

# ServINNo

Service innovation in  
the Nordic countries:  
Key Factors for  
Policy Design

## **Service innovation in the Nordic countries: An analysis using CIS4 data\***

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\* This report is part of the ServINNo project – Service Innovation in the Nordic Countries: Key Factors for Policy Design (<http://www.cfa.au.dk/SERVINNO/Servinno.htm>). Funding from the Nordic Innovation Centre (NICE) is gratefully acknowledged.

The data and calculations used in this report have been provided through the NIND project (Policy Relevant Nordic Innovation Indicators, also funded by NICE), by the statistical agencies responsible for CIS4 in each of the Nordic countries: Statistics Finland, Statistics Norway, Statistics Sweden, RANNIS in Iceland and CFA in Denmark. Their input to this report is gratefully acknowledged.

## Executive summary

There has been an increasing focus on innovation in services in recent years, both in research and policy discussions. A number of trends motivate this growing attention. First, the service sector in OECD countries has experienced large increases in size over the last two decades, now accounting for around 70 percent of GDP. The sheer size of the service sector emphasizes the importance of understanding innovation in this sector and how countries can help promote growth in service enterprises. Second, general views of innovation has developed greatly in recent years from being seen as passive adopters of existing technologies to a wider recognition that many service enterprises are important sources of creative knowledge, technology and novel products. Finally, it is becoming increasingly difficult to consider manufacturing and services as two distinct sectors. Many manufacturing enterprises are active in service development, some to the extent of transforming their business towards a complete focus on services. Service innovation is thus a phenomenon that should be analyzed across all industries in the economy.

This report examines service innovation in the Nordic countries utilizing data from the Fourth Community Innovation Survey (CIS4). CIS4 covers innovation activity in the business sector over the three year period from 2002 to 2004. The analysis here focuses on a number of topics that are relevant for policy discussions. Among these are:

- the scope of innovation activities and their characteristics across service sectors and Nordic countries
- the blurring boundaries between manufacturing and services and identifying enterprises that are active in both goods and service development
- the role of non-technological innovation
- R&D activities in service enterprises
- external linkages with other enterprises and public research institutions
- and the role of intellectual property rights (IPR's).

There is significant variation in the degree of innovation activity across Nordic service sectors. The ICT service sector has the highest share of enterprises with product and/or process innovations, around 2 out of 3 in IT services and around half in Telecommunications. The lowest levels of innovation activity are generally found in the Transport sector. In comparison with manufacturing, shares of innovative enterprises in IT service and Telecommunications are generally higher than manufacturing averages, while innovation shares in other service sectors are typically lower than manufacturing averages.

All five Nordic countries have strong innovation performance in IT service and Telecommunications. However, there is much greater variation across countries in other service sectors, such as Wholesale trade, Transport, Financial intermediates and Technical business services.

A large share of innovative service enterprises also engage in intramural R&D. Generally, shares of innovative enterprises with R&D are higher in knowledge intensive service sectors

than in the manufacturing sector, and shares in other service sectors are also high, with around half of innovative enterprises conducting in-house R&D.

A sizable share of product innovative enterprises within both manufacturing and services has introduced both new goods and new services. This activity is not limited to a few select sectors, but it prevalent both in high and low tech manufacturing and across service sectors. This result illustrates the increasingly blurring boundaries between manufacturing and services with manufacturing enterprises active in service development and service enterprises developing new goods along with their service products.

A large share of technological (product-process) innovators have also implemented non-technological (organisational and/or marketing) innovations, and an additional non-negligible share relied solely on non-technological innovation. However, these shares are generally only slightly higher for service sectors than for manufacturing. This suggests that non-technological innovation may be important for both manufacturing and service enterprises.

Public funding of innovation projects is mainly concentrated on IT service enterprises (software, consulting and data processing) and to a lesser extent technical business services. There is also large variation in funding across countries, with particularly high shares of innovation active enterprises receiving funding in Norway and Finland.

The most common form of protection of IP rights for service enterprises is trademarks, with around 25 percent of innovative enterprises having registered a trademark. This is similar to levels in manufacturing. Shares of innovative service enterprises having applied for a patent or registered an industrial design are around half the levels in manufacturing.

Overall innovation performance in the Finnish service sectors is somewhat lower than for Denmark, Sweden and Iceland. However, a general characteristic among Finnish service enterprises compared to other Nordic countries is a high outward orientation, particularly in Telecommunications. A very high share of enterprises in Telecommunications have innovation cooperation with a number of different types of sources, and over half cooperate internationally. This is substantially higher than any other sector in the Nordic countries.

Iceland is characterised by high innovative performance across all service sectors, with the exception of Technical business services. In particular IT services has a high share of innovative enterprises, with focus on customers and competitors as cooperation partners and external information sources. Innovation performance is also high within Financial intermediates.

Overall innovation performance in the Norwegian service sector is lower than in other Nordic countries. However, a notable exception to this is the ICT sector, with high innovation performance in both Telecommunications and IT service. In comparison, for example with Finland, Norwegian service enterprises are less outward oriented, with high share of enterprises conducting in-house R&D, but relatively lower shares with innovation cooperation or acquisitions of external technology.

Innovation activity is also high in the Swedish IT service sector, but notable for Sweden is high innovation performance in other service sectors, particularly Wholesale trade and Technical business services (engineering and technical testing). In both these sectors, shares of innovative enterprises are over 50 percent, exceeding manufacturing averages. An exception here is the Transport sector, with just over 20 percent of enterprises having product or process innovations.

Shares of innovative enterprises for Denmark are generally slightly lower than for Sweden, though innovation activity is more balanced across sectors, with no Danish service sector having less than a third with product or process innovations.

When discussing service innovation, a large amount of focus is on knowledge intensive services, which are thought to have the greatest potential for innovation and growth. It is thus somewhat surprising that innovation performance is generally quite low in Technical business services. A notable exception here is Sweden, with a substantially higher share of product-process innovative enterprises.

In comparing the Non-tech business service sector (Legal, accounting and consultancy) for Denmark and Sweden, there are strong similarities in innovation activities for the two countries. Market interactions (with customers or competitors) are important in both cases, though market cooperation is greater for Danish enterprises. Suppliers are less important external sources for Non-tech business services than Technical business services, and a lower share within Non-tech business services has acquired embodied technology or conducted in-house R&D. Hence, as might be expected, new technology, whether adopted or developed in-house, is less important for innovation activities in Non-tech business services. Non-technological innovation is however of greater importance for Non-tech business services. For Danish enterprises with Non-tech business services, a much higher share of enterprises has implemented an organisational or marketing innovation (than for Technical business services), and almost no enterprise in this sector has implemented a product or process innovation without also having implemented a non-technological innovation.

