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An exploration of domestic patent use among Norwegian firms



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Preface

The working paper is designed to provide input to the Ministry of Trade and Industry and to the members of the forum that the Ministry appointed in 2006 to consider measures to improve the use and conditions for use of patents by Norwegian entities. To this end, it provides detailed empirical information about patterns of patent use among different categories of Norwegian firms. It identifies characteristics of patenting firms, focusing on issues related to firm-size, industrial sector, geographical location, and other aspects of firm populations.

The working paper will further form the basis for a section of the Norwegian Indicator Report, which is coordinated by the Norwegian Research Council.

Oslo, November 2006

Petter Aasen
Director

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1 Introduction

The working paper presents a descriptive population study which focuses on Norwegian patent applicants and their domestic patenting activity in recent years. This study of domestic patent use among Norwegian firms is designed to provide useful insight about what types of Norwegian firms currently utilize the patent system domestically and constructive suggestions about current challenges they face. This information can be useful in understanding and addressing emerging concerns during the substantial transition that the reorientation from a nationally based to a regionally (European Patent Office, EPO) based system represents. This transition is likely to have different effects for different firm types: some Norwegian firms will find benefits, others may find themselves facing new types of challenges. The many small firms in the Norwegian population are a particular concern in this respect. The study addresses the need to take stock of the current patterns of patent use in order to better prepare for emergent concerns.

1.1 Approach and method

The approach is based on the firm-level study, which the World Intellectual Property Office (WIPO) financed to analyze the use of intellectual property rights (IPRs) by Norwegian small and middle-sized enterprises (SMEs) published in 2003. The analysis is based on coupling the identity of Norwegian applicants for patents with firm-level information available for a full-count of Norwegian enterprises. The Norwegian Patent Office (NPO) databases covering patents are linked with publicly compiled registry-data covering all Norwegian enterprises.

The approach thus associates domestic patent data with full-count registry data of Norwegian enterprises. The enterprise-level information used here includes information about firm-size, industrial activity, number of companies, etc. It comes from a unique, publicly assembled registry covering all active Norwegian companies. The registry is put together by Statistics Norway on the bases 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)

This working paper extends and improves the original approach. Patent data are updated through 2005, (although there is a change in procedure at 2003 which affects the data presentation) while the National Insurance Service's registry has also improved to encompass a greater number of enterprises in the period. In addition, attempts have been made to link the patent data with the Brønnøysund Register (Bedrifts- og foretaksregisteret) for 2001. Annex 1 provides details of the linking procedure.

2 General Dimensions of Norwegian patenting

In order to understand the domestic patent use among Norwegian firms, it is first necessary to draw a general picture of patenting in Norway to understand the position that Norwegian firms hold in it. The Norwegian Indicator report¹ has presented general information about Norwegian patenting since 1997 based on data provided by the NPO. This first section draws on dimensions of Norwegian patenting from that report using substantially updated data.

2.1 Domestic and foreign applicants

Norwegian applications are in the minority at the Norwegian Patent Office (NPO), as is the case in most small countries with independent patent examination authorities. Norwegian applications typically make up about 20 percent of the overall incoming documents to the NPO. Of the 60,000 applications lodged during the past ten years (1996-2005), 11,000 involved Norwegian applicants (NOR)².

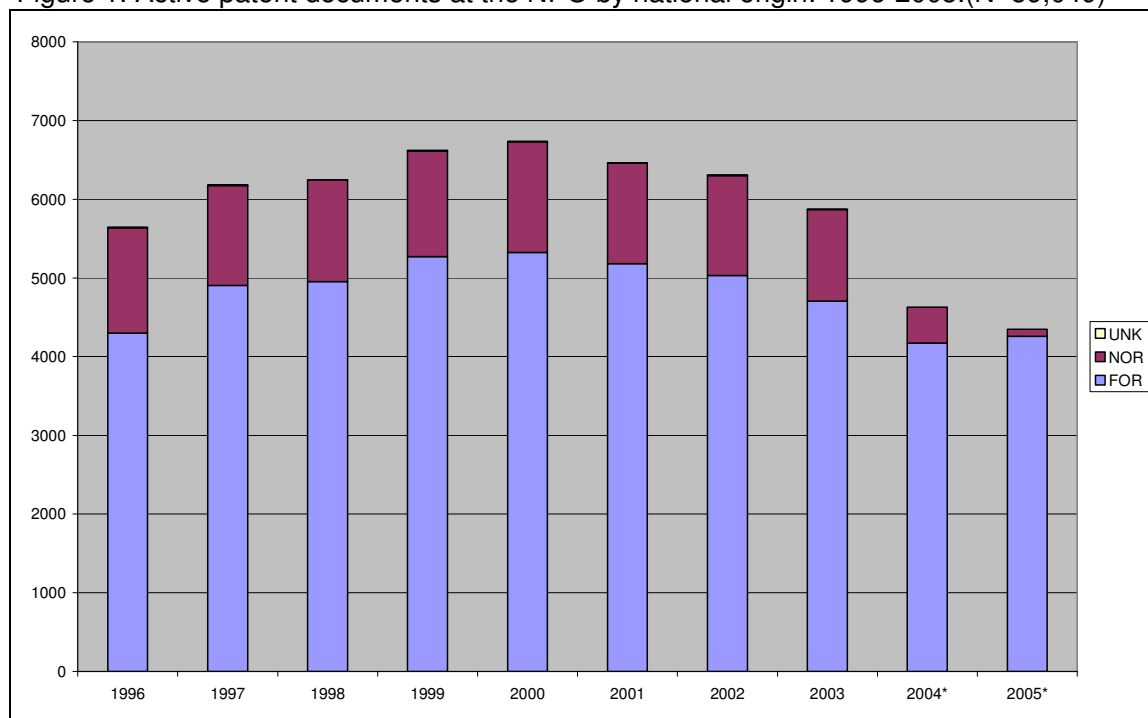
Figure 1 illustrates the minority situation of domestic applications. It includes all active documents by the year of their application in Norway up until 2003. The introduction of new database software (SANT) and of new procedures at the NPO however affects the way the data is presented from 2003 and forward³. Data for 2004-2005 include only documents that have been laid open after a statutory period. This change accounts for the steep reduction in 2004-2005 which particularly affects Norwegian patents.

