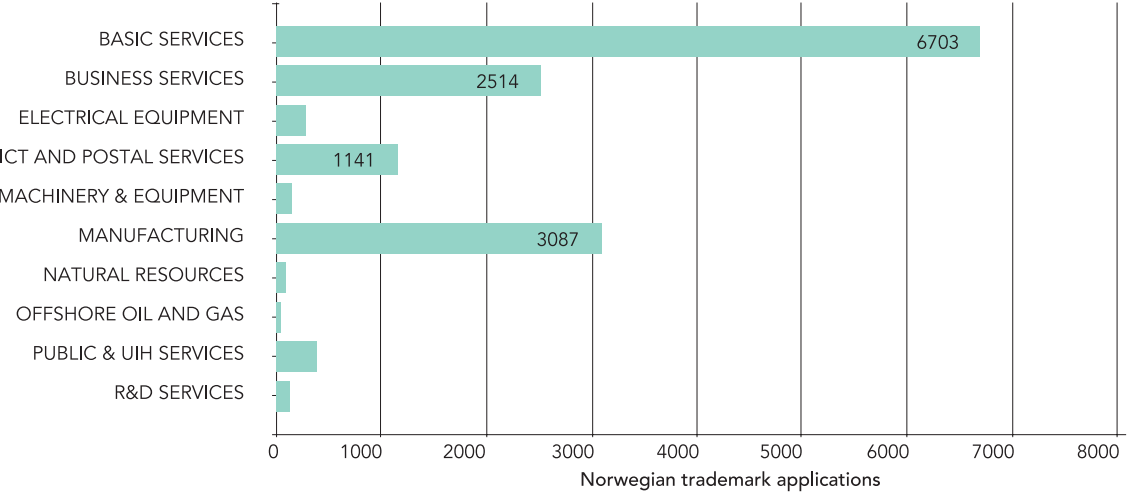
In this section, we see that the applicants are much less evenly distributed by industrial activity, but concentrated in services. We will see how this affects the size distributions of the applicants below.

First, we return to the occurrence of Norwegians in trademark applications to identify their orientation for the nineties. When we exclude those whose business areas we do not know,⁸⁴ enterprises in Basic Services

84 Independent entities, Unregistered enterprises and Unknowns. There were 8343 cases or 37 per cent of the total Norwegian trademark applications.

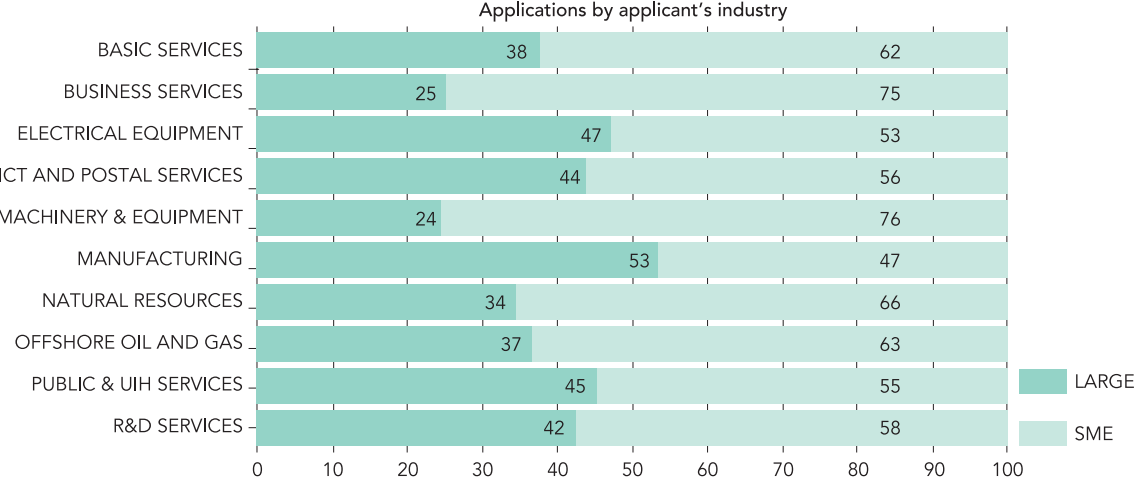
dominate trademark applications. An additional 3,655 come from Business Services and ICT Services, with the national telecom company, Telenor, especially active.

Figure 2.16. Norwegian applicants by business sector, (N=22,827)



The manufacturing sector is also relatively active in filing trademark applications. If we include the Electrical and Machinery sectors within a broadly-defined manufacturing sector, there are over 3,500 Norwegian trademark applications in the period under study. Companies in R&D services (somewhat surprisingly), Offshore and the Public Sector were not especially active in applying for trademarks.

Figure 2.17. Applications by applicant's industry and size-group (n=15,919)

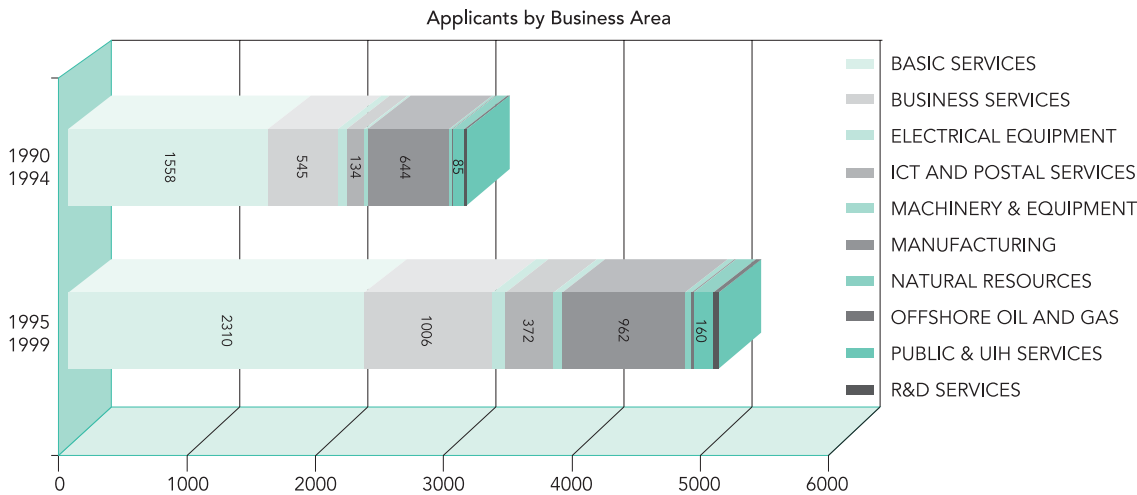


6. The increase in applicants, by sector over two periods.

Let us look at the 14,194 Norwegian users of the trademark system, ignoring for the moment how often they apply. On average, the number of new⁸⁵ enterprises that apply for trademarks increased by 60 per cent. Growth was especially high among ICT Service companies, including Telenor, and among enterprises in the Machinery field. From much higher volumes, the increase in Business Service applications was above average.

85 See the caveat about the 1995 dividing line, and the slight possibility that the enterprise is not recognized as the same enterprise between different periods.

Figure 2.18. Number of applicants by business area over two periods (N =14,194)



7. Number of applications (1995-1999) per firm (1998)

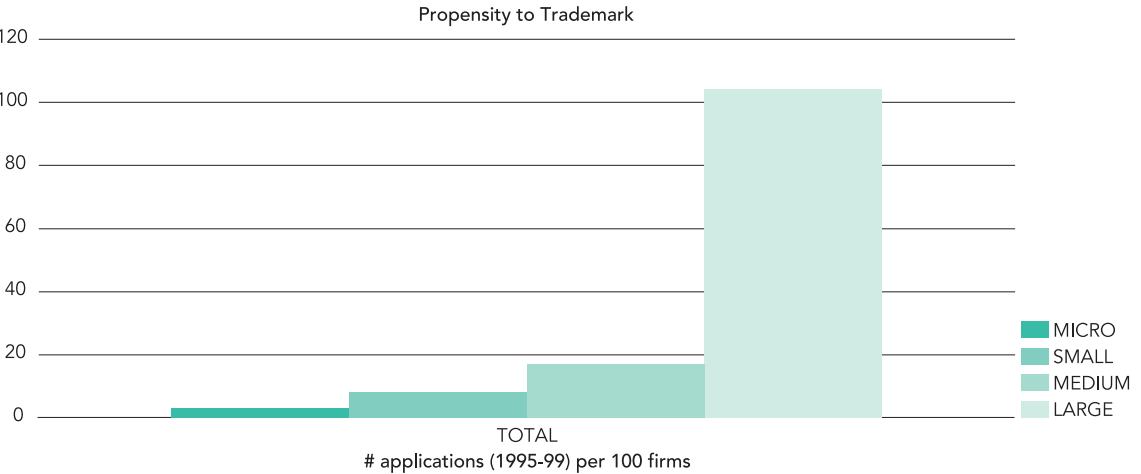
In this section, we compare the pattern of trademark applications to the profile of Norwegian enterprises, represented by a given year. The propensity to seek trademark protection is even more skewed than in the patenting case. On average, eight applications were filed in a five-year period per 100 firms in a given year. The table shows how this propensity varied by size-class and by the applicant's industrial activity.

Table 2.12. Number of Norwegian applications (1995-1999) per 100 firms (1998)

1995-1999	MICRO	SMALL	MEDIUM	LARGE	UNKNOWN	AVERAGE
Basic services	3	7	14	128	0	7
Business services	3	14	35	138	0	9
Electrical equipment	3	13	46	145	0	21
ICT and postal services	13	43	70	489	0	44
Machinery & equipment	3	7	18	40	0	8
Manufacturing	4	12	25	195	0	20
Natural resources	0	2	2	32	0	1
Offshore oil and gas	4	14	57	22	0	13
Public & UIH services	1	1	3	10	0	2
R&D services	0	21	85	146		60
Unknown	4	4	15	95	164	7
AVERAGE	3	8	17	104	68	8

By field, the greatest propensity to apply for trademark protection was, strangely, in the field of R&D services with an average of 12 trademark applications a year (or 60 for the five-year period) per 100 Norwegian enterprises. ICT services were also strongly represented, with an average of around one trademark application per large enterprise per year (489 per 100 large companies, or just under 1 per large enterprise per year). In fact, there is a much higher propensity to apply for trademarks in ICT services regardless of size-class than in any other industrial activity. Propensities were also considerably higher for Electrical Equipment (including information and communication technologies) and General Manufacturing. This is illustrated in the next figure

Figure 2.19. Propensity to apply for trademark protection based on size. The figure shows the number of Norwegian trademark applications during a five-year period (1995-1999) per 100 enterprises in a given year (1998)



In terms of size, the propensity to seek trademark protection increases 35 times from micro enterprises to large enterprise.

8. Size-classes by district of origin.

The next table shows that trademark applications are first and foremost an urban phenomenon.⁸⁶ The applications from Oslo and its surrounding areas (i.e. including Akershus), Trondheim and Bergen account for 73 per cent of the total number of Norwegian applications.

In general, the urban centers have the greatest proportion of large enterprise applications (almost as many applications from large enterprises as all SMEs in Oslo), while SMEs dominate in the periphery. In the small number of applications from Northern Norway (Finnmark and Troms), those of SMEs outnumber large enterprise applications by six or seven to one.