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## 1. Introduction

There has been an increasing focus on innovation in services in recent years, both in research and policy discussions. A number of trends motivate this growing attention. First, the service sector in OECD countries has experienced large increases in size over the last two decades, now accounting for around 70 percent of GDP. The sheer size of the service sector emphasizes the importance of understanding innovation in this sector and how countries can help promote growth in service enterprises.

Second, general views of innovation have developed greatly in recent years from being seen as passive adopters of existing technologies to a wider recognition that many service enterprises are important sources of creative knowledge, technology and novel products (Tether and Howells, 2006; CEC, 2007). A long running discussion has debated whether innovation processes in service enterprises are fundamentally different than for manufacturing enterprises (demarcation) (Djellal and Gallouj, 2001; Coombs and Miles, 2000) or whether they can be seen as variations of the same complex innovation processes (synthesis) (Drejer, 2004; Tether, 2005).

Recent studies of service innovation (Howells and Tether, 2004; Salter and Tether, 2006; CEC, 2007, DTI, 2007) indicate that:

- Service enterprises are indeed innovative, though with a greater emphasis on non-technological forms of innovation and correspondingly less technological innovation than in manufacturing.
- Service enterprises conduct less formal R&D, though R&D activities are increasing for the service sector.
- Due to the 'simultaneity' of production and consumption for many service products, client interaction is an important dimension of service innovation.
- Sources of external knowledge tend (to a greater extent) to be suppliers and customers and less research based institutions than for manufacturing enterprises.

However, innovation in services is difficult to characterize for the sector as a whole, perhaps more so than for manufacturing enterprises. Service enterprises are very heterogeneous and they innovate in a number of different ways. Evangelista (2006) finds that variation in innovation activities among service enterprises is substantially greater than for manufacturing enterprises. He finds for example much wider variation across service sectors compared to manufacturing sectors concerning overall innovative performance, the types of innovative activities carried out, and patterns of interaction.

Finally, it is becoming increasingly difficult to consider manufacturing and services as two distinct sectors. Many manufacturing enterprises are active in service development, some to the extent of transforming their business towards a complete focus on services. Service innovation is thus a phenomenon that should be analyzed across all industries in the economy. However, we know little about the blurring boundaries between manufacturing and services, and how manufacturing enterprises organize their service development activities.

The ServINNo project attempts to shed light on a variety of aspects concerning service innovation and their implications for innovation policy. A separate paper in the ServINNo project examines in detail the increasing integration of manufacturing and services. And, as a tool to analyse the wide diversity of service enterprises, the project develops a simple typology of service enterprises and service innovation processes, which highlights the core characteristics of service activities and innovation. Central dimensions that shape service activities and how they innovate are the degree of interaction with clients and the degree of product standardization.

This report examines service innovation in the Nordic countries utilizing data from the Fourth Community Innovation Survey (CIS4). The data and calculations have been provided by the statistical agencies responsible for CIS4 in each of the Nordic countries: Statistics Finland, Statistics Norway, Statistics Sweden, RANNIS in Iceland and CFA in Denmark. CIS4 covers innovation activity in the business sector over the three year period from 2002 to 2004.

Service innovation policy has drawn increasing attention in recent years. Both recent national and international studies (CEC, 2007; Forfas, 2006; Econ Analysis, 2005; DTI, 2007) have examined innovation activities in service enterprises and potential policy measures to promote service innovation. This interest has been particularly high in the Nordic countries. The analysis here focuses on a number of topics that are relevant for policy discussions. Among these are:

- the scope of innovation activities and their characteristics across service sectors and Nordic countries
- the blurring boundaries between manufacturing and services and identifying enterprises that are active in both goods and service development
- the role of non-technological innovation
- R&D activities in service enterprises
- external linkages with other enterprises and public research institutions
- and the role of intellectual property rights (IPR's)

## **2. Industry classifications**

In this paper we utilize the following breakdown of industrial classifications for service enterprises.

### **Service sectors**

- Wholesale trade
- Transportation
- Telecommunications
- Financial intermediation
- IT Service
  - IT consulting
  - IT software and data processing
- Technical business services

- Non-technical business services

In order to ensure comparability across Nordic countries, the group of covered sectors is restricted to those in Eurostat's Core NACE industries for innovation statistics<sup>1</sup>. In terms of enterprise size, the analysis here covers enterprises with 10 employees or more.

Note that attempts have been made to divide knowledge intensive services into more detailed categories. IT-services are divided according to a priori assumptions on product standardization, as this may be an important characteristic in the organization of innovation activities. For example, innovation processes in businesses producing standardized software products may differ greatly from businesses that offer specialized business solutions within IT. Business services are divided into two categories, those that are more technical in nature, such as engineering and technical testing, and less technical, such as accounting, legal services and management consulting. Note that the latter, non-technical business services, is not part of the Eurostat core, but is included due to its potential importance in understanding and classifying different types of service activities and service innovation. Data on non-technical business services are only available for Sweden and Denmark.

While this provides a broad coverage of the service sector, there are a number of service industries that are not covered in this classification. Service industries not included here are: Motor sales, Retail trade, Hotels and Restaurants, Tourism, Real estate, Renting, other business services such as labor recruitment and industrial cleaning, Public administration and a number of public, community or social services.

### **3. Basic Indicators**

In order to gain a general idea of the size of these industry groups and their economic importance for each of the Nordic countries, figure 1 shows the distribution of turnover for the Eurostat core industries for each country<sup>2</sup>. Table A.1 in the annex shows basic information on the size of each group in greater detail: number of enterprises, turnover as share of total turnover, number employees and share employees in innovation active enterprises (enterprises that have either introduced a product or process innovation over 2002-2004 or were in the process of doing so).

In terms of the number of enterprises, service and manufacturing sectors are almost equal in most countries (see annex). However, in terms of sales, manufacturing is significantly larger in Finland, while the opposite is the case for Denmark. The service sector is also larger than manufacturing in Norway. While services and manufacturing make up over 90 percent of the total in the other Nordic countries, they account for only around 70 percent in Norway. This reflects the large amount of activity in the extraction of crude petroleum for the Norwegian economy.