¹ Det norske forsknings- og innovasjonssystemet – statistikk og indikatorer 2005, Oslo, November 2005

² A number (43) of patent applications were of unknown providence (UKNOW).

³ It also excludes a small set of applications which are secret (10-20 per year) for certain reasons (e.g. military).

Figure 1. Active patent documents at the NPO by national origin: 1996-2005.(N=59,049)



Source: NIFU STEP patent database, compiled on NPO data (2003 and 2006), Note*: Changes in the NPO database associated with the transition to SANT affect data after 2003.

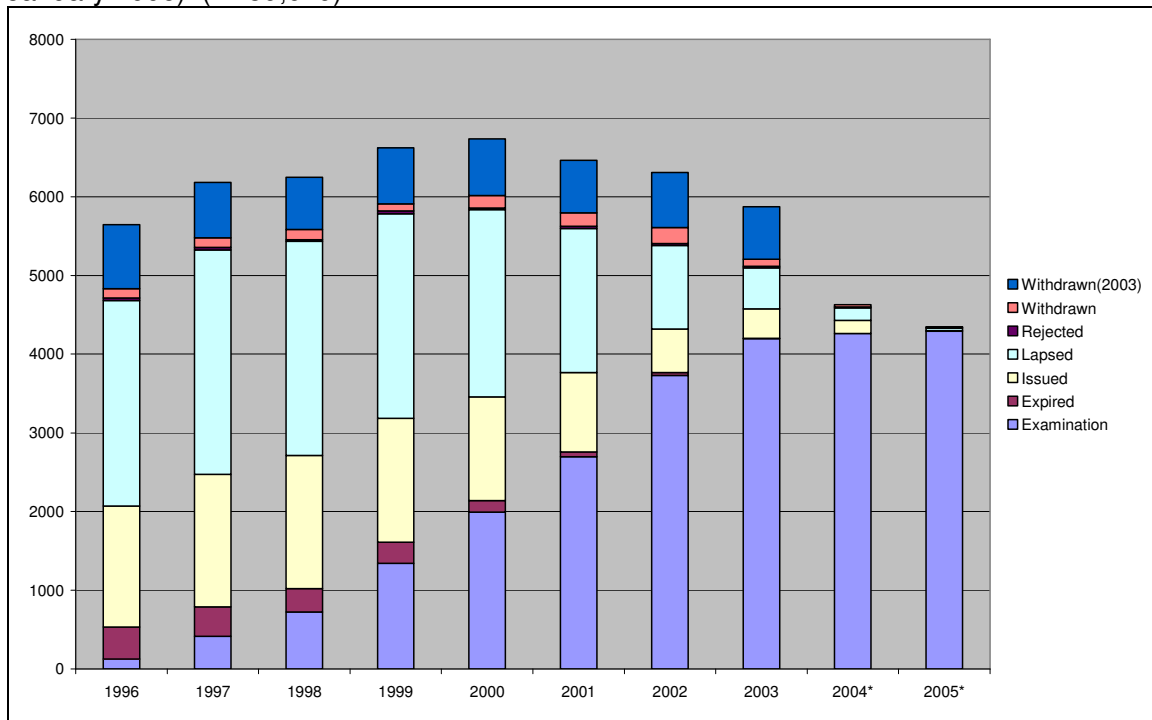
Foreign applications tend not to be affected because they are generally first applied elsewhere and are laid open by the time they enter the national phase in Norway. The change in procedure is important to take account of since it means that applications withdrawn during the statutory period are not visible in the data for these years, while they are included for earlier years. Norwegian filings that were withdrawn during the first 6 months are not included for 2004-2005, nor are others not laid open within the first 18 months.

2.2 Status

Applications that are withdrawn make up a sizeable population as Figure 2 indicates. This is significant because smaller firms are more likely to withdraw applications than are large firms, and these applications fall out of the record after 2003. We will return to this in the final section.

Meanwhile Figure 2 shows the current status (in 2006) of patents applied for at the NPO during the past decade by year of entry. It indicates the volumes of applications still in examination (blue) and those that were issued (beige). The applications that were withdrawn (navy blue) in the first 18 months are presented for the years up to 2003. This record of withdrawn patents is based on the status of patents at the end of 2003.

Figure 2. Volume of patent-documents active at the NPO, by Application Date and status (as of January 2006). (N=59,049)