Table 2.13. Trademark applications by size and district of origin of applicant

	INDIVIDUAL	LARGE	SME	UNKNOWN	UNREGISTERED	Total
Østfold	112	168	417	64	95	856
Akershus	423	768	1280	212	326	3009
Aust-Agder	52	23	103	19	35	232
Buskerud	132	248	464	62	81	987
Finnmark	27	7	39	19	3	95
Hedmark	46	93	135	25	40	339
Hordaland	218	310	719	96	190	1533
Møre Og Romsdal	90	133	263	37	91	614
Nord-Trøndelag	38	22	78	14	28	180
Nordland	46	25	180	32	61	344
Oppland	80	49	201	41	49	420
Oslo	964	3648	3748	584	1022	9966
Rogaland	177	184	519	72	108	1060
Sogn Og Fjordane	28	5	66	12	64	175
Svalbard			1	2	1	4

86 Notice, however, that there are applications here from Spitzbergen.

	INDIVIDUAL	LARGE	SME	UNKNOWN	UNREGISTERED	Total
Sør-Trøndelag	129	245	558	56	103	1091
Telemark	47	45	152	28	54	326
Troms	27	37	105	21	33	223
Unknown	6		6	8	5	25
Vest-Agder	67	70	255	43	57	492
Vestfold	129	125	425	75	102	856
TOTAL	2838	6205	9714	1522	2548	22827

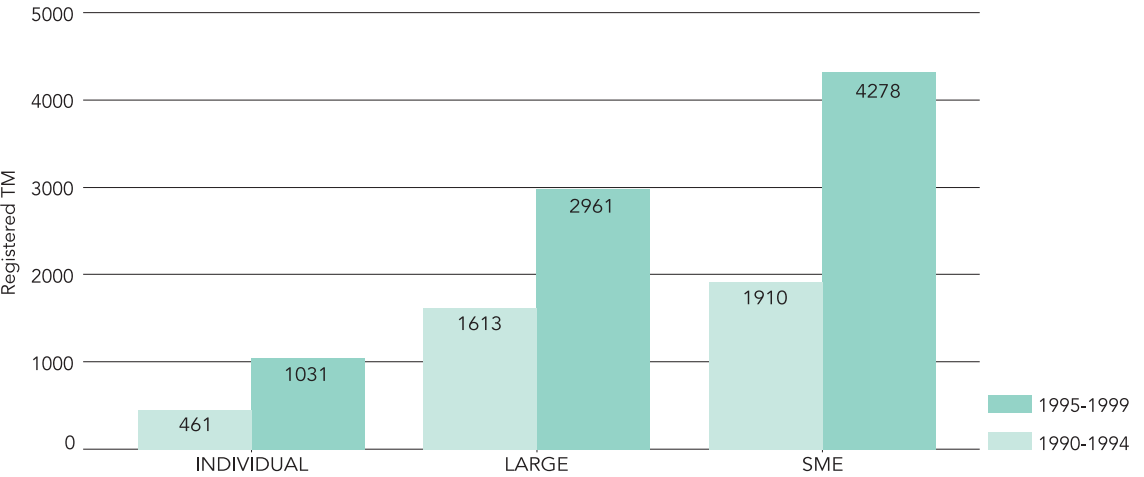
9. Registered Trademarks

We do not have as refined an indication of the status of trademark applications as we did for patent applications. We do, however, know how many applications were granted during the 1990s, regardless of the date of application (from 1980 onwards). Does this change our perspective?

There were 14,422 trademarks registered in the 1990s.⁸⁷ If we divide up the decade into two five-year intervals, trademark registrations are shown to have increased twofold. In fact, the total number of registrations increased by 108 per cent from 4,691 (1990-94) to 9,751 (1995-1999), including those unknown and unregistered.

Interestingly enough, the number of trademarks increased by 124 per cent both for SMEs and for individuals. The development was much less steep for large enterprises (84 per cent).

Figure 2.20. Number of trademarks registered, 1990-1999⁸⁸



Within the SME category, the increase in registered trademarks grew most for micro enterprises (167 per cent) and least for medium-sized enterprises (75 per cent).

87 A total of 4764 were registered with enterprises that are either unregistered or unknown.
88 Unknown and unregistered excluded.

SECTION 3:
GENERAL ASSESSMENT AND
RECOMMENDATIONS SECTION

The final section adds observations from a set of expert-interviews to the empirical findings from the above sections. This will conclude the study's assessment of the interrelationship between SMEs and the IPR system in Norway. We then move on to draw up a series of recommendations designed to address apparent problems and short-comings in the interrelationship between Norwegian SMEs and the IPR system. The section is, therefore, divided into two chapters. Chapter nine will look specifically at evidence suggested by the expert-interviews and it will conclude the general assessment of the Norwegian situation. Chapter ten will establish a series of final recommendations. Finally, a number of concluding observations will be made.

CHAPTER 9:
GENERAL ASSESSMENT

This chapter is designed to conclude the study's general assessment of the interrelationship between SMEs and the IPR system in Norway. Here, the empirical sources from the previous section are supplemented with results from a round of expert-interviews. In these interviews we targeted central players in important institutions of the Norwegian IPR system. Expert-interviews, combined with the empirical sources above, were deemed the best way to identify major trends in such a large and uniform population. These interviews have provided indications about the current use and awareness of IPRs among different sectors of the SME population and have helped to suggest areas for possible improvement.

1. Interviews

In all, the study team planned and conducted interviews with 27 individuals in 14 institutions or organizations that are central to the Norwegian Innovation System. Six main types of institutions were represented: the regulatory and administrative framework, major public funding and advisory agents, specialized advisory agents, joint-research activities, research parks (Trondheim and Oslo), private patent agents (Oslo and Trondheim), and organizations representing the interests of independent inventors and individual entrepreneurs. A number of those interviewed represent two or more relevant functions. Some are inventors themselves, while others hold positions, for instance, within research environments or within the Norwegian Association for the Protection of Industrial Property. Many also had experience from other relevant parts of the system, such as the ministries or the IPR divisions of large companies.

Table 3.1. Distribution of interviewees (N=27)

	ENTITIES	PEOPLE
Regulatory and administrative	2	7
Public advisory and finance organizations	2	5
Research parks/Affiliated research programs	3	3
Specialized advisory organizations	2	5
Patent agents	3	5
Interest organizations	2	2
TOTAL	14	27

The interviewees were asked whether they consider there to be scope for improvement in the relationship between Norwegian SMEs and the IPR system; and if so, which areas of weakness can be identified among SMEs (or subsets of the population) and/or within the IPR support system. Together, the different perspectives and experiences of the interviewees provide a cross-section of Norwegian institutions that illuminate the interrelationship between intellectual property rights, and small and medium-sized enterprises. Patenting was, by a large margin, the area of IPRs with which most of the interviewees had experience. Design was reflected directly in only one institution (three individuals): trade secrets and, to a lesser degree, trademarks emerged in several interviews, while input from the NPO included the full range of rights it administers.

2. General observations

The general diagnosis from the interviews is that there is clearly potential for greater efficiency both regarding the awareness and use of the IPR system among small and medium-sized enterprises, and regarding the IP support system itself. However, the interviews also emphasized that this should be put into perspective: awareness and use of IPRs should be considered in relation to Norwegian conditions. Specifically, it was observed that IPR awareness and the immediacy of the IPR question for SMEs is fundamentally affected by the fact that Norway remains outside the European Patent Convention (EPC). If Norway were to join the EPC, the number of foreign applications would quadruple, it was suggested, meaning that Norwegian companies would be forced to consider IPRs in a whole new (defensive) light.

Some interviewees wondered whether the level of awareness and use of IPRs by Norwegian SMEs, in fact, reflect the competitive situation that prevails in their domestic market. However, others strongly suggested that firm-level IPR awareness in Norway tends to be low or to be attuned to past market conditions. By and large, there was broad consensus that the way Norwegian SMEs approach and utilize the IPR system in general and/or the way this system caters for this population's special concerns do(es) indeed warrant special attention.

One last general concern that arose specifically among private-sector participants was the role of the public sector. Several observers emphasized that the public sector should only concentrate on consolidating its role in this area and making it more efficient, not in making its presence bigger. These participants made the case that the main contribution of the public sector would be to reduce the cost and administrative burdens that SMEs face in the innovation process.

3. Use and awareness of IPRs among Norwegian SMEs

In general, there are three basic points as to how small and medium-sized enterprises should approach the IPR system: SMEs should be aware of and informed about the system; they should think strategically about the inherent possibilities of the IPR system as a part of their wider business strategy; and they should have the ability and skill to utilize the system to its full potential. We present evidence from the interviews in this regard.

3.1. First, a basic level of understanding of how the different intellectual property rights work is necessary. SMEs should have a working understanding of the opportunities that the range of intellectual property rights (i.e. including trademarks, trade secrets, etc) represents. The level of this appreciation should stand in relation to the real possibilities the rights can reasonably be expected to hold for their industry and for their individual situation. SMEs should ideally be aware of how their potential competitors think about intellectual property rights, for example, in foreign markets.

The interviews support the observation that, in general, Norwegian SMEs tend to be ignorant about intellectual property rights. General awareness is highest in relation to the patent system, where it has risen in the past few years. The interviews tended to concentrate on patent-related issues. On other rights, the signals were small in number and somewhat less unanimous. One observation was that "everyone" knows about patents, but most know considerably less about industrial designs. The opposite position was also raised: Norwegian SMEs are generally more familiar with designs and see it as an "easier" form of IPR. Likewise, it was suggested that SMEs were not remarkably less informed about trademarks than larger companies, although few of the interviewees had much experience here. This observation is supported by the database analysis.

The interviewees were in general careful to differentiate between different types of small and medium-sized enterprises: different SMEs have different starting points and different needs. Some emphasized that the smallest actors, especially independent entrepreneurs, were the most important group to target: this group combines those where the limitations of competence and administrative resources are greatest and where the IPR choice is limited by the experience and expertise, and time available to a single person.

Another population that some interviewees argued deserves special attention is the group of academic researchers. Some interviewees claimed that many university researchers are not aware of possibilities offered by the IPR system, although there were signs that awareness and knowledge were on the rise here as well. Notwithstanding, there are several important considerations relating to this group, suggesting the need for greater attention from the IPR system: academic researchers have little experience with commercialization and this affects their understanding of the contribution made by the IPR system; they are often involved in areas where the rights system is immature and unclear, for example, in the field of biotechnology; and their needs are not necessarily catered for by their institutions or the support-system. In this light, some interviewees emphasized that the current developments in the regulatory environment underline the need to focus on long-term support systems, while others who are directly involved indicated that existing research parks already perform this function.

3.2. A second basic expectation as to how SMEs should approach IPRs involves strategy. In general, SMEs should actively evaluate what the IPR system can do for them in their competitive situation both as it is today and how it might look tomorrow. The aims of these strategies should be realistic, and should be in tune with what the IPR system can offer and with the realities of their own situation. In this process, it is important that SMEs do not equate IPRs solely with patenting, nor patenting only with protection. A strategic appraisal of the IPR system would also consider the use of IPRs in monitoring, collaboration and alliances, and signaling, or the other strategic uses of IPRs the study pointed to above.

The interviews underlined the importance of advancing the discussion of SMEs and IPRs from one of awareness to a discussion that focuses on strategic knowledge of intellectual property rights. They indicated that Norwegian SMEs tend to be tactically weak in their use of such rights, although certain subpopulations are at least as knowledgeable in their use as their larger competitors. As a rule, however, SMEs have trouble making informed strategic decisions about if, when and what IPRs to apply for. In general, SMEs tend to apply too early and their early patent applications tend to be too broad. This is compounded by a certain level of vulnerability in contacting other larger agents about their inventions. Some SMEs have trouble understanding when and how to enter into confidentiality agreements. The fact that SMEs are in general prone to make mistakes in dealing with IPR questions is compounded by the fact that SMEs tend to be much less tolerant of such mistakes than larger actors. This situation underlines the importance of an accessible, reliable and knowledgeable support-system.

The interviews also tended to differentiate the smallest players from the larger SME category. They distinguished between individual entrepreneurs, some of whom patent too much (some are "patent crazy"), and small companies which might tend to avoid patenting. A larger, informed strategic consideration is what is lacking in both situations.

3.3. A third basic expectation as to how SMEs should approach IPRs involves active utilization. SMEs should be able to make use of the full range of potential applications and to determine if and when these different uses are relevant to them. They should be skilful in their choice of tool (e.g. patent versus trade secrets), the timing of their use, and the details of drafting their applications, etc. Consequently, SMEs should become demanding "users" of the IPR system. Furthermore, it is instrumental that SMEs should be able — realistically and proactively — to defend their rights both nationally and internationally.

The interviews indicated that a significant proportion of those who consciously choose not to utilize the IPR system are weary of their ability to enforce their rights. The interviews also suggested that many small companies and start-ups are afraid that if their invention is patented, then others will steal the idea and that they will not be able to enforce their rights against larger enterprises. In general, SMEs fear having their ideas stolen, even if patented, especially by foreign companies. They obviously lack the time and resources for dealing with such conflicts.

Alternate uses of the systems — for example, to attract or facilitate collaboration — are specific to certain types of SMEs, for example ICT enterprises. There was, however, no general indication as to the ingenuity of such firms to use the IPR system. Regarding the general topic of whether SMEs utilize the information from patent applications/grants etc, the answer was that such use was extremely limited. Use of patent information is minimal. Some interviewees observed that this information source tends to be seen as "too academic" by many enterprises. SMEs tend to be "hands-on" and prefer conferences/trade-fairs. Patent information is not immediately intelligible to the SMEs. However, there was some indication that this attitude might be changing. The fact that the databases are only now coming on line might help raise awareness as to how this information source can be used.

3.4. Concluding observations on Norwegian SMEs

In brief, there is considerable distance between the ideal situation and the one in which SMEs tend to operate. In Norway, the anecdotal evidence and the ongoing survey work by the Norwegian Patent Office that we looked at above set the tone of general ignorance of the IPR system. The survey indicates that many SMEs know about the Patent Office (75 per cent) and have obviously heard about patents, but that their knowledge is limited (to patents) and, in some cases, beset by myths. One myth that is particularly disturbing is that as many as 20 per cent believe that the patent system is self-enforcing: that is, they believe that the Norwegian Patent Office takes care to prevent rights' infringement. It is expected that this sort of misconception about the IPR system is even more pervasive among the large number of independent applicants already using the patent system.