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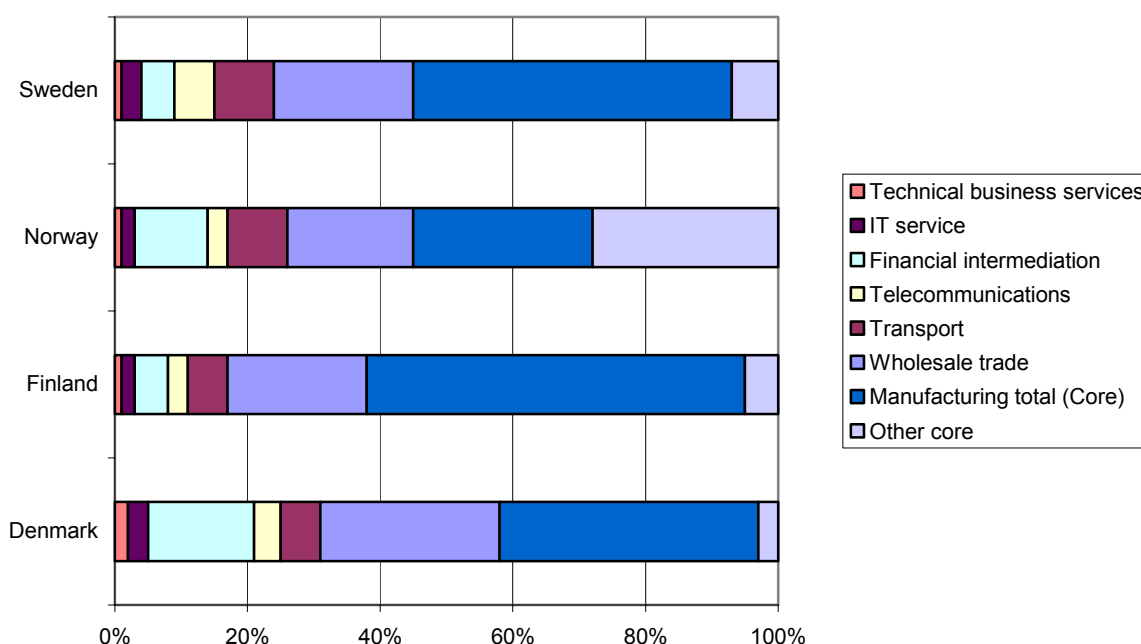
<sup>1</sup> See the Annex for a description of which NACE classes each industry group includes.

<sup>2</sup> Data not available for Iceland.



Wholesale trade is the largest service sector in terms of turnover for each country, at around 20 percent of total turnover<sup>3</sup> for Norway, Sweden and Finland, and 27 percent for Denmark. The transport sector is somewhat larger in Sweden and Norway than in Finland and Denmark, while the financial sector is larger in Denmark and Norway. Knowledge intensive services make up a small share of the service sector in terms of turnover. Telecommunications is largest in Sweden, while the share of turnover within Technical business services and IT service ranges from 3 to 5 percent across countries.

**Figure 1. Shares of total turnover by service sectors, 2004, Nordic countries. In percent.**



Source: Eurostat tables for CIS4 data for the Nordic countries. Data not available for Iceland. Note that 'total turnover' here is total turnover among the Eurostat Core NACE industries, and not aggregate turnover for all enterprises in each country. See the annex for a list of Core industries.

With a few exceptions, over half of employees in each industry group are in innovation active enterprises. The highest shares are generally within IT service and Telecommunications. However in Sweden this share in Telecommunications is quite low at around a third, while shares in other industry groups such as Wholesale trade, Financial intermediation and Technical business services are correspondingly high.

<sup>3</sup> Note that 'total turnover' here is total turnover among the Eurostat Core NACE industries, and not aggregate turnover for all enterprises in each country. See the annex for a list of Core industries.

## 4. Innovation performance in Nordic service enterprises

Innovation performance can be measured in a number of different ways, each providing different information on innovation processes in individual industries. This section will examine two types of indicators: shares of enterprises that have implemented a product or process innovation and shares of sales due to innovative products.

The CIS4 survey follows the guidelines set out in the Oslo Manual for the collection of innovation statistics (OECD/Eurostat, 1997, 2005). Box 4.1 shows the definitions utilized in the CIS4 survey.

### Box 4.1 Innovation concepts and definitions in CIS4

*Innovative enterprises* are defined as enterprises which introduced new or significantly improved products or processes during the observation period.

*Enterprises with innovation activity* are defined as enterprises which introduced new or significantly improved products or processes, OR had ongoing or abandoned innovation activity during the observation period.

A *product innovation* is the market introduction of a new good or service or a significantly improved good or service with respect to its capabilities, such as improved software, user friendliness, components or sub-systems.

A *process innovation* is the implementation of a new or significantly improved production process, distribution method, or support activity for your goods or services.

An *organisational innovation* is the implementation of new or significant changes in enterprise structure or management methods that are intended to improve your enterprise's use of knowledge, the quality of your goods or services, or the efficiency of work flows.

A *marketing innovation* is the implementation of new or significantly improved designs or sales methods to increase the appeal of your goods and services or to enter new markets.

Source: Eurostat CIS4 questionnaire

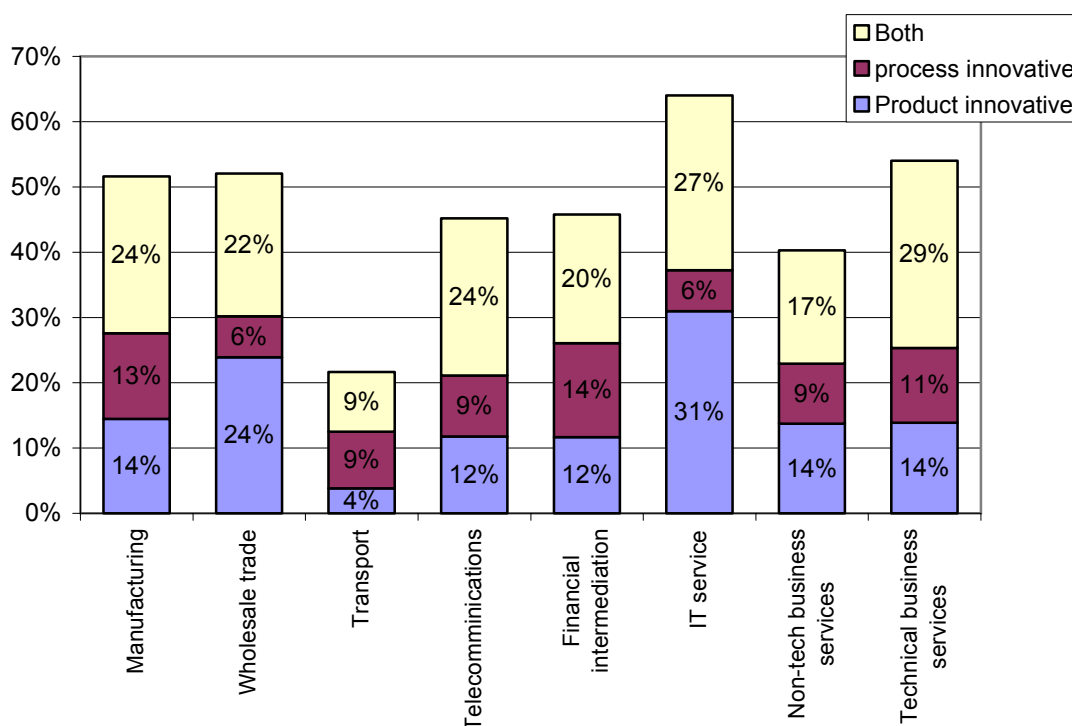
### 4.1. Product and process innovations