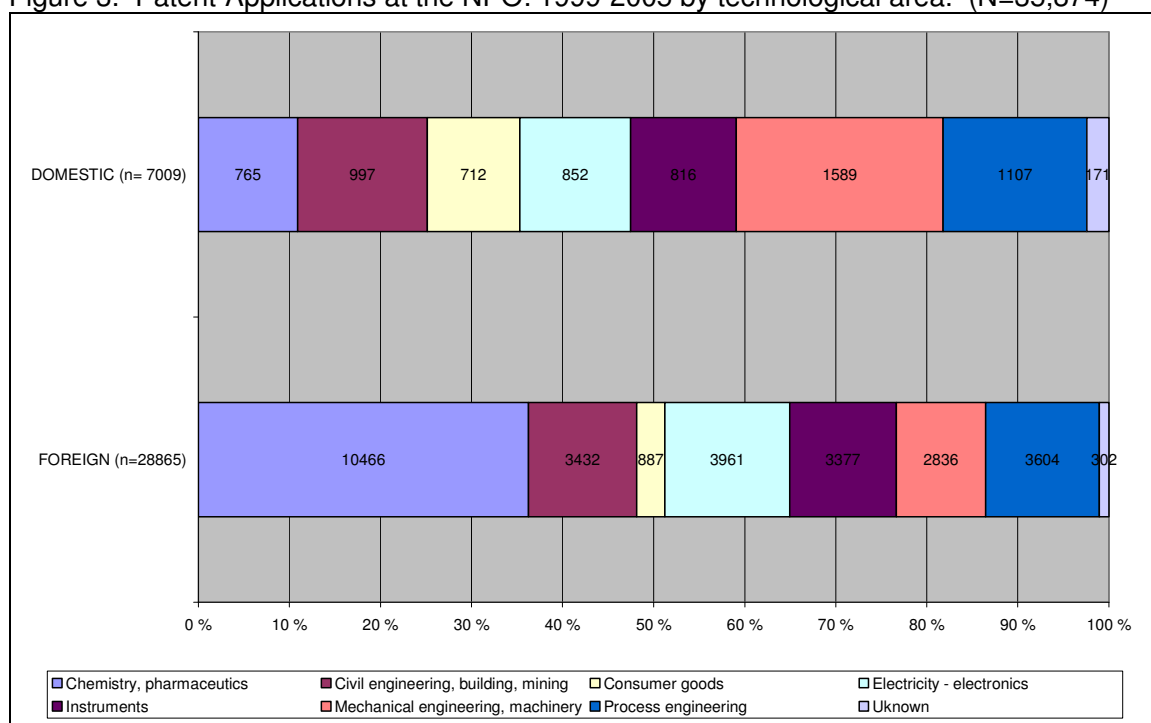
Source: NIFU STEP patent database, compiled on NPO data (2003 and 2006), Note*: Changes in the NPO database associated with the transition to SANT affect data after 2003.

About 18000 patents were granted by the NPO during the period up to 2003: patents involving Norwegian applicants made up about 19 percent of the total. The proportion of Norwegian patents granted in the period 1990-2003 grew consistently through the period, rising to over 20 percent in 2003. Thereafter, patent grants judged on dates of issue at the NPO shrunk hugely in 2003-2005. This was especially the case for foreigners, indicating a change either in the data or in examination procedures or both.

2.3 Technological profiles

The minority position is not the only distinguishing feature of Norwegian patenting. As a group, domestic applications also differ technologically from those filed from abroad. Figure 4.3 breaks down the patent applications the Norwegian Patent Office received in the period 1994–2003 by technical area using the OST-INPI-ISI correspondence key commonly employed by the OECD. See Annex.

Figure 3. Patent-Applications at the NPO: 1999-2005 by technological area. (N=35,874)



Source: NIFU STEP patent database, compiled on NPO data

Note*: 22 applications could not be assigned nationality.

Figure 3 illustrates that the largest concentration of domestic filings is found in machinery and equipment, while relatively few are filed in chemicals and pharmaceuticals. In contrast, foreign filings were most active in pharmaceuticals followed by chemicals⁴. This is particularly due to the fact that the chemical and pharmaceutical industries rely heavily on patenting to protect their products, which are expensive to develop but relatively inexpensive to imitate. Domestic patent applications are otherwise more evenly divided between the six technological areas than are foreign patents.

⁴ A minority (@30 applications) were reissued in part or subject to SPC. In these special cases two documents may exist for the same application.

3 Actor-oriented focus: Norwegian applicants

This section goes on to focus on the Norwegian population of patent applications and applicants from 1999-2005. The break in data at 2003 will also figure here. The section links patent application information to full-count registries covering all active Norwegian enterprises. The specifications for the linking process are found in the Annex. Unless otherwise indicated ‘normalized’ counts of patents are used, in order to account for the contribution of each applicant in multi-applicant patents without double-counting the patent document.

3.1 Norwegian Applicants by size

Norwegian applicants fall into two major groups. The first involves a significant number of individuals without apparent affiliation who apply for patents. The mode for the commercialization of these applications (licensing, a start-up, etc) is unclear and probably subject to a considerable degree of risk⁵. The volume of applications from unaffiliated individuals, while initially large, is dramatically winnowed down as the applications are processed. As the final section makes clear, these applications result in a dramatically smaller proportion of grants and in much shorter lives among patents that do issue than firm patents.

The second major group is that of enterprises, including research organizations.⁶ The demographics of Norwegian firms feature large volumes of enterprises, including many SMEs or enterprises with up to 99 employees. According to the AA register, there were 225,000 enterprises in the country in 2003 with at least one employee⁷. These are spread out through primary, secondary and tertiary sectors of the economy. Firms that are considered large (based on employment, number establishments, and turnover) make up in the region of one percent.⁸

We identified 3600 domestic entities who filed for one or more patents during the seven year period. Of these, 1245 applicants were identified as enterprises, while an additional 300 appear to be firms but do not link to the existing databases⁹. These are called “Other Enterprises” in the following figures. A further 140 have Organization numbers but lack

⁵ Some of these applications may include university researchers: See Iversen & al (2007) for a discussion.

⁶ “Enterprise” (Foretak) is to be distinguished from “Establishment” (Bedrift). Our focus is on enterprises which subsumes establishments. For a definition of how these size-classes are defined, see Annex.

⁷ A raw count of Organizational Numbers with more than 0 employees.