The existence of this type of misconception combined with the observation repeated in the interviews that many SMEs view their ability to enforce their rights as dubious, and with the observation from the databases that a considerable number of SMEs do in fact use the system, all indicate that the question of enforcement should be focused on. The literature also emphasizes the question of enforcement and litigation, not least in the ability of SMEs to protect rights abroad. This is an important issue as the ability to enforce rights obviously feeds into the firm's decision to apply for intellectual property rights in the first place.

By and large, the interviewees support the study's underlying assumption that the level of awareness and, moreover, of knowledge of IPRs, skill and expertise is low among Norwegian SMEs. The majority suggests that the level of awareness is in fact growing as regards patenting and has been doing so for several years. It is still seen as too low, especially given the changing economic environment. The interviewees suggest that the main area for improvement lies in improving the knowledge, skills and expertise of how to use the IPR system.

4. A brief appraisal of the Norwegian Support System

Let us now turn our attention to the IPR system and the observations from the interview round. Here the presentation will again consider a set of ideal characteristics of an efficiently functioning IPR system with the situation observed in Norway. We can start by observing that the nationally based IPR system should actively take into consideration the special needs of small and medium-sized enterprises. Primarily, however, a national IPR system should be characterized by fair and effective laws, by the effective administration of rights and distribution of IPR information, and by access to services inside the country. There should be a dynamic complement between publicly and privately provided services and there should be a minimum quality standard for the IP advice offered; the standard should also be realistically high.

4.1. Preliminary observations

An opening observation about the Norwegian IPR system is that little existing analysis surrounds it. This is in itself an indication of its low status in the policy discussion. The most visible attempt to direct attention to it was the Conference on IPRs and Norwegian Industrial Policy that the Ministry of Industry sponsored in 1995. This conference was designed to look at the IPR system in terms of how it can contribute to "creating better conditions for innovation activity in the Norwegian system in terms of increasing competitiveness and of generating economic growth."⁸⁹ The conference introduced some observations that remain useful today in our context.

In brief, the Ministry sought to initiate a business-oriented discussion of IPRs and how they are utilized in the Norwegian system. This was based on the impression that the Norwegian IPR system is not as effective as it might be in terms of its ability to react to challenges in the form of a changing international trade environment and new technologies and markets. The conference served to indicate that the legal and regulatory framework provides Norwegian business and research institutes with an "outstanding" legal basis. Further, the Conference raised the question about how the different components of the support-structure are coordinated, and it questioned how to "vitalize" Norwegian users not least among SMEs.

The impression that the IPR system is not effective enough persists, as does the concern of vitalizing Norwegian users. The present study highlights this issue. Nonetheless, the conference failed to spark a sustained policy discussion about IPRs in Norway so that six years on the same concerns still exist. This indicates that there is a lack of a sustained and concerted national strategy or vision for intellectual property rights. Top-level discussions about IPRs, when they do emerge, tend to focus only on legal considerations. A clearer national profile that involves the strategic issues related to IPRs in terms of trade and industry would, among other things, help to raise awareness of intellectual property rights among SMEs.

4.2. Interview-based observations

This subsection is designed to reflect some of the comments and concerns that were raised during the mapping of the Norwegian system and the interview round. First, we provide a taste of some of the main types of concerns the interviewees had about the Norwegian IPR system.

- a. The first concern was almost unanimous among interviewees. It linked the low levels of awareness, and especially those of knowledge, skills and expertise in IPR matters, with the virtual absence of IP-related subjects in the Norwegian education system. The indications were that teaching/training in IPRs is mainly limited to specialization in law faculties, whereas engineering and entrepreneurial education is virtually never exposed to this subject. Some find this omission symptomatic of the Norwegian IPR system and the Norwegian attitude to IPRs in general. The call was that intellectual property rights should be included in the syllabus in technical and management education, and/or through supplementary training, refresher courses, etc. It is understood that a dialog has begun.

89 Conference on IPRs and Norwegian Industrial Policy, 1995, see Minutes (Iversen 1995).

Notwithstanding, this is seen by many as a key element in improving awareness and competency, not only with potential and practicing entrepreneurs but also within the public support structure.

- b. The second main type of concern involved the way IPRs are dealt with by the support structure, especially the level of knowledge and the coordination of the system. Ideally, the different parts of the IPR system should be coordinated and should have a common understanding of the issues and possibilities inherent in the IPR system. SMEs should not have to wonder whom they should contact, and the quality and basic gist of the advice should not vary greatly from one component of the IPR system to another, or from one advisor to the next. In general, SMEs have a right to qualified, sound advice on IP issues, wherever they make contact with the institutions involved in the national IPR system.

The interviewees indicated that knowledge and awareness of IPR matters is improving in the innovation system as a whole. Some interviewees did comment on the need for a "cultural revolution" in the IPR system as a whole, while also noting that increased knowledge of IPRs and a general change in attitudes signal that one is under way. In general, the IPR system was seen as engendering sophisticated expertise concerning intellectual property rights and strategies. Expertise on most questions SMEs are likely to raise is available in the system. For the most part, however, there were concerns about how well IP expertise is spread through the Norwegian system. Most expertise seems to involve the patent system, raising the question of how well strategic dimensions of design, copyright and trademarks are represented. Several interviewees recognized that the support structure should consider more closely the use of trademarks and other rights in their advice to companies. In this sense, IPR expertise appears to be too concentrated in the Norwegian system.

Expertise on IPRs also seems to be isolated in pockets. In general, it is important that leading institutions of the national innovation system have clear and operational IPR policies and strategies. These should be geared to current situations, and should be consistent with the prevailing framework of the national IPR system. In Norway, the level of awareness and knowledge of, and skills and expertise on, the IPR system within the support system is, however, variable. Different "cultures" or attitudes about IPRs were noted within the different institutions and between them. For example, the Research Council was observed to have an unclear IPR policy with no one working expressly on IPR questions. The way this flagship institution deals with intellectual property rights was characterized by what one observer called a "dual culture." On the one hand, different programs (such as FORNY) or different areas (such as Biotech) are active in promoting commercialization of research and the use of the IPR system. On the other hand, other areas of financing seem to discourage the use of IPRs.⁹⁰ Furthermore, there was no apparent prospective effort to evaluate the changing IPR environment and any potential ramifications this might have for that institution's activities.

The interviewees also noted that for individual SMEs, the system is only as good as the case-worker it meets in the support structure. It is again not essential for every case-worker to be an IPR expert but there should be some common understanding of the basic issues and knowledge that a typical case-worker has. One interviewee pointed out that the tendency of SMEs to apply too early for IPRs might in fact be reinforced by the way the IPR support system works. One observer claimed that the way some case-workers have interpreted application procedures for the SND have encouraged some SMEs to apply for patents too early.

d. The dependability of patent agents

Another topical concern that emerged during the interviews involved patent agents. Ideally, the Private Advisory Framework should dynamically complement the public one as a certain degree of competition among patent agents and with the services provided by Patent Office is an important feature of the system. In this situation, there should be a certain standard of service that underlies this competition.

Patent agents should provide qualified advice of a certain minimum standard (IP services are not a good you can return for a full refund). They should also develop their services and provide new ones that address the emerging needs of SMEs. However, the Norwegian system cannot reasonably engender all types of technical expertise at any given time. Today, part of the "Norwegian" system involves foreign advisors on technical questions concerning biotech, which have not yet been developed domestically. This need not be a problem as long as this expertise is readily available elsewhere. Over time, however, the Norwegian knowledge-base should grow to encompass important new areas of expertise.

90 The Research Council contracts promote outcomes in the form of written publications unless the applicant can demonstrate that another form of outcome (such as a patent) is important.

The topic of certification of patent agents emerged in a minority of interviews towards the end of the interview round. Concerns coincided with newspaper reports (Dagsavisen, June 18, 2001) of an inventor whose substantial investment in two inventions was reportedly made valueless by bad advice from a private patent agent. There is no accreditation or other system for the authorization of patent agents in Norway and inventors have no redress in such cases. As in the article, it was suggested that this is an important concern for SMEs.

e. Enforcement and Litigation

There are several signals that enforcement of rights, and the expense and uncertainty of potential litigation shape the way SMEs, which have an awareness of IPRs, think about their utilization. In general, the threat of litigation should not be a tool to extort the vulnerable small firm. SMEs should not be disadvantaged in relation to larger firms because the latter have superior ability to monitor intellectual property rights and to litigate. The court system should, furthermore, be attuned to the special IP concerns of SMEs, and patent attorneys should be available, also for highly complicated (technical) cases. Communication between counsel and technical environments should not be a problem for the judicious rendering of a legal judgement.

The interviews indicated an increase in the number of IPR cases, although no direct evidence of this was found and there was no indication as to what degree the increased litigation involves SMEs. What did emerge, however, is that SMEs are indeed concerned about the risk of larger, especially international, firms pirating their ideas in relation to whether they are covered by IPRs. Another concern involved the risk that SMEs become involved in infringement cases.

It was noted by some interviewees that an insurance litigation scheme that would help fund enforcement and litigation costs for SMEs would reduce the risk of stronger entities victimizing weaker ones. Such a plan is currently being discussed in the European system. However, it was emphasized that in the design of such a plan great care should be taken to ensure that it works properly. Alternatively, a certification system already under discussion was also recommended as a method to discourage unethical use of the IPR system.

Finally, there was concern about what can happen abroad. The fact that there is limited awareness in Norway is compounded when an enterprise looks abroad. However, the interviewees noted that internationally-oriented SMEs tend to be those which know most about the IPR system. Ideally, SMEs would have access to and advice concerning the systems in other countries, as well as information about emerging IPR issues, and on relevant matters concerning patents, trademarks and other IPRs in force in other countries.

f. Information about patent, trademark and design applications

A more fundamental part of the IPR system that can help SMEs to avoid infringing existing rights is of course already in place: this is the publication of patents, trademarks and design rights applied for in Norway. As mentioned, however, access to Norwegian databases for patents and trademarks is only now being deployed on the Internet, and has therefore lagged behind countries such as the US where a lot more information is available in full text versions on the Web. The interviews confirm the survey-based information that, at this point, SMEs do not know about patent databases and do not know how to use such databases by themselves. SMEs can, however, obtain different types of information services from patent agents and the Norwegian Patent Office.

CHAPTER 10:
FINAL RECOMMENDATIONS

In this final chapter we present a list of recommendations designed to address how Norwegian SMEs might be better assisted by the intellectual property system. The recommendations have been suggested by the interviews as well as by observations from the empirical work with the patent and trademark databases, and the literature.

This study of the inter-relationship between SMEs and the IPR system in Norway suggests, at this stage, three general areas for initiatives. Specifically, we recommend measures designed to:

1. improve awareness and knowledge of the inter-relationship between SMEs and the IPR system
2. address general "attitudes" toward, and knowledge about, intellectual property rights in Norway
3. improve the operating form and function of the IPR system as a whole.

In this section, we present a total of 12 areas where the Norwegian IPR system would benefit from increased attention.

1. Measures to improve knowledge of the inter-relationship between SMEs and the IPR system.

1.1. Recommendation to extend the analytical basis of this study to other countries

The study indicated that one of the fundamental stumbling blocks in addressing how SMEs may be better assisted by the intellectual property system is the lack of reliable and suitably detailed information about how SMEs use different IPRs in different IPR systems. We showed that patent data dominate the analytical basis for the "IPR studies" and that these studies are limited to individual countries. We know very little about the practical uses of other rights such as industrial designs, copyright and trademarks, and we know very little about the situation in the vast majority of countries. Further, we noted that the specific use of intellectual property rights should be related to the specific institutional set-up of the IPR system in a given country, as these differ considerably from country to country.

In view of this, we recommend that the type of pilot study undertaken here should be extended to other WIPO member States. At this stage, studies that map the IPR systems of individual countries, explore how the concerns about their small and medium-sized enterprises are addressed by those systems, and investigate how SMEs in those countries approach and utilize the systems are seen as the best way forward. In order to ensure a reasonable degree of continuity and comparability, such studies should be coordinated, for example, by WIPO.

1.2. Recommendation to improve the analysis of IPR questions in Norway

There is a notable lack of research in Norway on intellectual property rights and their strategic importance in the innovation system. The Norwegian government has highlighted the innovation-policy importance of intellectual property rights (cf. the 1995 Conference discussed above). In addition, the Norwegian government has also emphasized the importance of SMEs to the Norwegian economy. What is lacking is a sustained focus on these areas in the form of:

- a high-level policy discussion of the (changing) strategic dimensions of intellectual property (see below);
- initiatives that promote increased study in this area.