This first group of figures shows shares of enterprises that have implemented a product innovation, process innovation, or both. Some standard (though perhaps less widely held nowadays) conceptions of innovation in services are that it mainly entails the adoption of technologies for their internal and delivery processes and that products and processes are very closely linked (and in some cases indistinguishable). Both these views make it interesting to see the breakdown of enterprises in terms of product and process innovators.

As noted above, service sectors are highly heterogeneous. Nordic comparisons for the service sector as a whole will thus fail to capture this variation. For this reason, the figures here will be displayed across service sectors for each individual country. As will be seen, there is indeed wide variation across sectors and, in a number of cases, results also vary greatly for service sectors across countries.

Figure 2 shows shares of innovative enterprises for Sweden. In comparison with manufacturing, a smaller share of enterprises in services are process innovative (only), while the share of product-process innovative enterprises that have implemented both is very similar, at a little under a half. The figure indicates a high level of innovation activity among Swedish service enterprises, both compared to manufacturing and compared to results for the other countries. A little under two thirds of enterprises in IT services have implemented a product or process innovation, which is similar to other Nordic countries. In all Nordic countries, IT service is by far the service sector with the highest level of innovation activity. Innovation performance within Technical business services is substantially higher in Sweden than in other Nordic countries, with over 50 percent of enterprises having introduced a product or process innovation. And, with the exception of the transport sector, shares of product-process innovative enterprises are high for less 'high tech' industries such as wholesale trade and financial intermediation.

**Figure 2. Shares of product-process innovative enterprises for Sweden, CIS4 data. In percent.**



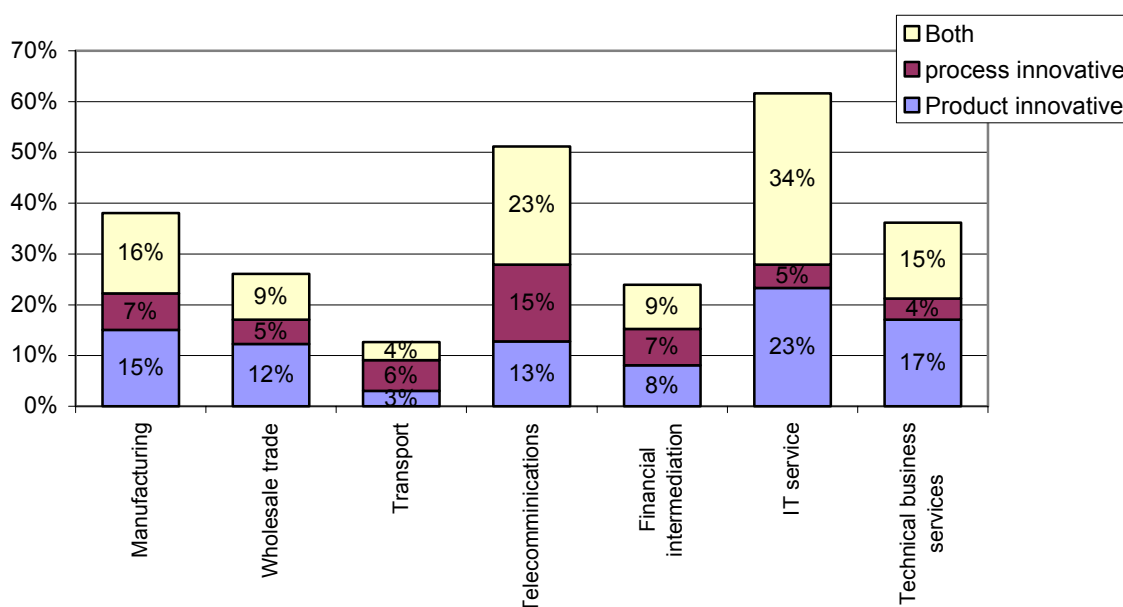
Source: CIS4 Eurostat tables for Sweden.

Innovation performance in Norway as measured by shares of product-process innovative enterprises (see figure 3), is strong in the ICT sector (IT service and Telecommunications), though much lower in other service sectors such as wholesale trade, transport and financial intermediation. Shares of product-process innovative enterprises are around 60 percent and 50 percent for IT services and Telecommunications, respectively, which is substantially higher than Norwegian manufacturing averages. 15 percent of enterprises in Telecommunications have implemented a process innovation only. This reflects the

substantial resources devoted to development and implementation of new technologies to improve internal processes and service delivery. Much of this development would appear to be undertaken in-house as evidenced by the high share of Norwegian telecommunications enterprises with intramural R&D and much lower share with acquisitions of external technology (see tables 1, A.5 and A.6).

In contrast to the ICT-based service sectors, innovation performance is very low in Wholesale trade, Transports and Financial intermediation, with around a quarter of enterprises in Wholesale and Financial intermediation having implemented a product or process innovation and only 13 percent within Transports. The share of product-process innovative enterprises in Technical business services is similar to that in Finland and Denmark.