⁸ Depending on the definition. The basis for the AA database changed in 2001 to include a larger number of enterprises with part-time employment. See population studies see e.g. Spilling, 2005; Nås & Sandven, 2007). For an application to patenting, see Iversen, 2003; 2005.

⁹ Datasets for 1999-2005 are used. These are generated on the AA data (Employment) to make up enterprises and establishments. (also called ‘tilleggsfilene’). These are separate from the Bedrifts- og foretaksregisteret (BOF) which encompass all establishments in the country. This study supplemented AA data with BoF data for 1996 and 2001.

information about employment and other firm-characteristics. These go under the heading of “No Activity” in the next figure but are combined with ‘other enterprises’ in subsequent figures.

Figure 4 breaks down the set of Norwegian applicants in seven categories. Eleven hundred enterprises were broken down according to size:

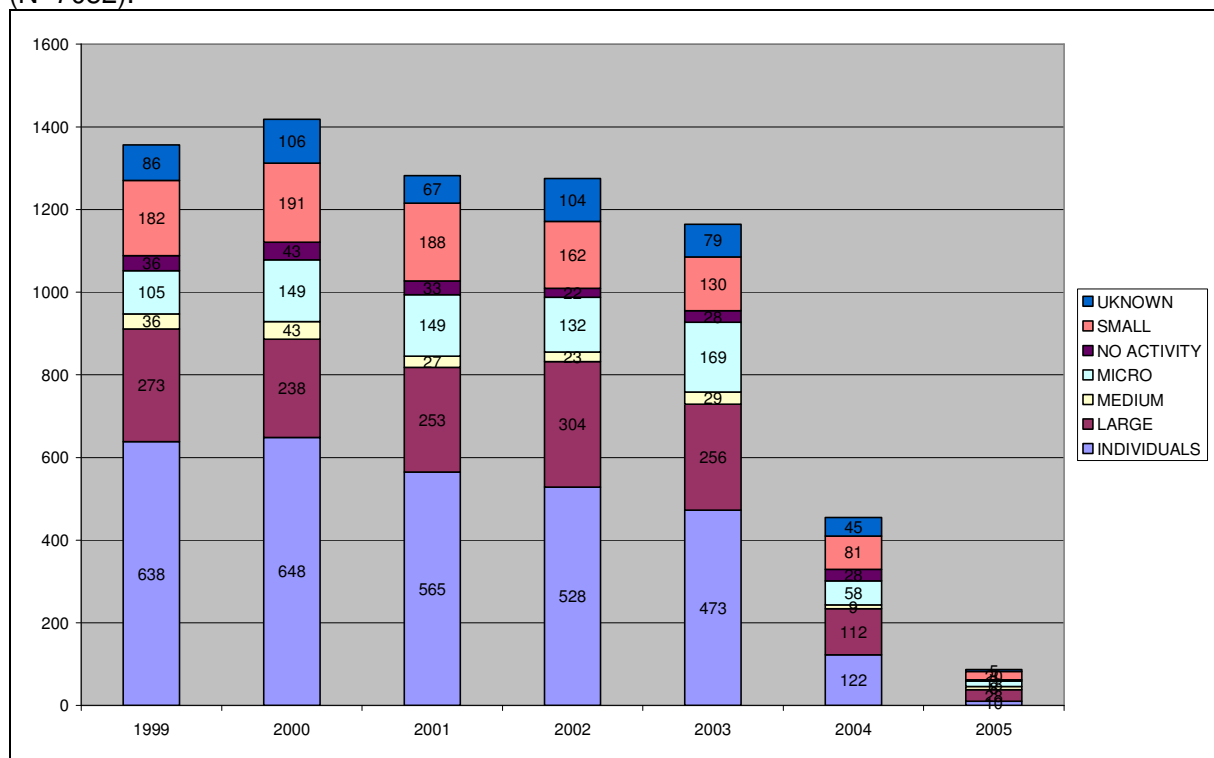
- Micro for firms under 5 employees:
- Small for firms with between 5 and 49 employees
- Medium for firms with 50-99 employees.
- Large includes firms with over 99 employees. In addition firms are considered large if they report annual turnover of over 100 million NOK, and/or have more than 15 establishments. To pick up large firms organized as holding companies, such firms with over 30 employees are also defined as small even where they do not meet the above criteria.

We identified 406 micro firms, 419 small firms, 49 medium-sized firms, and 235 large firms among Norwegian applicants. There were a further 136 firms with ‘no activity’ (no employment and no turnover), most if not all are expected to be micro firms. A further 298 remain unknown. In addition to this population of 1543 entities, 2088 unaffiliated individuals were also identified.¹⁰

Figure 4 breaks down the patenting activity of the approximately 3630 Norwegian applicants for the period 1999–2005, given the discontinuity in NPO data after 2003. It illustrates how the patent filings break down according classes of applicants over time.

¹⁰ A small set of individuals did link to the AA registry in this iteration. Further work will be needed to identify commercial enterprises linked to them.

Figure 4. Norwegian patent-applicants (N=3631) by year of application: normalized counts (N=7052).