The present study, provides a rich basis on which to pursue further research. We recommend that a strategy should be drawn up to follow up the work that has been started here. Relevant funding organizations include the Research Council as well as individual ministries. We suggest that the following areas be taken into consideration in this work:

- I. How can the existing data be used in other analysis?
- II. How can we assess the challenges and opportunities implicit in the IPR system in a changing competitive situation?
- III. How can we study IPR management in Norway compared with other countries?
- IV. How can we study the (lack of) IP strategies of SMEs in different branches?
- V. What are other countries such as Germany and the UK doing to meet the IPR needs and concerns of SMEs?
- VI. How can we evaluate the implications of the increased importance of the knowledge component for IP strategies?

1.3. Recommendation to improve Norwegian IPR databases

One area that can be focused on independently is the question of how empirical information sources — such as databases — might be extended and improved. A major problem that this study encountered in analyzing patent and trademark data was the inconsistency of the identifier of the patent/or trademark applicant. Since all Norwegian firms have a unique number which they use in other areas of contact with public administration (for purposes of taxation, census counts, etc.), this same identifier should be supplied by the applicant for a patent, trademark or industrial design application. This will help not least the Norwegian Patent Office to keep more effective registers of its rights, for example by helping it to verify whether the applicant is an SME (since SMEs are given a discount), and by removing the duplicates inherent in its existing system. In turn, using this number would also help the Norwegian Patent Office to better understand its applicants, for example, in its ongoing regional campaign to assist SMEs.

There are signs that the organization number will be introduced into the application with the digital application process at the Norwegian Patent Office (the SANT system). The system should use the firm-level key (or *bedriftsnr*) and attempts should be made to associate the same identifiers to applications that are under examination or that have been granted/registered. This job should be carried out by the Norwegian Patent Office (possibly with assistance from Statskonsult), but facilitated by the Ministry of Trade and Industry.

2. Recommendations involving general 'attitudes' toward, and knowledge of, intellectual property rights in Norway

2.1. Measures to improve the visibility of IPR questions in the policy arena

It is worth reiterating that the increasing strategic importance of IPRs is emphasized both in the economics-oriented literature and in policy-oriented literature. In each, increased attention to policy is prescribed. In Norway, a discussion of the importance of intellectual property rights in the context of the national innovation policy was indeed initiated in 1995 (see above) but that initiative died shortly thereafter, and the area has since faded from the policy agenda. Today there seems to be a lack of a visible, coherent policy discussion about industrial property and the strategic role of intangible assets in Norway in enhancing competitiveness. This has a generally negative effect on awareness and knowledge throughout the system.

A vitalization of the national discussion of IPR issues and the development of a more unified policy on questions that involve the strategic use of intellectual property rights would have several advantages. In addition to the direct effect of priming operative policies on specific issues, a visible and vital policy discussion would invigorate awareness of IP issues not least among small and medium-sized enterprises. Further, it would also serve to heighten awareness of the IPR system within the wider innovation system. A dedicated high-level discussion would also help to deepen the understanding of the IPR system both in institutions and enterprises. Indeed, one should not expect IP awareness and knowledge to flourish in companies and institutions if it is silent or, at best, fragmented and split within the government.

There are, furthermore, several current developments that would benefit from a consolidated IPR-policy discussion. For example, the recent launch of two venture-type funds involving substantial private participation further raises the question about how the public sector addresses intellectual property rights. A more visible discussion would help orient the way IPRs are thought about in the IPR system. In addition, current policy initiatives — not least, measures related to the status of employees' invention at academic institutions — would benefit from a larger policy discussion of strategic aspects of intellectual property rights. It would make these issues easier to discuss and it would lend them perspective.

We therefore recommend the elaboration of a strategy at the ministerial level (Ministry of Trade and Industry) designed to focus policy attention on the strategic use of IPRs in the economy.

2.2. Measures to promote the coverage of intellectual property matters in the national education system.

Another long-term initiative suggested by the study is to integrate IPR issues more actively into the national education system. Many interviewees pointed out that IPR issues are isolated to parts of the legal education, but that they should be encouraged as a part of technical and management education as well. It is important that inventors and entrepreneurs are confronted by the system for the first time when they are involved in the hectic process of project implementation. Tomorrow's inventors and entrepreneurs should learn about relevant aspects of the IPR system and its uses during their formal education.

We suggest that a balanced exposure to the IPR system within the existing education framework is, in the long term, the best way to promote more sophisticated use of the system. The study therefore encourages initiatives already under way to study and implement the best ways of accomplishing this.

2.3. Recommendation to monitor and nourish outreach activities of the Norwegian Patent Office

The Norwegian Patent Office has, together with the Ministry of Industry, initiated outreach activities targeting SMEs. The spearhead of this effort is (again) the campaign directed at SMEs in the districts, which includes detailed information-gathering, tailored awareness-raising seminars and proactive visits to SMEs. It is further supported by the general advice to applicants about (the Infocenter), courses directed toward SMEs, Norwegian Patent Office participation in business fairs and other promotional activities, together with its information resources on the Internet, which are currently under development.

A proper evaluation of this activity is of course not possible in the framework of this study. However, the interviews indicate — and the general impression is — that the outreach activities are moving in the right direction but are not fully in place. We recommend that this work should be systematically followed up (a job for the Ministry, which has a commitment to ensure long-term funding) and developed over time (a job for the Norwegian Patent Office) in line with apparent needs. The experience of other countries might also be monitored with help from WIPO in order to ensure the use of best practices on this front.

3. Recommendations targeting the operating form and function of the IPR system as a whole

3.1. Measures to promote greater practical knowledge of the IPR system among SMEs

The database work done here indicates that a considerable number of smaller entities already use the patent and trademark systems. In addition, the interviews indicate that awareness of the patent system may be increasing. At the same time, the database work raises the question (via high withdrawal rates) of how skillfully SMEs use the system. The interviews also indicated that a subpopulation of smaller entities (especially independent agents) might in fact be using the patent system somewhat indiscriminately. But how do you increase firm-level knowledge of the strategic uses of intellectual property rights as a part of a commercialization strategy in the short term?

There is no easy answer to this complex question, but obviously it involves the ability of the support system to aid the SMEs in question. Interviews within the IPR system did not point to obvious flaws in the current system. A small minority posed the question whether SMEs receive the best possible support from the IPR system, while many indicated the scope for improvement. These involve a general boot-strapping of IP knowledge plus the encouragement of uniformity of advice throughout the system. The brief assessment of the system undertaken here does not suggest obvious, comprehensive measures to address this scope for improvement beyond the specific measures noted.

What does emerge is the importance of independent inventors in the Norwegian system. As noted, there is a support structure that addresses this population (the National Advisory Office for Inventors). In addition, there is an interest organization (Now Association of Sole Proprietorships). The study noted that the level of IP competence in the SVO support system appears to be very high, but that it is in fact very small. The apparent discrepancy in the Norwegian IPR system, between the large number of independent inventors that apparently (mis) use the system and the tiny but very competent apparatus that caters for this population, suggests that this is an area for improvement.

We therefore suggest that this apparent scope for improvement should be studied more closely by relevant institutions in the IPR system (e.g., Ministry of Trade and Industry), and that specific recommendations for improvements be evaluated.

3.2. Initiatives to improve the IPR policy and strategies of central institutions of the support structure.

Similarly, the study encountered several indications that the overall workings of the IPR system in Norway could be improved. The 1995 Conference suggested that the support-services of the IPR system are characterized by a collective lack of coordination. However, system-wide coordination does not seem to most of the interviewees to be an overriding problem today, although a greater degree of coordination was seen as desirable by some. One concern, however, was whether the smallest players actually find their way to the IP-support system in the first place.

We recommend exploring initiatives that will encourage greater exchange of experiences and know-how across institutions of the IPR system. Several interviewees suggested that a forum that would bring actors in the different institutions together to discuss experiences and concerns about IPR issues would be helpful.

A more pronounced concern was the need to promote more consistent IPR policies in key institutions of the support system. We noted that within the different institutions and between them, different "cultures" or attitudes prevail on the subject of IPRs. These seem potentially divisive and serve to undermine the legitimacy and unity of the system as a whole. This was pointed out and observed especially in the case of the Research Council, where the lack of formal IPR expertise and of a formal IPR policy at the institutional level, in combination with the incidence of conflicting views about IPRs, underlines the need to articulate a self-consistent IPR strategy here. In the other advisory and financing agents such as the SND, there were concerns that attitudes and levels of IPR expertise of individual case-workers might affect the quality of advice SMEs receive. These can have serious consequences for SMEs, such as promoting patent applications at too early a stage.

We recommend that greater attention be directed to IPR issues by the central institutions of the support structure, especially the Research Council. We recommend that the institutions themselves (perhaps with the support of the Department of Trade and Industry) explore ways of improving IPR policies and strategies.

3.3. Measures to improve IPR system awareness among SMEs

The improvement of awareness of the IPR system among SMEs is of course a prerequisite to improving the level of knowledge and ultimately their skill in using the system. The outreach activities already undertaken by the Norwegian Patent Office are important here, and these should be sustained and pursued across the country. It is important that the focus of these activities should encompass the full range of intellectual property rights and not just patents. This work, combined with making IPR issues more visible on the political agenda and integrating IPR issues more actively into relevant educational frameworks, should help improve not only awareness but also practical knowledge of the IPR system.

3.4. Initiatives targeting use of design rights

The area of industrial designs is unfortunately not addressed by the database work in this study, and it is only picked up in a small minority of the interviews. In these, it was indicated that awareness of designs as a competitive factor was low in general and that, apart from specialized environments, the awareness and use of design rights is therefore also low.

Several factors suggest that industrial design rights are an area where Norwegian attention should be turned. In general, there is the general topicality of design for small enterprises. Industrial designs can offer small enterprises niche markets not least in industries that are strong in Norway, for example the furniture industry. Further, industrial design is also an area where recent regulatory changes have been made in Norway and, thirdly, it is an area that has attracted recent policy interest.

It is therefore suggested that initiatives to target awareness and use of design rights should be considered within the framework of the present policy focus. The feasibility of a study using design applications from the databases of the Norwegian Patent Office should be evaluated in this context.

3.5. Certification of patent agents

The study revealed that patent agents operating in Norway are not subject to authorization or other certification system, as in the US for example (although it is widely criticized). In the majority of interviews, this was not noted as a disadvantage for SMEs, and indeed interviews with patent agents from three agencies showed perhaps the most sophisticated knowledge of the system, as should be expected.

However, a current case involving an independent inventor demonstrates the potential for problems to which SMEs are especially vulnerable. As noted above, newspaper reports indicate that the inventor in question became the victim of bad advice in his patent applications, and that his personal investment was allegedly lost. Through the article's presentation, the case presents the whole patent system in a bad light.

This study recommends that different approaches which address this issue be evaluated together with the relevant parts of the IPR system (Ministries and the Norwegian Patent Office).

3.6. Measures to improve SME security in litigation cases

There are several signs that the greatest potential weakness of SMEs in terms of the IPR system is their ability to enforce and litigate their rights vis-à-vis stronger entities. This concern strikes at the underlying motive for an SME to patent: lacking the certainty that its patent can in practice be enforced means that it becomes counterproductive for the SME to apply for protection. The signals come from the literature, the interviews, and also from anecdotal evidence.

There was, however, limited evidence that these threats are currently shaping the way Norwegian SMEs approach the IPR system. There are, apparently, no cases before the courts that illustrate this nor are there wide-scale, substantiated stories of either of these things happening. However, there is every sign that this is a fear — substantiated or not — that does shape the way Norwegian SMEs approach the system.

This is supported by interviews on the question of why SMEs consciously opt not to seek patent protection. The literature also indicates that SMEs may prefer trade secrets to patenting for this reason. Ergo, the fear of getting dragged into legal battles with larger, stronger competitors tends to condition how many SMEs approach the system both in Norway and abroad.

How can this concern be addressed? How can the trust of SMEs in the IPR system be supported? Several countries including the USA (where the cost of litigation is especially high) have introduced patent litigation insurance schemes, while others including Denmark, and indeed the EU Commission, are studying the question. Based on some form of premium payment (for example, part of the patent application fee), patent insurance schemes provide support for applicants, should they become involved in litigation in order to enforce their rights. The schemes deter stronger actors from indiscriminately infringing patents of a weaker player, owing to the fact that, with the insurance scheme behind him, his enforcement capabilities become more credible.

There are many delicate questions to be dealt with in designing such a system, including the questions of who can qualify, how the scheme is to be funded and, of course, how it should work. **This study recommends that a patent litigation insurance scheme for the Norwegian or Nordic area should be evaluated. In train with this evaluation, existing measures (such as the US insurance scheme) should be studied as well as following how**

this is being studied in other fora, especially in the EU.⁹¹ In addition, alternative or supplementary measures should be studied to safeguard SMEs against misuse of the IPR system, for example to withstand bogus infringement cases.