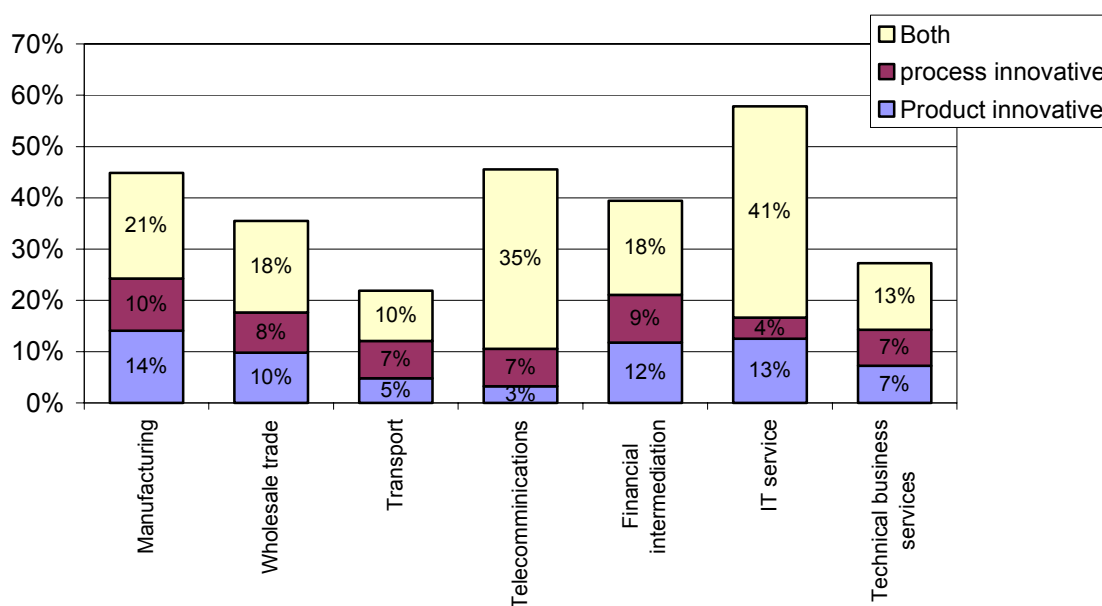
**Figure 3. Shares of product-process innovative enterprises for Norway, CIS4 data. In percent.**



Source: CIS4 Eurostat tables for Norway.

In Finland, a much higher share of product-process innovative enterprises have introduced both types of innovations. This is both in comparison with other countries and also with Finnish manufacturing enterprises. As in the other Nordic countries, innovation performance among Finnish service sectors is strongest in IT services, however, the share of innovative enterprises is much lower in Technical business services. 35 percent of enterprises in Telecommunications have implemented both a product and process innovation, and 41 percent in IT service. In particular, Telecommunications enterprises are extremely outward oriented, also internationally, with very high shares engaged in cooperation with external partners and also having acquired technology externally (see below).

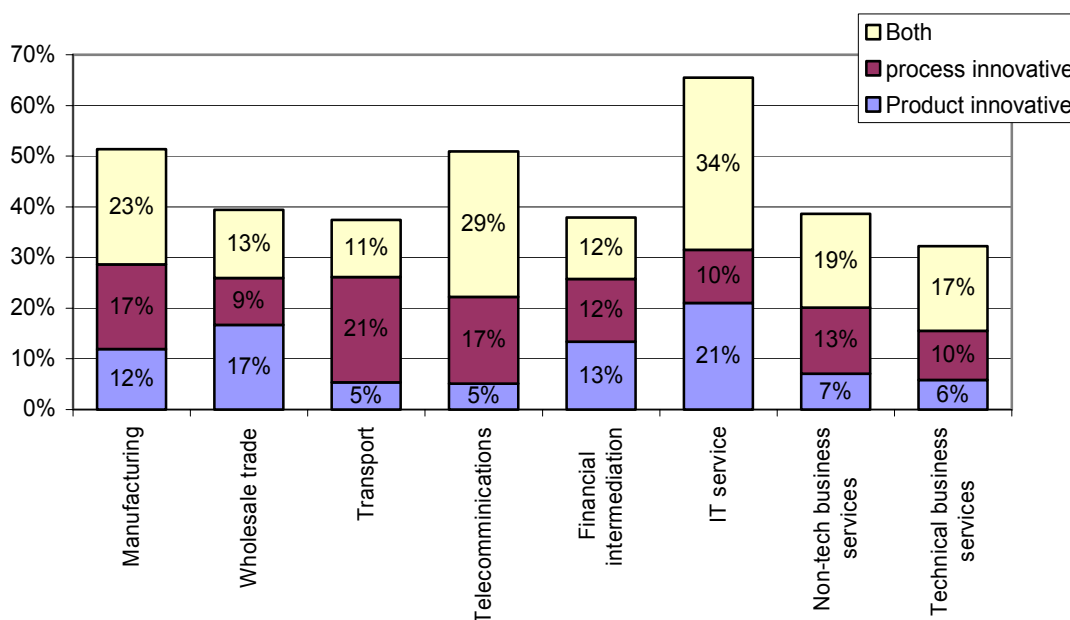
**Figure 4. Shares of product-process innovative enterprises for Finland, CIS4 data. In percent.**



Source: CIS4 Eurostat tables for Finland.

In Nordic comparison, innovation is significantly higher in the Danish transport sector<sup>4</sup>. In addition, both Transport and Telecommunications are fairly process oriented. Innovation

**Figure 5. Shares of product-process innovative enterprises for Denmark, CIS4 data. In percent.**



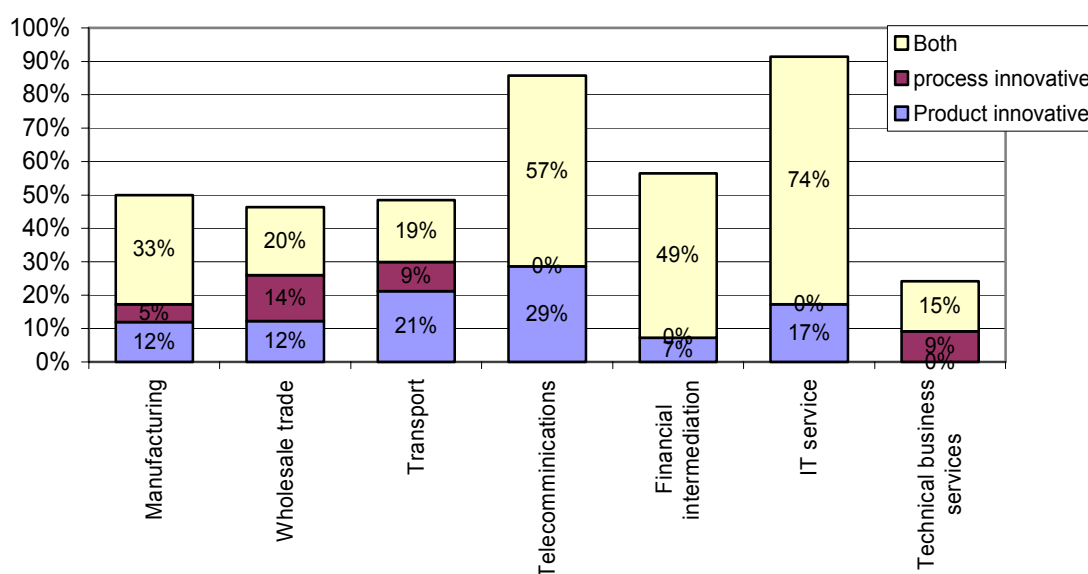
Source: CIS4 Eurostat tables for Denmark.