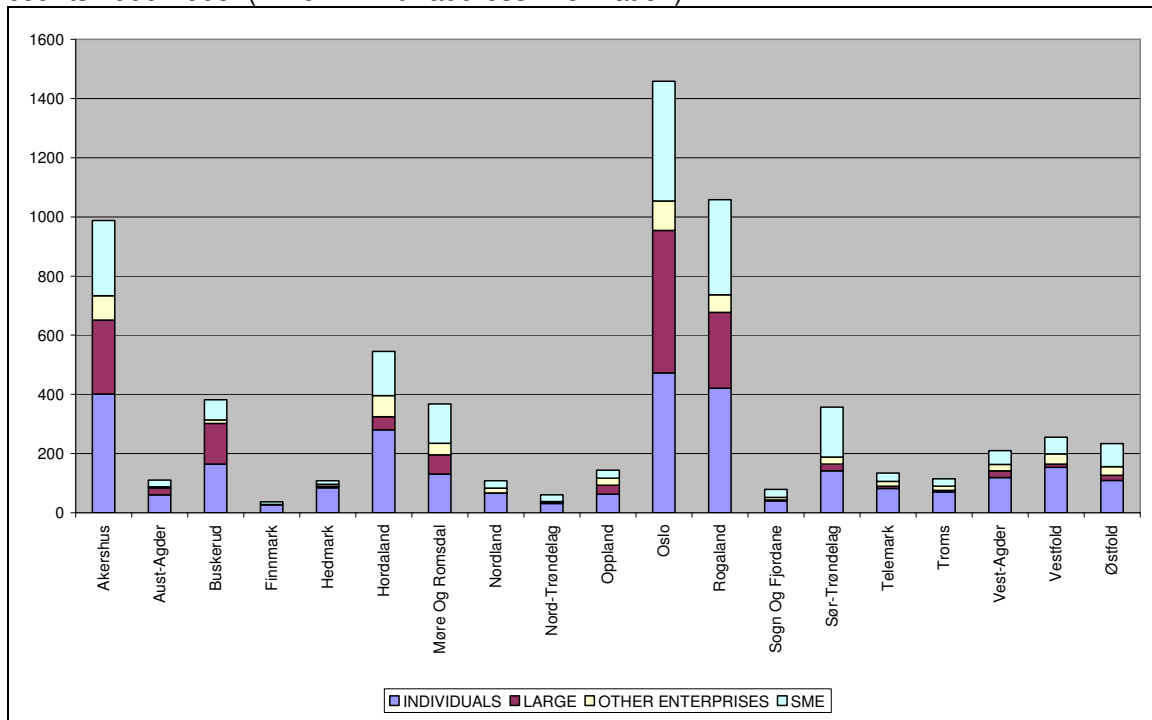
Source: NIFU STEP patent database, compiled on NPO data
 Note*: 22 applications could not be assigned nationality.

The effect of the change in procedure is quite evident here, with a large number of Norwegian filings not yet public in the latter years. Two characteristics can still be mentioned. The first is that the number of filings from individuals falls consistently over the period, from 638 in 1999 to 473 in 2003. The second is that, as we will see in more detail, the number of overall filings from small and medium-sized enterprises (1911) is greater than that from large firms (1466). Large patenting firms however filed on average file 6.3 domestic patents during the period, while the equivalent for the combined group of small and medium-sized enterprises was 2.2.

3.2 Geographical spread

Norwegian applicants are also spread throughout the country, although the largest volumes come from Oslo/Akershus, Hordaland/Rogaland, and Sør Trøndelag/ Møre og Romsdal. Those with larger shares of patenting tend also to be those with greater relative proportions of firms in their patenting. Larger firms tend to be in urban areas, and this effect is especially clear in the Oslo region.

Figure 5. Norwegian patent-applicants by year of filing and applicant County (Fylke): normalized counts 1999-2005 (N= 6747 with address information)



Source: NIFU STEP patent database, compiled on NPO data

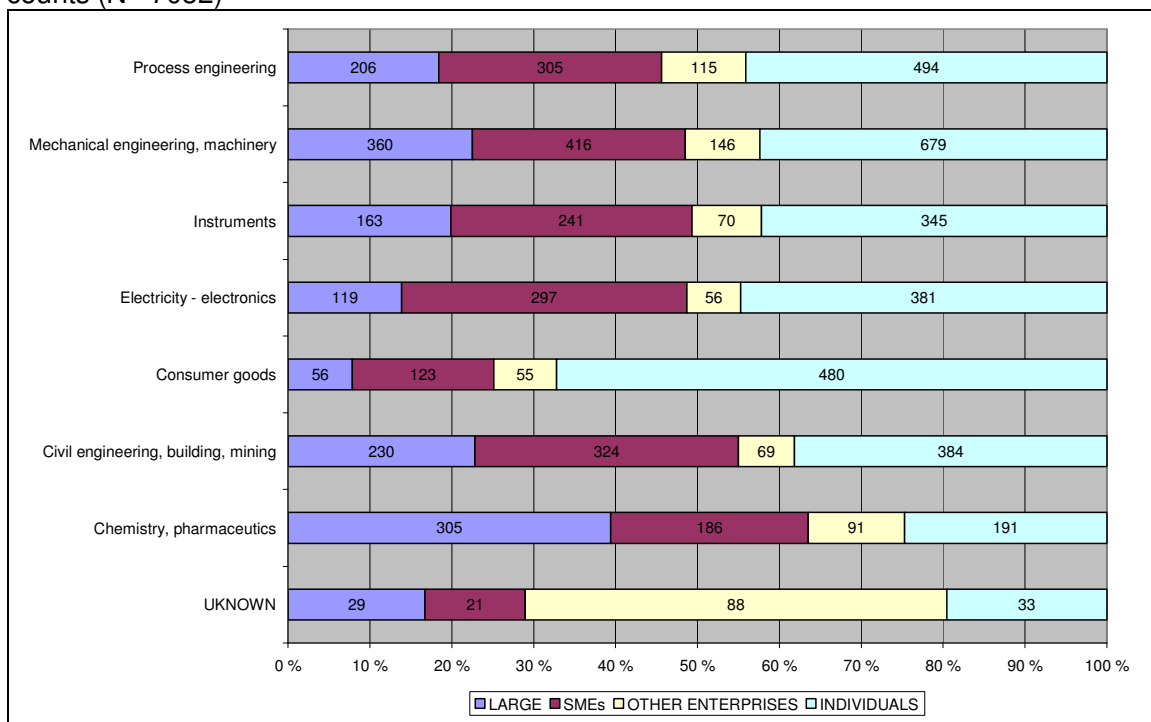
Note. Geographical localization was lacking for a further 285 applications. The majority of these involved the class of 'other enterprises' for whom other information is missing.