3.7. Measures to activate idle patents and design rights

One apparent concern in the Norwegian context is that Norwegian inventions protected by patents or design rights never find a market and die out. There appear to be many small and medium-sized enterprises or individual inventors that lack the wherewithal to develop the idea themselves. Many of these apparently also fail to find a partner in the Norwegian system (through a licensing scheme) in order to develop the idea, even if they utilize the advisory infrastructure in Norway. This infrastructure is designed first and foremost to help the applicant develop the idea to the point of commercialization. The technology transfer units associated with universities do try to attract potential licensees to ideas developed by academic researchers. Notwithstanding, there remains the question of whether a significant number of idle patents from companies and universities could be better linked to partners or licensees domestically or internationally. SMEs obviously come up short here and the IPR system does not seem to address this issue squarely.

This is an activity which is well developed in other countries. In the US, there are many IPR management organizations that buy up idle IPRs and try to capitalize on them. In some cases, this means that the IPR management company tries to extract royalties from the patents, domestically and abroad, simply (and in some cases, indiscriminately) by threatening lawsuits. This sort of development is obviously not to be repeated in Norway, even though the conditions probably do not exist for this type of operation here. A more interesting opportunity to be considered is a State-run organization whose job it is to find partners or licensees both within the county and outside. In Japan, the publicly-run Japan Technomark Foundation (JTF) has, since 1997, attempted to find partners for patent holders.

We suggest that this function should be evaluated by the institutions of the Norwegian IPR system, specifically by the Norwegian Ministry of Trade and Industry. This recommendation requires careful consideration since, if exercised incorrectly, it has the scope to undermine its intention to help SMEs. With regard to finding partners for patent holders internationally, a natural operator would be the Norwegian Trade Council with its offices across the world.

3.8. Recommendation to evaluate the inclusion of petty-rights/utility patents

The study reinforces earlier observations that the general legal basis for the IPR system in Norway is solid and up-to-date. However, petty-patents/utility patents are not a part of the set of rights available in Norway. Should they be? These are clearly rights aimed at SMEs. Only a couple of interviewees wondered whether a type of "in-between right" is needed in Norway. Other interviewees indicated that the value of these rights might be dubious for the SME. On the other hand, the patent databases did indicate that there is a large proportion of withdrawals among the smaller applicants. This might indicate a need for a different type of right. It might, however, merely indicate that better knowledge is needed at the firm-level concerning how best to use existing rights. Another argument for petty-patents is their lower cost. However, the reduction in patent fees may well have addressed this concern of small entities. Something else that raises the topicality of petty-patents is the experience in other countries, especially the ongoing discussions in some countries regarding their introduction. Is this a topic for the Norwegian case? Are the considerable costs that the incorporation of a new right implies justified in terms of putative advantages for SMEs?

In short, further study is required to determine whether there is indeed a national need. **We recommend a preliminary study of the situation in other countries that already have the right (Danish 'bruksmodeler') or are considering introducing this type of instrument, specifically in the EPC countries.**

91 [cf. http://europa.eu.int/comm/internal_market/en/intprop/indprop/litigation.htm](http://europa.eu.int/comm/internal_market/en/intprop/indprop/litigation.htm)

3.9. Recommendation to evaluate the University-Industry link

There are several issues involving traditionally “academic” research that are currently raising questions about the IPR system in Norway. On the one hand, initiatives aimed at promoting biotechnology, which is traditionally an academic area of research, raise questions about the present IPR system and its use. On the other, the present re-evaluation of the status of employees’ inventions at academic institutions raises more directly the question of how researchers that traditionally have not used the IPR system could be better assisted as they are encouraged to do so.

We therefore recommend the evaluation of the IPR system to identify new needs or concerns more closely. Questions that should be evaluated include whether new structures such as transfer offices are needed in universities, or whether the existing apparatus at research parks are sufficient. How are these questions being dealt with in other comparable countries?

CONCLUDING OBSERVATIONS

In rounding off this study, it is worthwhile looking forward and outward. This chapter stands as a bookend to remind the reader of the fundamental basis for the IPR system, and to present some of the activities under way internationally that involve the interrelationship between SMEs and IPRs.

1. General observations

It is worth noting again that a general assessment of the nation-wide IPR system will raise fundamental questions. It is therefore important that the observer has some of the complicated trade-offs involved very much in mind while digesting this report. To that end, we rehearse some of the main concerns here.

One quandary that a general assessment of a national IPR system must confront is: how much IPR protection is “optimal”? The question is essentially a moot point, an inherently complex question, and in practice there is no single answer. Its answer will involve a clash between what is best for the economy as a whole and what is best for the individual; as well as what is best in the short and what is best in the long term. There are, however, constraints and guidelines already in place. All these issues, however, are to be looked at in the context of the leeway available in designing the national IPR system which must conform to various international obligations that flow from Norway’s membership of WIPO and WTO Treaties, and which must, at the same time, look at “best practices” in other comparable countries.

For the economy as a whole, there is a set of basic tradeoffs to consider:

- On the one hand, IPR-protection brings with it social costs in the form of higher prices (monopoly pricing): on the other, IPRs provide the economy with an incentive to innovate (based precisely on the prospects for an innovative firm for monopoly pricing).
- Another trade-off that is fundamental to the patent system especially is the one between the grant of a limited monopoly to exercise one’s invention and the disclosure of full information about the patented invention. This disclosure of information allows subsequent innovators to build on or close to earlier inventions.
- The monopoly profits provided by IPRs may have additional advantages for the economy as a whole if it is ploughed back into higher levels of production and innovation.

The question of what is *optimal* for the IPR system as a whole therefore stands in a certain state of tension with what can be deemed “optimal” for the specific firm. It is important that this tension should be appreciated by the observer. In this light, some guiding observations should direct the assessment of the interrelationship between SMEs and the IPR system. Several are asked here:

- A fundamental but working assessment of the implicit trade-offs existing in the IPR system should (continue to) lay the basis for public policy in this area.
- Decision-makers in SMEs and relevant positions in the IPR system should operate with an assessment of the full range of IPRs, including Trade Secrets. The surveys noted above suggest that secrecy is a preferred strategy for many firms, especially those involved in process innovations. The IPR system should be mindful of this and encourage the best method or methods for the individual firm to capitalize on its innovation.
- The national IPR system should work from an assessment that the relationship between intellectual property rights and SMEs needs to be geared to the competitive situation of the firms. Low intensity competitive situations, in general, suggest low intensity utilization of active IP strategies. Areas where the competitive environment is dynamic suggests more dynamic use. It is therefore not impossible that the traditionally modest levels of IPR use in Norway have reflected the competitive realities of its markets.
- However, decision-makers in SMEs and relevant positions in the IPR system should also be aware that all competitive situations are subject to change. Considering the changes in the “big picture” noted in chapter 1, both are better off being proactive than caught off-guard.

2. Recent foreign policy discussions

The concern that the competitive situation is indeed changing; that intangible assets are in fact of increasing importance to the economy; and that the formation of the IP-system and its use (not least by SMEs) are increasingly important have recently spawned a number of initiatives internationally. At one level, there has been a surge of policy documents calling attention to the strategic importance of intellectual property rights, not least in the international environments of the OECD and the EU. We will consider some aspects of this general discussion below.

In this arena, the particular concerns of SMEs have not yet been central to this surge in policy activity. However, WIPO has started to do something about this and promises to play a leading role in focussing attention on these concerns. In many ways, WIPO provides the natural atmosphere to focus on the specific issues concerned. Its potential here is primarily based on its unique position as the mainstay of international coordination of IPRs through its administration of treaties (not least its administration of the PCT system). Furthermore, WIPO's broad membership of (at present) 179 countries means that it is well positioned to inform and help coordinate a broad policy discussion on this front.

In order to develop its potential here, WIPO has set up a special SME Division which is designed to address the special issues and concerns intrinsic to this area. The SME Division has played a central role in a series of fact-finding and analytical studies of this area, including financing the present study. It has also launched a "panoramic" website (<http://www.wipo.org/sme/en/index.html>) to cater for the wider needs of the member countries. This website is designed to "provide an overview of the type of assistance WIPO offers for promoting the use of the IPR system by SMEs, including information on past and forthcoming events as well as other useful data and reference material."

Furthermore, WIPO has begun to coordinate initiatives that address particular issues related to SMEs. A major initiative on this front was the Milan Forum on Intellectual Property for SMEs, from which the Milan Plan of Action emerged. This Plan of Action incorporates a nine point-plan in order "to empower SMEs to benefit fully from the IPR system." (http://www.wipo.org/eng/meetings/2001/ip_milan/ip_mil01_5.htm) The nascent activities of WIPO could well be used to inform the discussions that have begun to emerge in policy environments.

2.1. Aspects of the general international policy discussion

In this last section, we survey some of the issues emerging in policy discussions more broadly. A quick glance is provided by the recent European Trend Chart on Innovation & IPR (2000). It reflects several of the policy-level currents in this area and makes special reference to SMEs. In addition, this trend chart also reflects a degree of enthusiasm for so-called "new trends" that should be treated with caution by decision-makers contemplating the question of how to adapt their IPR systems.

For 2000, the Trend Chart emphasizes seven general "trends" in the policy theater:

1. "Increasing awareness that IPRs are essential to a successful and competitive economy;
2. the strengthening of IPRs as a means of generating innovation;
3. the international harmonization of IP legislation;
4. the introduction of new technologies and the need to include them within IP frameworks;
5. the importance of public sector institutions in generating intellectual property and the need to revise rules governing ownership;
6. the changing roles and functions of national patent offices;
7. specific public measures to assist companies (especially SMEs) in acquiring IPRs (sic!)."⁹²

This list draws attention to some of the trends we have pointed to, in addition to certain "trends" we find potentially fallacious. The important signal to the Norwegian system is primarily that policymakers in Europe and elsewhere have begun to approach IPRs as "an integral part of the competitive economy." It is helpful in addition to note that special attention has been directed to SMEs in this context.

92 <http://trendchart.cordis.lu/>

One of the conclusions of the study is that IPR issues do not have a real presence in the Norwegian policy environment. The general impression is that Norway, in contrast to its neighbours (especially Sweden), has not been especially active in studying this question.

However, as decision-makers start to approach IPRs in this light, they should be careful to filter out the hype. One thing that can be detrimental to a country's careful consideration of the issues related to IPRs, competition and SMEs is the uncritical acceptance of overoptimistic and unsupported conclusions about what IPRs can do. Norwegian SMEs are certainly not less skeptical than most about what IPRs can and cannot achieve. In fact, a popular perception is that Norwegians are culturally averse to patenting, although our study indicates that this may be changing. Undocumented rhetoric that uncritically heralds a "pro-patenting" era will therefore meet the skeptical attitude that is established in Norway and perhaps reinforce it. This study emphasizes that a balanced and informed discussion is needed. One of its roles is therefore to help provide both the conceptual framework and the empirical basis to approach the question.

The EU policy document quoted here is helpful insofar it provides a snapshot of what is happening in different countries. However, the way it jumps from cataloguing this information to defining current "trends" and "measures" should be treated with considerable caution. One should for example be wary when the policy documents create the impression that "strengthening of IPRs" is a trend that in general leads to the increased "generation of innovation." This is potentially a dangerous impression to perpetuate. It is certainly not supported either by the literature or by past experience in any general way. In order to put such questions into perspective, our study emphasizes the importance of consulting what the literature can teach us about such questions.

The experience of others also needs to be built upon. In today's environment, many are inclined to look at the experiences of the US which has made certain changes to its IPR system, particularly since the mid-80s. At the same time, it has enjoyed high levels of growth both in new technologies and more generally. Few would claim that this economic growth is a direct outcome of the changes in the IPR system in the US and of the "pro-patent" era more generally. Many nonetheless are inclined to associate the two in some way, and conclude that such changes should be exported to other countries. Such conclusions are potentially perilous.

There are many things to consider before one jumps to such conclusions. For example, the general validity of the claims should be assessed: what do we know about the effect that the changes in the IPR system have had on patenting behavior? What is the relationship between the documented increase in patenting in the US and innovation in general? A deeper point involves the transferability of measures from one context to another. How would the measures in the US play out in a European context or indeed in a Norwegian one? It is not recommended that policies be lifted from other policy contexts and used in the Norwegian context without careful consideration. Our study has emphasized that an understanding of the domestic system, both the IPR system in a broad sense and SMEs, is a first step to understanding how to improve that system.