<sup>4</sup> Though, it should be noted that enterprises in the Transport sector with less than 50 employees are not surveyed in Denmark. This may impact the results for Transport.

activity appears to be somewhat more 'balanced' in Denmark: no sector has less than 30 percent innovative enterprises. Surprisingly, the share of innovative enterprises is actually lowest in Technical business services. Results for Non-tech business services for Denmark are very similar to those in Sweden, with around 40 percent having implemented a product or process innovation. However, the relation between Technical and non-tech business services are very different in the two countries. Technical business services are much more innovative in Sweden whereas the opposite is the case in Denmark.

For Iceland, the share of product-process innovative enterprises within Telecommunications and IT services is 85 to 90 percent. This is substantially higher than shares in other Nordic countries. Shares are around 50 percent in Wholesale trade, Transport and Financial intermediates, and under 25 percent for Technical business services. Thus, with the exception of Technical business services, shares of innovative enterprises in all other services are either around or higher than manufacturing averages.

**Figure 6. Shares of product-process innovative enterprises for Iceland, CIS4 data. In percent.**

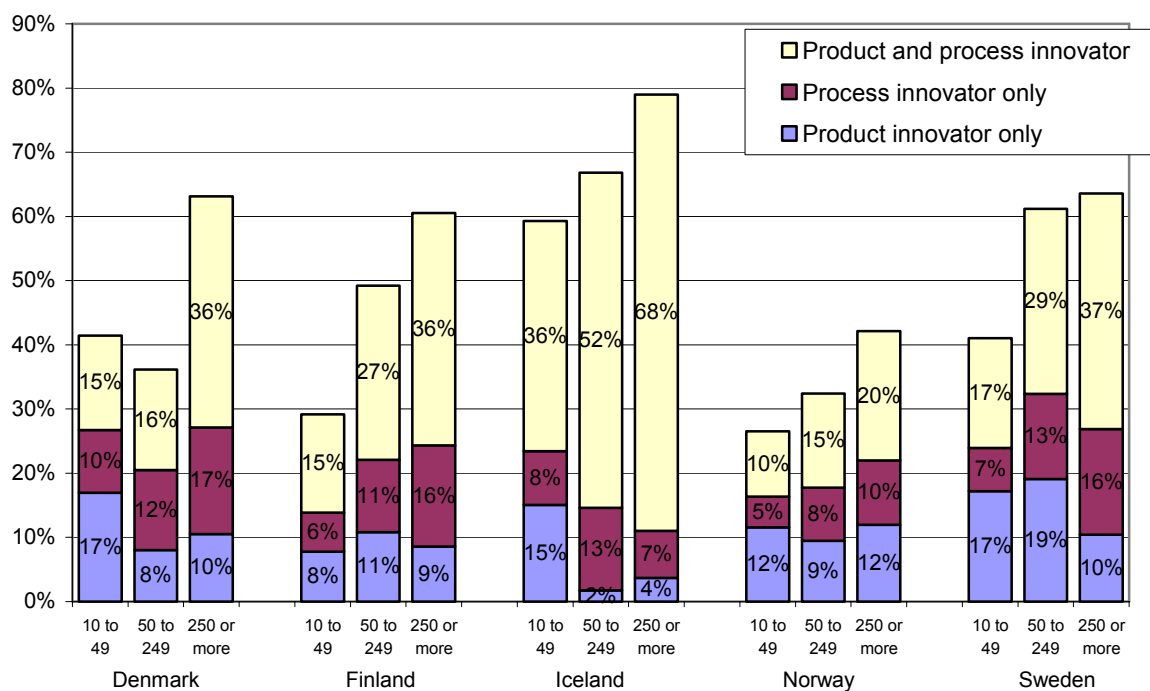


Source: CIS4 Eurostat tables for Iceland.

#### 4.1.1. Product and process innovation by enterprise size

Figure 7 shows shares of innovative enterprises across enterprise size classes for the five Nordic countries. It shows some fairly large differences among countries. For small enterprises, shares of innovative enterprises are significantly higher in Denmark and Sweden. Given that the large majority of enterprises are small (around 70 percent of enterprises with 10 or greater employees), this is a major source of the difference in shares of innovative enterprises for Denmark and Sweden compared to Finland and Norway.

**Figure 7. Shares of product-process innovative service enterprises by size class, Nordic countries, CIS4. In percent.**



Source: CIS4 Eurostat tables for the Nordic countries.

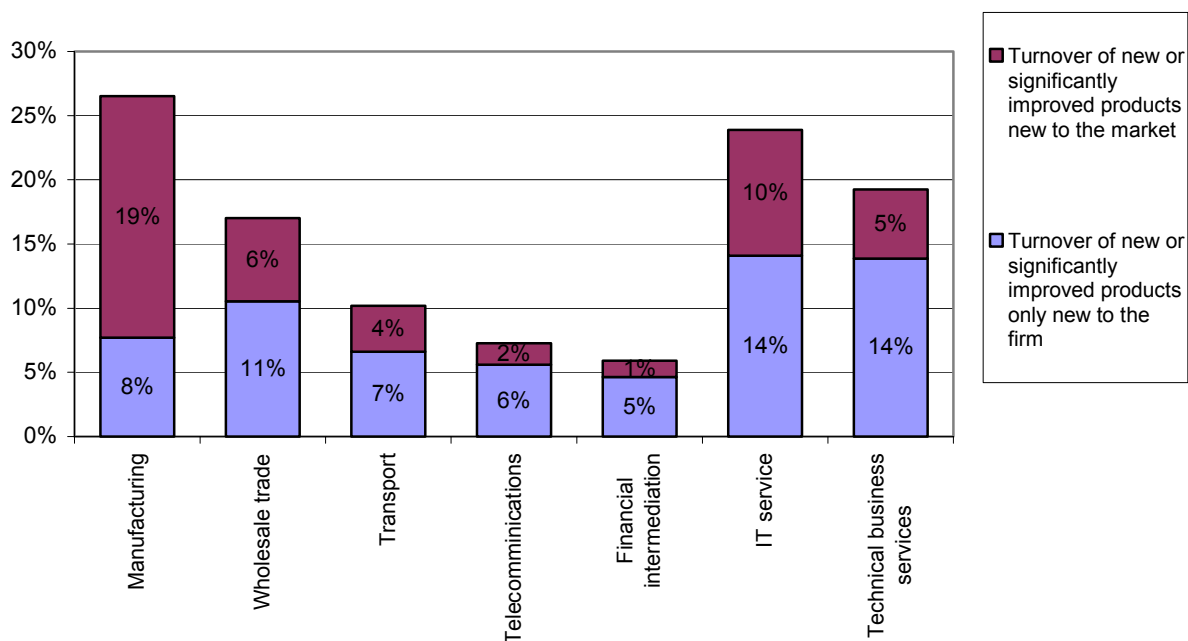
Innovation among medium sized enterprises is however much lower in Denmark in comparison. Shares for medium sized enterprises are much higher for Sweden and Finland, in contrast. And, unsurprisingly, for all countries the highest share of innovative enterprises is among large enterprises, at around 60 percent for Finland, Sweden and Denmark.