3.3 By technical area of application

Patenting is known to be highly sector specific, the propensity to patent is higher for some technologies than for others. We look at this important element of the patenting picture from two perspectives. The first looks at how the patenting of different firm classes stack up in relationship to the technology of the patented technology.

Figure 6 illustrates how the patent filings of large firms, small and medium-sized enterprises (less than 100 employees), and apparently unaffiliated individuals were distributed according to technical area during the period. A sizeable category of enterprises are presented here as "other enterprises" to denote firms where the number of employees could not be established: most of these are again expected to be SMEs.

Figure 6. Norwegian patent-applicants by applicant size and technology: 1999-2005 normalized counts (N= 7052)



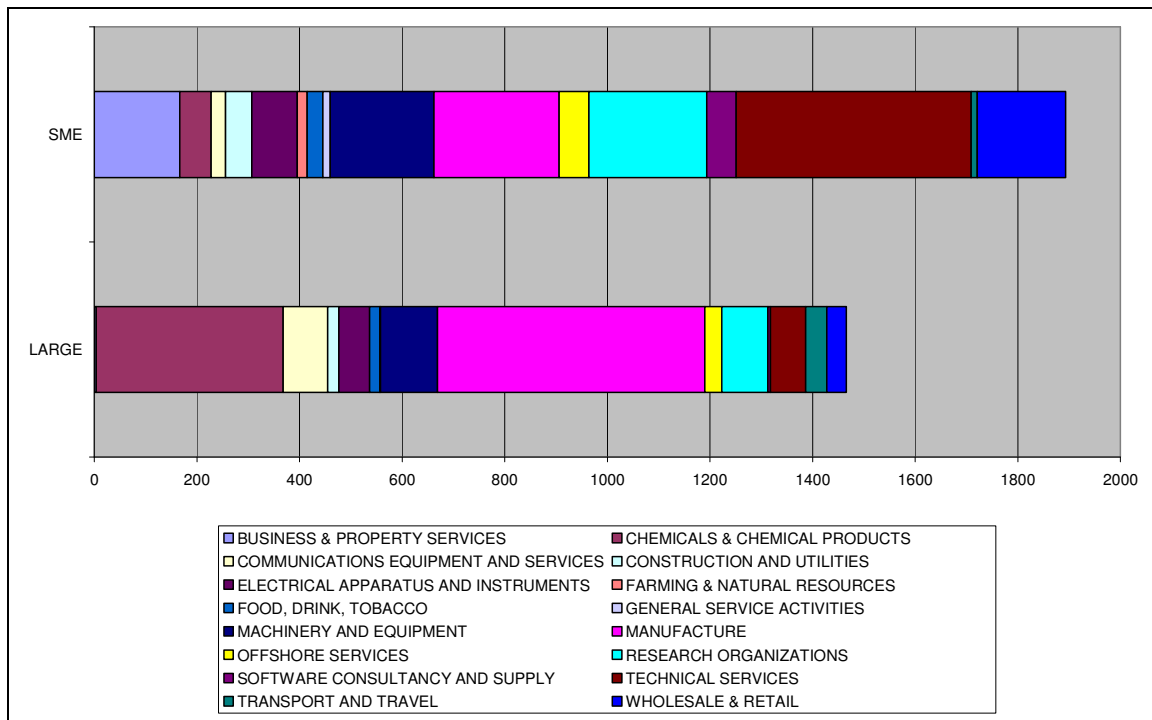
NIFU STEP patent database, compiled on NPO data

Figure 6 indicates that patenting by large firms is highest in Mechanical Engineering as well as Chemistry and Pharmaceuticals, where it is strongest proportionately. SMEs patenting is also high in Mechanical Engineering, as well as in Engineering, and Electronics where it is proportionally strongest. The patents of non-affiliated individuals dominate the area of Consumer Goods. There are also a number of applications which could not be linked to technological areas.

The second way to approach the technological profiles of patenting firms is to look at the industry in which the applying firm has its dominant product. Here the enterprise's industry is defined via the EU's NACE classification which is based on the enterprises' main product. (refer to the annex for specifications) Figure 7 therefore narrow our focus on the enterprises with levels of employment¹¹. These were involved in over 250 mainly five-level Nace categories which have been aggregated here according to 16 areas of industrial activity.

¹¹ Excludes applicants who are individuals with no affiliation (normalized patenting =2987) and Other enterprises with no match (normalized patenting N= 489)

Figure 7. Norwegian enterprise-applicants by applicant size and industry (NACE): 1999-2005 normalized counts (N=3368)



Source: NIFU STEP patent database, compiled on NPO data

The profile of the large firms differs from that of SMEs with regards to number of (normalized) patents. Two areas stick out in large firm patenting; the area of Chemical and (petro)-chemical products and that of Manufacture in general. Research Organizations here includes research institutions notably Sintef: it also includes the first patents to be applied for in the name of Norwegian universities after new legislation went into effect in 2003 that made this viable. SME patenting involves Manufacture and Machinery and Equipment as well. A large proportion however comes from firms in a variety of specialized service areas, including firms active in Technical Services (such as software consultancies, measurement, testing and analysis, etc), Offshore services (including surveying, testing and analysis), and Business services (e.g. management and technical transfer offices).