SELECTED LITERATURE

- A. Le Bars, V. Mangematin, L. Nesta (1998), INNOVATION IN SMES: THE MISSING LINK. INRA/SERD Université Pierre Mendès France.
- Acs, Zoltan J. and David B. Audretsch (1988), Innovation in large and small firms: an empirical analysis A 678 - 690 *The American Economic Review* 78 September 4, 1988.
- Acs, Zoltan J. and David B. Audretsch (1987), Innovation, market structure, and firm size A 567 - 574 *The Review of Economics and Statistics* LXIX November 4, 1987.
- Agawal, R. and David B. Audretsch (2000), Does entry size matter? The impact of the life cycle and technology on firm survival. Forthcoming in the *Journal of Industrial Economics*.
- Albaladejo, Manuel and Henny Romijn (2000), Determinants of innovation capability in small UK firms: an empirical analysis, Working Paper 00.13, Eindhoven Centre for Innovation Studies, the Netherlands.
- Archibugi, D., R. Evangelista and R. Simonetti (1993), Concentration, firm size, and innovation. Evidence from innovation costs A 293 - 305 *Rivista internazionale di Scienze sociali* 3 1993 X.
- Archibugi, Daniele and Mario Pianta (1992), Specialization and size of technological activities in industrial countries: the analysis of patent data *Research Policy* 21: 79 – 93.
- Archibugi, Daniele, Sergio Cesaratto and Giorgio Sirilli (1986), Firm size and sources of innovation: an analysis of the Italian survey on innovation diffusion P 1 - 11 *OECD Workshop on Innovation Statistics*, Paris, December 8-9, 1986.
- Arrow, Kenneth J. (2000), Preface: Edwin Mansfield's research on technology and innovation, *International Journal of Technology Management*, 19 (1-2), 1-2.
- Arundel, Anthony (2001), The relative effectiveness of patents and secrecy for appropriation, *Research Policy*, 30, 611-624.
- Arundel, A. and E. Steinmueller (1998), the use of patent databases by European small and medium-sized enterprises, *Strategic Analysis & Strategic Management*, 10 (2), 157-173.
- Arundel, A. and E. Steinmueller (1998), the use of patent databases by European SMEs, *Technology Analysis and Strategic Management*, forthcoming.
- Arundel, Anthony (2001), "Patents - the Viagra of innovation policy?" Internal report to the Expert Group MERIT prepared as part of the project "Innovation Policy in a Knowledge-Based Economy" commissioned by the European Commission.
- Baldwin, J. (1996), The use of intellectual property rights by Canadian manufacturing firms: findings from the innovation survey. AEA 54th Conference, Luxembourg November 28-29, 1996, *Econometrics of Innovation*, 1996.
- Barber, John, Stanley Metcalfe and Mike Porteous (1989), Barriers to growth: the ACARD study in: J. Barber, J. S. Metcalfe, M. Porteous (eds.), *Barriers to growth in small firms* (Small business series), London: Routledge.
- Barth, Henrik and Luis Puerto (1999), Strategy, structure and technology as influential factors on performance in SME's, AR 1999:37, Paper presented at the 29th European Small Business seminar, September 15-17, Lisbon, Portugal.
- Beije, Paul R. And Huub W. Buise (1990), Innovation policy for small and medium-sized enterprises - cost approach or network approach? B 229 - 242 In: *Consulting in innovation: practice, methods, perspectives - International Conference*, Berlin September 28–29, 1989.
- Bessen, James and Eric Maskin (2000), Sequential innovation, patents, and imitation, Working Paper No. 00-01, Department of Economics, Massachusetts Institute of Technology (MIT), Cambridge, Mass.
- Bhagat, Sanjai, Brickley, James A. and Coles, Jeffrey L. (1994), "The Costs of Inefficient Bargaining and Financial Distress: Evidence from Corporate Lawsuits," *Journal of Financial Economics*. 35, 221-47.

- Bosworth, Derek, Christine Greenhalgh, Peter Hayward and Mark Longland (1996), Opening the Black Box: company performance and the valuation of intellectual property, Revised version of a paper presented at the Economics and Econometrics of Innovation Conference, Strasbourg, June 3-5, 1996.
- Brouwer, Erik and Alfred Kleinknecht (1999), Innovative output and a firm's propensity to patent - An exploration of CIS micro data, *Research Policy*, 28, 615-624.
- Calvert, Ian A. and Michael Sofocleous (1992), "Interference Statistics for Fiscal Years 1989 to 1991," *Journal of the Patent and Trademark Office Society*, 74, 822-26.
- Carlsson, B. and R. Stankiewicz (1991), On the nature, function and composition of technological systems, *Journal of Evolutionary Economics*, 1, 93-118.
- Carroll, Glenn R. and Michael T. Hannan (2001), *The Demography of Corporations and Industries*, Princeton Univ. Press 2000.
- Chabbal, Robert. Characteristics of innovation policies, namely for SME's, *OECD, STI* 16.
- Cheung, Steven N.S. (1982), "Property Rights in Trade Secrets," *Economic Inquiry*. 20, 40-53.
- Chu, Michael P. (1992), "An Antitrust Solution to the New Wave of Predatory Patent Infringement Litigation," *William and Mary Law Review*. 33, 1341-68.
- Cohen, WM, RC Levin and DC Mowery (1987), "Firm size and research-and-development intensity: a re-examination." *Journal of Industrial Economics* 35: (4) 543-565.
- Cohen, Wesley M. and Steven Klepper (1996), A reprise of size and R&D, *The Economic Journal*, 106 (July), 925-951.
- Cohen, Wesley M., Richard R. Nelson and John P. Walsh (2000), Protecting their intellectual assets: appropriability conditions and why U.S. manufacturing firms patent (or not), NBER Working Paper No. 7552, National Bureau of Economic Research, Cambridge, MA.
- Cohen, W.M. & Klepper, S. (1990), Firm size versus diversity in the achievement of technical advance. In Z. Acs & D. Audretsch (Eds.), *Innovation and Technical Change*. Ann Arbor, MI: University of Michigan Press.
- Cohen, Wesley M. and Steven Klepper (1992), the Tradeoff between Firm Size and Diversity in the Pursuit of Technological Progress A 1-14 *Small Business Economics* 4 1992.
- Cordes, J.J., Henry R. Hertzfeld, Nicholas S. Vonortas (1999), *Survey of High Technology Firms*. US Small Business Administration, Office of Advocacy.
- Crépon, Bruno, Emmanuel Duguet and Jacques Mairesse (1998), NBER Working Paper 6696, National Bureau of Economic Research, Cambridge, MA.
- Da Motta e Albuquerque, Eduardo (2000), Domestic patents and developing countries: arguments for their study and data from Brazil (1980-1995), *Research Policy* (29) 9 (2000), pp. 1047-1060.
- Dahl, Michael S. and Toke Reichstein (2000), Sectoral patterns of firm growth – An empirical study, Draft to be presented at DRUID Summer 2000 Conference, Rebild, Denmark, June 15-17.
- Deiaco, Enrico (1993), Profit from Innovation: A comparison of Swedish and Japanese Intellectual Property Management. Presented at OECD Workshop on Innovation, Patents and Technological Strategies.
- Dijk, Machiel van and B. Verspagen (1996), Dynamics of entry and growth in Netherlands: small and medium-sized enterprises. An overview of relevant aspects. *Research Memoranda*. Maastricht : MERIT, Maastricht Economic Research Institute on Innovation and Technology.
- Dijk, Theon van (1994), the economic theory of patents: a survey, MERIT Research Memorandum 2/94-017, University of Limburg, Maastricht, the Netherlands.
- Dijk, Theon van (1994), Patent height and competition in product improvements, MERIT Research Memorandum 2/94-015, University of Limburg, Maastricht, the Netherlands.
- Edquist, Charles (ed.) (1997), *Systems of innovation: Technologies, institutions and organizations*. London: Pinter.

- Ernst, Holger (2001), Patent applications and subsequent changes of performance: evidence from time-series cross-section analyses on the firm level, *Research Policy*, 30, 143-157.
- Martínez-Ros, Ester and José M. Labeaga. The relationship between firm size and innovation activity: a double decision approach and an application to Spanish manufacturing firms.
- Evangelista, Rinaldo, Daniele Archibugi, Roberto Simonetti. Innovation and firm size: new evidence supporting the Neo-Schumpeterian hypothesis M 8 X.
- Felder, Johannes, Georg Licht, Eric Nerlinger and Harald Stahl (1995), Appropriability, opportunity, firm size and innovation activities - Empirical results using East and West German firm level data P 27 + vedl. ZEW Discussion Paper No. 95.
- Feldman, Maryann (1997), Small firm innovative success: external resources and barriers, the Small Business Research Summary, No. 182, U.S. Small Business Administration, Office of Advocacy.
- Friedman, David D., William M. Landes, and Richard A. Posner (1991), "Some Economics of Trade Secret Law," *Journal of Economic Perspectives*, 5 (Winter) 61-72.
- Georganta, Z., A. Hatziparadissis, P. Panousis (1996), Size and innovation activity. AEA 54th Conference, Luxembourg November 28 - 29, 1996, *Econometrics of Innovation*.
- Glass, Amy Jocelyn and Kamal Saggi (1998), "International Technology Transfer and the Technology Gap," *Journal of Development Economics* 55 (April): 369-398.
- Gold, Bela (1981), Changing perspectives on size, scale, and returns: an interpretative survey A 5 - 33 *Journal of Economic Literature* XIX March 1981.
- Gould, David M. & William C. Gruben (1997), The role of intellectual property rights in economic growth. *Journal of Development Economics* Vol. 48 (2): 323-350.
- Granstrand, Ove (1999), Intellectual capitalism – An overview. <http://129.16.27.14/dept/ime/Publications/NOPEC.pdf>.
- Granstrand, Ove (2000), Corporate management of intellectual property in Japan, *International Journal of Technology Management*, 19 (1-2), 121-147.
- Granstrand, Ove (2000), The economics and management of intellectual property. Edward Elgar Publishing Ltd: Cheltenham, UK.
- Gray, Colin and Naomi Lawless (2000), Innovations in the distance development of SME management skills <http://www1.nks.no/eurodl/shoen/Gray.html>.
- Guinet, Jean (1995), Financing innovation, *The Observer*, No. 194, June/July, 10-16.
- Hall, Bronwyn H. and Rosemarie Ham Ziedonis (1999), The patent paradox revisited: an empirical study of patenting in the US semiconductor industry, 1980-94. NBER Working Paper # W7062.
- Hall, Bronwyn H. and Rosemarie Ham Ziedonis (2000), The surge in patenting by U.S. semiconductor firms: an empirical analysis, STEP Board IPR Conference, Washington, D.C., February 2, 2000.
- Hall, and Weiss (1967), "Firm Size and Profitability." *Review of Economics and Statistics*, August 1967.
- Hanel, P., A. St- Pierre (1996), Direct and indirect effects of R&D activity on the profitability of firms. AEA 54th Conference, Luxembourg November 28 - 29, 1996, *Econometrics of Innovation*, 1996.
- Harabi, N. (1996), Patents in theory and practice: empirical evidence from Switzerland. AEA 54th Conference, Luxembourg November 28 - 29, 1996, *Econometrics of Innovation*.
- Harabi, Najib (1995), Appropriability of technical innovations: An empirical analysis. *Research Policy* Vol. 24 (6), pp. 981-992.
- Harmon, Robert L. (1991), Patents and the Federal Circuit. Washington: Bureau of National Affairs.
- Haug, Robert og Ole Skorge (1994), Patentering i Norge - Økonomisk utvikling, bedriftsstørrelse og lokalisering som forklaring på variasjon i antall patentsøknader i Norge Siviløkonomoppgave 50301 Innvasjon og iverksetting, Bodø Graduate School of Business, May 31, 1994: 136.
- Hauknes, Johan (1999), Technological infrastructures and innovation policies, Literature review for the RISE project, Contract number SOEI-CT98-1115.