#### 4.2. Innovative sales

An important measure of the impact of innovation activity, or innovation output, is the share of sales that is due to product innovations, or innovative sales. Both at enterprise and aggregated levels, this provides an indication of the scope and impact of product development activities, and can supplement information on shares of innovative enterprises.

Figure 8 shows shares of innovative sales for Finnish service sectors, both the share of sales due to products that are new to the enterprise's market and products that are new only to the enterprise itself. None of the service sectors has shares of innovative sales that are greater than manufacturing averages, suggesting that innovative performance in Finland is much stronger in manufacturing than in services.

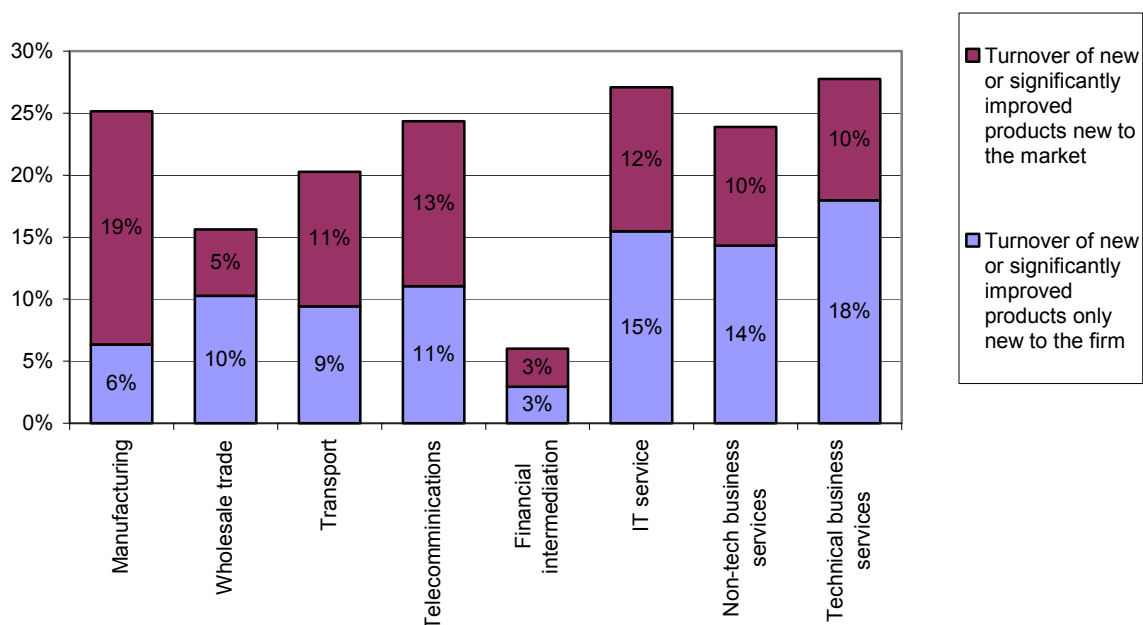
**Figure 8. Shares of turnover due to product innovations 2004, CIS4, Finland. In percent.**



Source: CIS4 Eurostat tables for Finland.

When examining shares of innovative enterprises, innovative performance for Finland in Wholesale trade and Technical Business Services were low in Nordic comparison. However, both these sectors have fairly high shares of innovative sales compared to other countries.

**Figure 9. Shares of turnover due to product innovations 2004, CIS4, Sweden. In percent.**

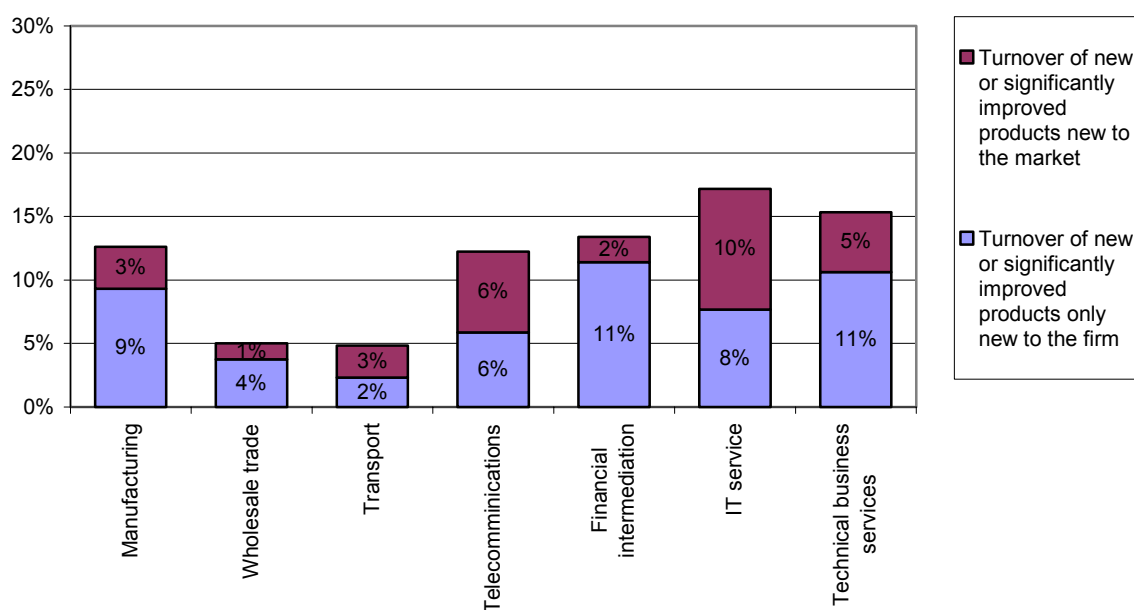


Source: CIS4 Eurostat tables for Sweden.