4 Proportion of patenting firms in total firm population

This section supplements the impression presented above of patenting enterprises in Norway. This section represents a preliminary attempt to put that picture into the overall context of Norwegian industrial activity. The approach takes as its basis the industries¹² where we find patenting (1999-2005) and looks at it in the context of the total population of Norwegian enterprises in those (four and five digit NACE classes) in National Insurance Service's registry¹³.

National Insurance Service's registry for 2001 indicates that there were about 80,000 enterprises in the industrial segments where we find patenting firms. This picture excludes the majority of enterprises which are found in other industrial areas¹⁴. The assumption is that patenting is less relevant (or perhaps irrelevant) for firms in these other areas and that, therefore, it does not make sense to include these when comparing the overall volume of domestic patenting. The average size of firms in these 16 areas was 6.6 employees, with a range from 2 to 160 employees in the small segment of Research Organizations which include universities¹⁵ as well as research institutions.

Table 1 indicates that an average of 1.5% of the enterprises in the overall set of industries where we find firms that patent. (see P-FIRMS (%)) The percentage varies considerably from industrial area to industrial area.

¹³ The list includes 256 Nace (Nomenclature générale des Activités économiques dans les Communautés Européennes) codes.

¹⁴ Several of the classes in which a handful of patents were filed in the 1999-2005 period were not extant in the National Insurance Service's 2001 registry.

¹⁵ Two universities appear in the patenting data under their own names. The patenting of other universities as well as some of the commercialization activities of research institutions are defined under profession services and thus fall under the SME heading. Most patenting from the large research institutions are found under their own names, are thus categorized as large.

Table 1. Proportion of patenting firms in industries with domestically patenting units: number of identified patenting firms (1999-2005, N=1153) per total number of firms (2001) in the same (NACE, 4-5) industries.

INDUSTRY	ENTERPRISES 2001			PATENTING FIRMS 1996-2005	
	ENTERPRISES	EMPLOYEES	EMPL/FIRM	P-FIRMS	P-FIRMS (%)
Nace					
BUSINESS & PROPERTY SERVICES	11922	35268	3.0	95	0.80
CHEMICALS & CHEMICAL PRODUCTS	166	15170	91.4	37	22.29
COMMUNICATIONS EQUIPMENT AND SERVICES	326	26579	81.5	20	6.13
CONSTRUCTION AND UTILITIES	9246	43991	4.8	40	0.43
ELECTRICAL APPARATUS AND INSTRUMENTS	721	11687	16.2	58	8.04
FARMING & NATURAL RESOURCES	2247	2137	1.0	14	0.62
FOOD. DRINK. TOBACCO	1246	24913	20.0	29	2.33
GENERAL SERVICE ACTIVITIES	6461	9850	1.5	13	0.20
MACHINERY AND EQUIPMENT	1150	17917	15.6	118	10.26
MANUFACTURE	5542	85198	15.4	238	4.29
OIL & GAS	314	11079	35.3	36	11.46
RESEARCH ORGANIZATIONS	727	116142	159.8	57	7.84
SOFTWARE CONSULTANCY AND SUPPLY	2145	12203	5.7	36	1.68
TECHNICAL SERVICES	6655	39956	6.0	208	3.13
TRANSPORT AND TRAVEL	7242	18783	2.6	14	0.19
WHOLESALE & RETAIL	23494	51889	2.2	140	0.60
Totals	79604	522762	6.6	1153	1.45

Source: NIFU STEP patent database, compiled on NPO data
 Number of enterprises in 2001, according to National Insurance Service's registry of enterprises.

Industrial areas with larger proportions of patenting firms include Chemical and (petro) Chemical products, where 22% patent by this count; Oil & Gas 11.5 %; and Machinery & Equipment (10.3%). On average, 4.3% manufacturing firms also patent.

This provides an indication of the patent intensities against a national population of enterprises. Further refinement of the link is needed and the approach. However this preliminary approach however provides an indication of the patterns of specialization in Norwegian firm patenting.

5 Concluding discussion: What signs do we find that applicants experience difficulties when patenting?

What happens to domestic patent applications? As indicated above, the propensity to apply for patent protection is affected by size, as well as by other factors, chiefly industry. Firm size also plays an established role in the success of a patent and in its overall life-cycle. Applications involving small firms are less likely to result in a grant, and are oftentimes withdrawn by the applicant. Patents that are granted to small entities also tend to lead shorter lives than those granted to larger ones.

This negative size-effect might testify to a variety of factors, including invention quality or sensitivity to risk-taking. As suggested in Wipo (2003), it might also testify to a lack of expertise and a need for help to better use of the patent system. Such factors may be important if Norwegian applicants are to realize the potential gains of the transition to the regionally oriented EPO.