- Henrik Barth and Luis Puerto (1999), Strategy, Structure and Technology as Influential Factors on Performance in SMEs 1 AR 1999:37.
- Hicks, Diana, Tony Breitzman, Dominic Olivastro and Kimberly Hamilton (2001), The changing composition of innovative activity in the US – A portrait based on patent analysis, *Research Policy*, 30, 681-703.
- Hoffman, Kurt, Milady Parejo, John Bessant and Lew Perren (1998), Small firms, R&D, technology and innovation in the UK: a literature review, *Technovation*, 18 (1), 39-55.
- Horstmann, Ignatius, Glenn M. Macdonald, and Alan Slivinski (1985), "Patents as Information Transfer Mechanisms: To Patent or (Maybe) Not to Patent," *Journal of Political Economy*. 93, 837-58.
- Hyvarinen, L. (1992), "Innovativeness and its Indicators in Small- and Medium-Sized Industrial Enterprises," *International Small Business Journal*, Vol. 9, No. 1, 65-77.
- IP Patent Statistics http://www.cordis.lu/ipr-helpdesk/en/i_008_en.htm.
- Iversen, Eric (1995), Immaterielle rettigheter og Norsk Næringspolitikk: Et kommentert referat til NOE-konferansen. ('Intellectual property rights and Norwegian Industrial Policy: A critical review of the Dept of Industry Conference') STEP-Working Paper; 1995.
- Iversen, Eric (2000), An excursion into the patent-bibliometrics of Norwegian patenting. *Scientometrics* Vol 49, 1: 63-80.
- Iversen, Eric (1998), 'Hvorfor så få norske patenter?' (4 s) i *Forskningspolitikk* (NIFU), februar 1998. ""('Why are there so few Norwegian Patents?')," published in *Forskningspolitikk* (circulation 10,000).
- Jaffe, Adam B. (2000), the U.S. patent system in transition: policy innovation and the innovation process, *Research Policy*, 29, 531-557.
- Jaffe, Adam B. (1986), Technological opportunity and spillovers of R&D: evidence from firm's' patents, profits and market value, NBER Working Paper No. 1815. National Bureau of Economic Research, Cambridge, MA.
- Jager, Melvin F. (1994), Trade Secrets Law (New York: Clark Boardman Callahan).
- Johnson, Björn and Bengt-Åke Lundvall (2000), Promoting innovation systems as a response to globalizing learning economy, second draft of contribution to the project Local Productive Clusters and Innovations Systems in Brazil: New industrial and technological policies.
- Juma, Calestous (1999), Intellectual property rights and globalization: implications for developing countries, Science, Technology and Innovation, Discussion Paper No 4, Center for International Development, Harvard University, Cambridge, MA.
- Kaminski, Philippe (1996), How can very small technology firms be helped? B 125 - 137 In: Innovation, patents and technological strategies.- Paris: OECD 1996.
- Katrak, H. (1985), "Imported technology, enterprise size and R&D in a newly Industrialising country: The Indian experience," *Oxford Bulletin of Economics and Statistics*, 47, 213-229.
- Kern, Sander (2000), Dutch innovation policies for the networked economy: a new approach?, TNO Strategy, Technology and Policy, Delft, the Netherlands.
- Khan, Arshad M. and Veerachai Manopichetwattana (1989), Models for distinguishing innovative and non-innovative small firms, *Journal of Business Venturing*, 4, 187-196.
- Khan, Arshad M. and Veerachai Manopichetwattana (1989), Innovative and noninnovative small firms: types and characteristics, *Management Science*, 35 (5), 597-606.
- Kitch, Edmund W. (1980), "The Law and Economics of Rights in Valuable Information," *Journal of Legal Studies*. 9, 683-723.
- Kleinknecht, Alfred (1989), Firm size and innovation: observations in Dutch manufacturing industry A 1 - 8 *Small Business Economics*, September 1, 1989.
- Kleinknecht, Alfred, Tom P. Poot and Jeroen O. N. Reijnen (1990), Formal and informal R&D and firm size: survey results from Netherlands M 24. SEO research memorandum nr 9004 June 1990.

- Klitzman, Maurice H. (1984), *Patent Interference: Law and Practice*. New York: Practising Law Institute.
- Knudsen, Svein A. (1996), *Norske oppfinnelser: kreativitet og nyskaping*. Oslo: Universitetsforlaget.
- Koen, Mary S. (1990), *Survey of Small Business Use of Intellectual Property Protection: Report of a Survey Conducted by MO-SCI Corporation for the Small Business Administration*. Rolla, Missouri: MO-SCI Corp.
- Koenig, Gloria K. (1990), *Patent Invalidity: A Statistical and Substantive Analysis*. New York: Clark Boardman.
- Kortum, Samuel and Josh Lerner (1999), *What is behind the recent surge in patenting?*, *Research Policy*, 28, 1-22.
- Kortum, Samuel and Josh Lerner (1998), *"Stronger Protection or Technological Revolution: What is Behind the Recent Surge in Patenting?"*, *Carnegie-Rochester Conference Series on Public Policy*. Forthcoming.
- Kumar, Nagesh and Mohammed Saqib (1996), *"Firm size, opportunities for adaptation, and in-house R&D activity in developing countries: The case of Indian manufacturing,"* *Research Policy*, 25(5), 712-22.
- Lanjouw, Jean O. and Josh Lerner (1997), *the enforcement of intellectual property rights: a survey of the empirical literature*, NBER Working Paper No. 6296, National Bureau of Economic Research, Cambridge, MA.
- Lanjouw, Jean O. (1994), *"Economic Consequences of a Changing Litigation Environment: The Case of Patents,"* National Bureau of Economic Research Working Paper No. 4835. Cambridge: National Bureau of Economic Research.
- Le Bars, A., V. Mangematin and L. Nesta (1998), *Innovation in SMEs: the missing link*, Paper presented at the Sixth Annual International Conference at the University of Twente, the Netherlands: High Technology Small Firms Conference, June 4-5, 1998.
- Lerner, Josh (1994), *"The Importance of Patent Scope: An Empirical Analysis,"* *Rand Journal of Economics*. 25, 319-333.
- Lerner, Josh (1994), *"The Importance of Trade Secrecy: Evidence from Civil Litigation."* Unpublished manuscript. Boston: Harvard University.
- Lerner, Josh (1995), *"Patenting in the Shadow of Competitors,"* *Journal of Law and Economics*. 38, 563-595.
- Lillian Hatling, Sverre Herstad & Arne Isaksen (2000), *SND og distriktsutvikling – rolle, virkemidler og effekter* Step-Report 05/2000.
- Lundvall, Bengt-Åke (1996), *Reflections on how to analyze national systems of innovation*, in: Kuusi, Osmo (ed.), *Innovation systems and competitiveness*, Helsinki: Taloustieto Oy.
- Macpherson, Alan D. (1994), *Industrial innovation among small and medium-sized firms in a declining region A 145 - 163* *Growth and Change* 25, Spring 1994.
- Malerba, Franco and Luigi Orsenigo (1999), *Technological entry, exit and survival: an empirical analysis of patent data*, *Research Policy*, 28, 643-660.
- Mansfield, Edwin (2000), *Intellectual property protection, direct investment and technology transfer: Germany, Japan and the USA*, *International Journal of Technology Management*, 19 (1-2), 3-34.
- Mansfield, Edwin (1969), *Industrial research and development expenditures: determinants and relation to size of firm and inventive output*, in: E. Mansfield, *Industrial research and technological innovation: an econometric analysis*, London: Longmans, Green, 1969.
- Mansfield, Edwin (1968), *Industrial research and development expenditures: determinants and relation to size of firm and inventive output*, in: *Industrial research and technological innovation: an econometric analysis/* Edwin Mansfield.- London: Longmans 1968.
- Maskus, Keith E. (1990), *Normative concerns in international protection of intellectual property rights* A 387 – 409.

- Mazzoleni, Roberto and Richard R. Nelson (1998), *the benefits and costs of strong patent protection: a contribution to current debate*, *Research Policy* 27, 273-284.
- Merges, Robert P. (1992), *Patent Law and Policy*. Charlottesville: Michie Company.
- Metcalfe, J. Stanley (1998), *Evolutionary Economics and Creative Destruction*, London: Routledge.
- Meyer-Krahmer, Frieder, *Policy for small And medium-sized enterprises: Concepts, experience, impact, evaluation*, D upag. Seminar, NTNf - Tirsdag 13. August.
- Miles, Ian, Birgitte Andersen, Mark Boden and Jeremy Howells (2000), *Service production and intellectual property*, *International Journal of Technology Management*, 20 (1-2), 95-115.
- Milgrim, Roger M. (1993), *Milgrim on Trade Secrets* (New York: Matthew Bender).
- Mogee, Mary Ellen (2000), *Foreign patenting behaviour of small and large firms*, *International Journal of Technology Management*, 19, (12), 149-164.
- Mowery, David C. (ed.) (1999), *U.S. Industry in 2000: Studies in Competitive Performance* 424 pages, 6 x 9, 1999.
- Muller, Emmanuel (1999), *There is no fatality ! (or how innovation interactions between KIBS and SMES may modify the development patterns of peripheral regions)* P 33 *Fraunhofer Institute for Systems and Innovation Research - Working Papers, Firms and Region No. R3/1999*, 1999.
- Mytelka, Lynn K. (2000), *Local Systems Of Innovation In A Globalized World Economy*. *Industry and Innovation*, Vol. 7, No. 1, pp. 15-32, June 2000.
- Narula, Rajneesh (2000), *R&D Collaboration by SMEs in ICT industries: opportunities and limitations*, paper presented at the International Workshop on The New Euro-Asia Pacific Partnership and the Role of SMEs, Singapore, November 14- 15, 2000.
- National Competitiveness Council (1999), *Annual Competitiveness Report 1999*.
- Nauwelaers, Claire and René Wintjes (1999), *SME policy and the regional dimension of innovation: towards a new paradigm for innovation policy?*, MERIT, University of Maastricht, the Netherlands.
- Nelson, Richard (1996), *Why do firms differ, and how does it matter?*, in: Richard Nelson, *the sources of economic growth*, Cambridge, Mass.: Harvard University Press.
- Nielsen, A.O. (1998), *A Selection Model of Patenting Firms in Denmark*. <http://ideas.uqam.ca/ideas/data/Papers/fthaascbu98-5.html>.
- OECD, *Economic arguments for protecting intellectual property rights effectively* (1989).
- OECD, *The Measurement Of Scientific And Technological Activities Using Patent Data As Science And Technology Indicators*. Patent Manual. (1994). Ocde/Gd(94)114.
- OECD, *Group of national experts on science and technology indicators* (1994), *Profit from innovation : a comparison of Swedish and Japanese intellectual property management*, Paper No. 25, Workshop: Innovation, Patents and Technological Strategies, Paris, December 8-9 1994.
- OECD, *Working Group on Innovation and Technology Policy* (1998), *National innovation systems: analytical findings*, June 18-19 1998.
- OECD, *Working Group on Innovation and Technology Policy* (2000), *Focus groups on national innovation systems: draft final report – Knowledge markets and innovation systems: nurturing the institutions of innovation*.
- OECD, STI (1999), *Regulatory reform for smaller firms*.
- OECD, (1999), *Regulatory reform for smaller firms*.
- Office of Advocacy. *The Facts about Small Business 1999*. October 2000.
- Office of Economic Research of the U.S. *Small Business Administration's*.
- Ordovery, Janusz A. (1991), *A patent system for both diffusion and exclusion*. A 43 - 60 *Journal of Economic Perspectives* 5 1 Winter 1991.

- Padgett, B. (1996), Intellectual property protection and promotion on a low budget P.P. AEA 54th Conference, Luxembourg November 28 - 29, 1996 - Econometrics of Innovation.
- Penrose, Edith (1995), The economies of size and the economies of growth, in: the theory of growth of the firm, 3rd ed., Oxford: Oxford University Press.
- Rapp, Richard T. and Richard P. Rozek (1990), Benefits and costs of intellectual property protection in developing countries A 74 - 102 Journal of World Trade 24 5.
- Rappert, Brian, Andrew Webster and David Charles (1999), Making sense of diversity and reluctance: academic-industrial relations and intellectual property, Research Policy, 28, 873-890.
- Remøe, Step-working paper A 03 /1999.
- Rizzoni, Alina (1994), Revue d'Économie Industrielle, No 67, 135-155.
- Rothwell, Roy and Mark Dodgson (1992), European technology policy evolution: converge towards SMEs regional technology transfer A 223 - 238 Technovation 12 4.
- Rothwell, Roy and W. Zegveld. Innovation and the Small and Medium-sized Firm Frances Pinter Pub.
- Rutter, Nancy (1993), "The Great Patent Plague," Forbes ASAP, (March 29) 58-66.
- Saviotti, Pier Paolo (1998), On the dynamics of appropriability, of tacit and of codified knowledge, Research Policy, 26, 843-856.
- Scherer, F. M. (1998), The Size Distribution of Profits from Innovation, Annales d'Economie et de Statistique, No. 49/50.
- Schmoch, Ulrich and Thomas Schnöring (1994), Technological strategies of telecommunications equipment manufacturers: a patent analysis, Telecommunications Policy, 18 (5), 397-413.
- Schreyer, Paul (1996), SMEs and employment creation: overview of selected quantitative studies in OECD member countries P 24 OECD, STI Working Papers 1996/4.
- Schwartz, Herbert F. (1988), Patent Law and Practice. Washington: Federal Judicial Center.
- Scotchmer, Suzanne, and Jerry Green (1990), "Novelty and Disclosure in Patent Law," Rand Journal of Economics. 21, 131-46.
- Senker, Jacqueline (1991), The Biotechnology Directorate's programmes for technology transfer in relation to small and medium-sized firms. SPRU Special Report February 1991 X.
- Siddharthan, N. S. (1988), "In-house R&D, imported technology and firm size: lessons from Indian experience," Developing Economies, 26, 212-221.
- Simpson, Margaret Jean (1991), Valuation of Scandinavian patent rights across industries, nationalities, and time: analysis, estimates, and applications (industrial policies). PhD dissertation. The University of Wisconsin - Madison. 52/04-a of Dissertation abstracts international. 113 pages.
- Small Business Administration Gopher <http://www.sba.gov/gopher/Legislation-And-Regulations/General-Information-And-Publications/>.
- Small Business Data and Resources <http://cued.org/hotlinks/smallbusdata.html>.
- Small Business Economic Indicators (1998), A reference guide to the latest data on small business activity, including State and industry data.
- Small Business Research Portal (<http://www.perren71.freemove.co.uk/npublications.htm>).
- Smiley, Robert (1980), "Firm Size, Market Power, and the Distribution of Income and Wealth, in J. Siegfried, ed., The Economics of Firm Size, Market Power, and the Distribution of Income, FTC, Wash, D.C. 1980.
- STEP Group (1995), Innovation inputs and firm size in the Norwegian manufacturing sector - Report to SMB Programme. Project "Innovation in Norwegian Industry: a project portfolio." D 56 June 29, 1995.
- Spilling, Olav R. (1996), SMB-typologi: om klassifisering av små og mellomstore bedrifter, Sandvika: Handelshøyskolen BI, Senter for Næringsutvikling og Entreprenørskap.

- Stuart, Toby E. (1999), A structural perspective on organizational innovation. Industrial and Corporate Change, vol. 8.
- Stuart, Toby E. (1999), A Structural Perspective on Organizational Innovation. The University of Chicago Graduate School of Business. Dissertation. Current version.
- Symeonidis, George (1996), Innovation, firm size and market structure: Schumpeterian hypotheses and some new themes P 42 OECD, Economic Department, Working Papers No. 161, 1996.
- Tang, Puay, John Adams, Daniel Paré (2001), Patent protection of computer programmes. Final Report Submitted to European Commission, Directorate-General Enterprise.
- Teece, David J. (1986), Profiting from technological innovation: implications for integration, collaboration, licensing and public policy, Research Policy, 15, 285-305.
- Teitel, S. (1994), Patents, R&D expenditures, country size, and per-capita income: an international comparison A 137 - 159 Scientometrics 29 1.
- U.S. Department of Commerce, Patent and Trademark Office (1991), Annual Report: Fiscal Year 1991. Washington: Government Printing Office.
- U.S. Department of Commerce, Patent and Trademark Office (1992), Manual of Patent Examining Procedure. 5th edition, Revision 14, Washington: Government Printing Office.
- U.S. House of Representatives, Committee on the Judiciary, Subcommittee on Economic and Commercial Law (1992), the Threat of Foreign Economic Espionage to U.S. Corporations. (102nd Congress, Second Session, April 29 and May 7, 1992). (Washington: U.S. Government Printing Office).
- U.S. Small Business Administration, Office of Advocacy, Washington D.C. (1999), the facts about small business 1999.
- Van Leuven, J.W.M. (1994), Utilisation of patent protection in Europe - Representative survey carried out on behalf of the European Patent Office, Paper No 40, Workshop: Innovation, Patents and Technological Strategies, Paris, December 8-9 1994.
- Verheve, D.M. , J.P. Carpentier (1996), Incidence de la loi belge sur les brevets pour les PME-PMI. AEA 54th Conference, Luxembourg November 28 - 29, 1996.Econometrics of Innovation.
- Verspagen, B. (1996), R&D spillovers and productivity: evidence from US manufacturing microdata. AEA 54th Conference, Luxembourg November 28 - 29, 1996.Econometrics of Innovation.
- You, Jong-Il (1995), Small firms in economic theory, Cambridge Journal of Economics, 19, 441-462.
- You, Jong-Il (1995), Small firms in economic theory. Cambridge Journal of Economics: 19, 441-462.

ANNEXES

Overview

- Annex 1: Databases Used and Specifics about Methodology.
- Annex 2: Acronyms for the Norwegian System of Innovation.
- Annex 3: Functional Institutional Matrix.

ANNEX 1. THE COMPILATION OF THE DATABASES AND THEIR ANALYSIS

The database analysis conducted in this study is based on coupling the identity of Norwegian applicants for trademark and patents with firm-level information available for a full-count of Norwegian enterprises. We linked the Norwegian Patent Office databases covering patents and trademarks with publicly compiled registry data covering all Norwegian enterprises. This was clearly the best possible way to approach the question of who uses the patent and trademark systems in Norway. It was pursued because it could provide a unique and detailed picture of Norwegian applicants for these two types of rights.

Some problems were inevitably confronted which required more work than anticipated. The major reason for this was the fact that the link between databases had to be made on the basis of names (and zip codes) of the Norwegian applicant: there was no reliable identifier in the applications that would allow a link to be made with the public registry data (see recommendations). Since errors or variations occur in the names' columns of the databases involved, this required different approaches to make the links, combined with a large degree of manual checking of the links.

Below we provide more information about the NPO databases and the Registry data, how the databases were linked, and assumptions made in their interpretation.

THE NPO DATA

- A. The trademark and patent data were selected along the following lines:
 - 1. The Time Span: all applications that were active during the 1990s. By this we mean all applications that were received from January 1, 1990 to December 31, 1999, or any application that was granted during that period, regardless of the application date.
 - 2. "Norwegian applications" are applications in which at least one of the applicants (not necessarily the inventor) provided a Norwegian address. Only a small proportion of the total applicants were mixed and most of these had the Norwegian addressee as the primary applicant.
 - 3. The information included information about the **who** (the names of all applicants and an unreliable identity number), the **where** (applicant address and zip-code), the **when** (application date and, if applicable, grant/registry date), the **what** (application titles and the primary IPC class), and the **how** (the status of the patent application, for example whether granted, whether withdrawn/rejected and under what conditions, or whether still under examination).
- B. These data were then cleaned and the following links made:
 - 1. the zip codes were associated with county and district-levels via the Norwegian Post's database.
 - 2. the primary IPC classes of the patent applications were associated with Technological Areas by means of a widely-used Correspondence Key: the INPI/OST/ISI Key, Version 3.

THE REGISTRY DATA

The above data were then associated with full-count registry data of Norwegian enterprises. The enterprise-level information used here includes information about firm-size, industrial activity, number of companies (in later years), annual turnover, etc. It comes from a unique, publicly assembled registry covering all active Norwegian companies. This type of registry is found only in a limited number of countries, especially the Nordic countries.

The registry is compiled by Statistics Norway on the basis of firm-level information from the Brønnøysund Register Centre (<http://www.brreg.no/english/>) register of Norwegian enterprises and companies, and the National Insurance Service's (Rikstrygdeverket: www.trygdeetaten.no) registry of active employees and employers. This database gives us a picture of all enterprises (and subsidiary companies) which formally pay wages to at least one person (a registered workforce of about two million).

- A. The registry data were selected along the following lines:
 - 1. Enterprises (*foretak*) versus Establishments (*bedrift*): the enterprise-level was used and all values (number of employees and turnover) were aggregated up to this level.

- 2. Industrial activity: The enterprise's industry is defined via the EU's NACE classification (*Nomenclature générale des Activités économiques dans les Communautés Européennes*). The activities of enterprises prior to 1994, when NACE was introduced in Norway, have been linked to the previous classification system used by Statistics Norway (=ISIC). Industrial activity is based on the enterprises' main product. In aggregating up from establishment to enterprise, the dominant NACE class has been used (see NACE 74150, Holding company as special case). The most up-to-date classification is used, where this had changed over time.
- 3. Zipcodes were combined with county and district-levels via the Norwegian Post's database, thus allowing us an additional criterion against which to check the identity of the applicants.

B. These data were then cleaned and defined in the following way:

1. DEFINING "LARGE" Enterprises

Large enterprises are basically those with a total of at least 100 employees. Three additional criteria are used to define what is considered "large" here as well. The first supplement involves enterprises which include at least 19 "establishments;" these include Norwegian parts of large franchises. Enterprises defined under NACE 74150 (holding corporations) that employ more than 30 are also considered large. These include diversified corporations whose management is defined as a separate enterprise. In order to pick up all large-scale operations, enterprises with a combined turnover of MKR 99 in at least one of the years for which we have turnover data (1997-1999) are also considered large.

There is disruption around 1995 in the data, both regarding the NACE code and number of employees. One source of these difficulties is the transition to NACE from the ISIC Rev 2 classification system. Another is the way the firm-level information was compiled. A third is the fact that several major Norwegian companies were undergoing restructuring at that time (for example, the telecoms operator, Telenor). These potential sources of errors have been screened and any remaining inaccuracies are not expected to affect the results.

2. DEFINING "INDIVIDUAL"

The classification "individual" is based on applications with no apparent affiliation with an enterprise or other organization. These are applications in which the assignee is listed on the basis of a first and last name, and which do not connect with the significant number of individually-run enterprises when the county is also checked. This population potentially includes inventions made at universities, since Norwegian law currently allows academic researchers to own their inventions. The addresses were hand-checked to help prevent their incorrect classification.

3. DEFINING "UNKNOWN"

A number of IPR applicants whose names appear to be that of an enterprise or institution would not connect with the AA register or Enhetsregister (2001). In other words, these entities are not entered in the registry material. These may be companies which folded before they could be registered or which are in the process of registration. Or there might be a mistake that makes it impossible to link the name in the application to the name in the registry database. This population was checked manually to try to isolate any apparent mistake. We assume that entities in this population are most probably not large companies.

4. DEFINING "UNREGISTERED"

Another population has been called "unregistered." These include entities that have an identifiable enterprise number but which cannot be connected with substantive information in the registry database we have. This indicates that there are no employees, especially if the link was made with the registry-data in the period, 1989-95.

SOFTWARE USED

In order to link the databases, the database program Paradox (9) was used. Presentation of figures and tables relied principally on SPSS (10) for Windows.

108

ANNEX 2.
ACRONYMS FOR THE NORWEGIAN SYSTEM OF INNOVATION

From Ørstavik, 1998.

RFU	Regjeringens forskningsutvalg [The Government's research policy board]
DFU	Departementenes forskningsutvalg [The interministerial committee on research policy]
SND	Statens nærings- og distriktsutviklingsfond [The Norwegian Industrial and Regional Development Fund]
NFR	Norges forskningsråd [The research council of Norway]
S&T	Science and technology [Board under NFR]
M&H	Medicine and health [Board under NFR]
I&E	Industry and energy [Board under NFR]
C&S	Culture and society [Board under NFR]
BIO	Bioproduction and improvement [Board under NFR]
E&D	Environment and development [Board under NFR]
TI	Teknologisk insititutt [National Institute of Technology]
VINN	Veiledningsinstituttet i Nord Norge [Partly State supported advisory office for Northern Norway]
BRT	Bedriftenes Rådgivningstjeneste [Regional advisory services in economic and administrative disciplines for private businesses]
BFI	Bransjeforskningsinstitutter [Industry joint-owned research institutes; for instance the paper industry research institute]
SINTEF	Stiftelsen for industriell og teknisk forskning ved Norges tekniske høyskole [The Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology]
IFE	Institutt for Energiteknikk [Institute for Energy Technology]
FFI	Forsvarets forskningsinstitutt [Norwegian Defense Research Establishment]
RF	Rogalandsforskning [Rogaland Research]

109

ANNEX 3.
FUNCTIONAL INSTITUTIONAL MATRIX (ØRSTAVIK, 1998)

INSTITUTION →	Parliament, Cabinet, Ministries	Regulatory, standards certifying	NFR	SND	BRT	Other public funds, banks etc TI, VINN,	SVO	Patent	Universities, higher education	R&D institutes	R&D	Corp. R&D	Libraries databases	Commercial banks, venture capital	Private consultancy firms	Industry and prof. assoc.	Science and business, Parks
• Technology and innovation policy formulation and co-ordination	X	(X)	X	X					(X)	(X)						X	
• supervision and assessment		X	X	X	X		X	X	X	X							
Performing R&D:																	
• basic									X	(X)	(X)						
• pre-competitive									X	X	X						
• applied					(X)			(X)	(X)	X	X				X		
Financing R&D:																	
• for non-business institutions and organizations undertaking basic or applied research	X		X			X											
• support of R&D projects in the business enterprise sector (direct and indirect)	X		X	X													
• support of special areas of research independent from the institution or firm where it is undertaken			X	X		X					(X)		(X)				
• Promotion of human resource development and mobility			X	X	X		X		X	X					X	X	X
Technology dissemination:																	
• improve the adoption and adaptation of specific technologies		X	X	X	X	(X)				X					X	X	
• improve the general technology absorption capacity of firms			X	X	X			(X)	(X)	X					X	X	X
• build the innovation capacity of firms			X	X	X	(X)		(X)	(X)	X					X	X	X
Promotion of technological entrepreneurship:																	
• financing technology-based firms (e.g. Venture capital)		X	X	X		X								X			
• other				X			X	X	(X)	X	X			X			X
Publicly available information:	X	X	X	X	X		X	X	X	X			X			X	X
Standards and regulations	X	X						X									
Other (physical) infrastructure	X	X		X									(X)				X

Source: Ørstavik. STEP Working Paper. 1/98.