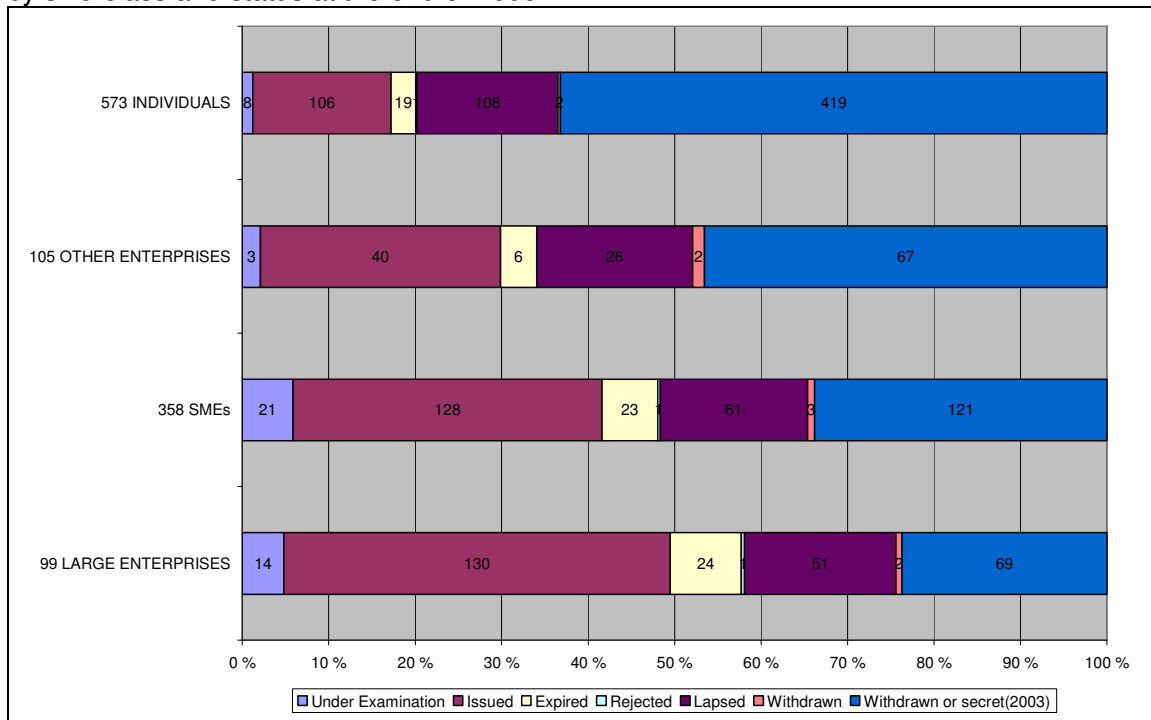
We conclude by exploring a cohort of patents applied for in a single year to see what happens to them in subsequent years. Specifically we look at the status of 1999 applications at the end of 2005 to indicate whether firm size plays a role in survival rates.

In 1999, 1025 applicants with Norwegian addresses¹⁶ were involved 1456 documents or a normalized patent count of 1360. We supplement the data with observations of the status at the beginning of 2003, when patents withdrawn before being laid open were still included.

Figure 8 presents the status of the 1456 documents by applicant-size. It demonstrates (in the blue areas of Withdrawn or Secret (2003)) that the volume of the withdrawal before term is considerable and that it is correlated with the size of the applicant. Large firms are much less likely to withdraw an application than smaller firms. In the case of individual applicants without any visible affiliation, it makes up the majority of their

¹⁶ We do not rely on the 'Kundenummer' to identify distinct applicants. Distinct applicants are identified on the basis of name and zip codes and organization numbers of identified firms.

Figure 8. Norwegian applicants (N=1025) involvement (1456 times) in applications filed in 1999, by size-class and status at the end of 2005.



Source: NIFU STEP patent database, compiled on NPO data

Moreover the proportion of applications that go to grant is also size-specific. It is largest for larger firms, smaller for smaller firms¹⁷. Only about 16 percent of individual applications are granted. The size-effect apparently extends also to the life-span of granted applications. Of the applications given Issue dates, roughly 1 in 6 expired within the 6 years after application. This includes 40 percent of the individual applications and 8 percent of the SME issued patents. Meanwhile, 4 percent of patents granted to large firms lapsed in the period.

This brief look at the fate of one batch of patent-applications suggests that there are concerns to be addressed with regard to firms that already use the system. Problems faced by firms that set out to patent in the a domestically oriented system, where there are certain home-court advantages (language, proximity, etc) and where fees are relatively low (lower in fact for smaller companies than for larger), suggest that more serious challenges will need to be faced if Norwegian firms as a group are expect to benefit in the transition to a regionally-oriented system.

However more study is required to find out more about what characterizes successful versus unsuccessful patent application (is there a learning effect?) and what practical significance this may have.

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¹⁷ The category of Other Enterprises would not link in this iteration with the current databases; most are likely to be small firms without formal employment.

Annex 1. The compilation of the databases and their analysis

The database analysis will be based on coupling the identity of Norwegian applicants for patents with firm-level information available for a full-count of Norwegian enterprises. The Norwegian Patent Office databases covering patents are linked with publicly compiled registry-data covering all Norwegian enterprises.

Below we provide more information about the NPO databases and the Registry data.

The NPO data

A. The selection of patent data was done along the following lines:

1. The Time-Span: all patent applications filed between January 1 1999 to December 31, 2005.
2. This study will provide fractional or normalized counts to analyze the contribution of each Norwegian applicant. In cases where an application includes several applicants, the contribution of each applicant will be counted as a fraction of the single application: thus, if a patent has three applicants, each will be counted as 1/3. This is a different approach than that employed in the WIPO study
3. The information included information about **who** of the application (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).

The Registry Data

This data is 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, etc. It comes from a unique, publicly assembled registry covering all active Norwegian companies. This type of registry is only found in a limited number of countries, especially the Nordic countries.

The registry is put together by Statistics Norway on the bases 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). The basis for including firms in the database changed in 2001, when the number expanded to include more part-time employment.

A. The selection of the registry data is conducted along the following lines:

1. Enterprises (foretak) versus Establishments (bedrift): the enterprise-level is used and all values (number of employees and turnover) are 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). 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 if this had changed over time.
- B. This data is then cleaned, and the following links made:
1. Names and addresses are used to link enterprises to the applicant fields of the patent application. The zip-codes associated to county and district-levels via the Norwegian Post's database are used
 2. The primary IPC classes of the patent applications are associated to Technological Areas by a widely-used Correspondence Key: the INPI/OST/ISI Key, Version 3. Some data presentation will use an updated correspondence key between IPC and NACE industrial codes.