Sweden is by far the strongest Nordic performer in terms of innovative sales. With the main exception of Financial intermediation<sup>5</sup>, Sweden has the highest share of innovative sales across all service sectors. This is also the case for sales due to products new to the market. Shares of innovative sales for knowledge intensive service sectors are either at or above manufacturing averages, though shares due to new to market products are substantially lower than for manufacturing enterprises.

**Figure 10. Shares of turnover due to product innovations 2004, CIS4, Norway. In percent.**



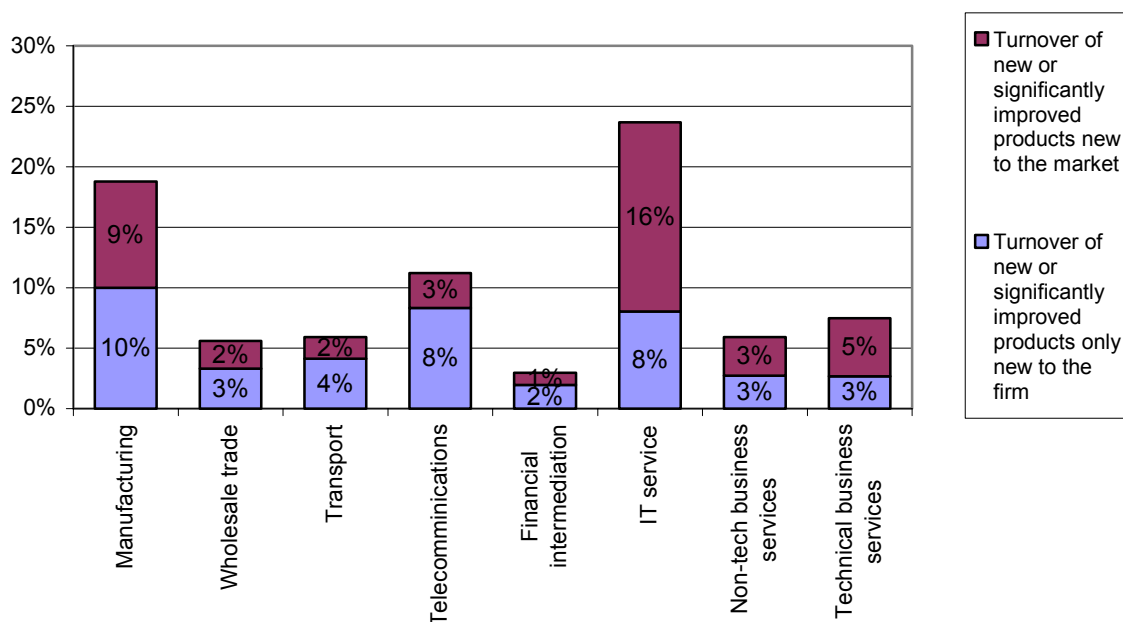
Source: CIS4 Eurostat tables for Norway.

Norwegian shares are lower than in Sweden and Finland, though are quite high in comparison with averages for Norwegian manufacturing. IT service, Telecommunications, Technical business services and Financial intermediation are all at or above manufacturing averages. Furthermore, the shares due to novel (new to market) products are also higher than in manufacturing in a number of service sectors.

With the single exception of IT service, shares of innovative sales in Danish service sectors are very low, both in comparison with manufacturing and with other Nordic countries. This results contrasts somewhat with the generally higher shares of product-process innovative enterprises.

<sup>5</sup> Share of innovative sales for Wholesale trade is slightly higher for Finland.

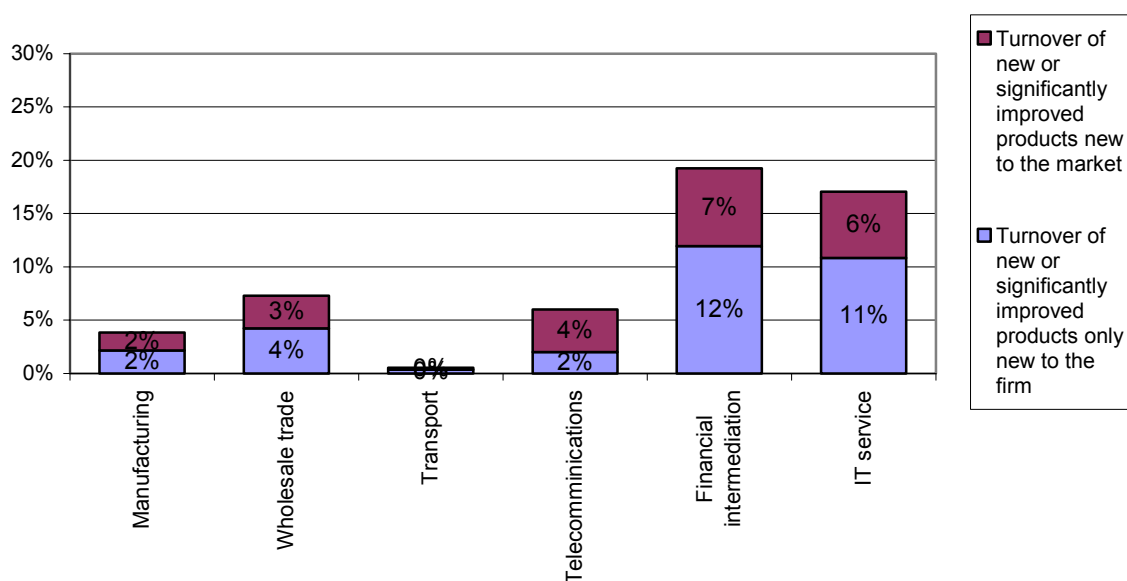
**Figure 11. Shares of turnover due to product innovations 2004, CIS4, Denmark. In percent.**



Source: CIS4 Eurostat tables for Denmark.

In contrast to the other Nordic countries, shares of innovative sales in Iceland are much lower in manufacturing (4 percent) than in the majority of service sectors. Financial intermediation and IT service have the highest shares among Icelandic service sectors.

**Figure 12. Shares of turnover due to product innovations 2004, CIS4, Iceland. In percent.**



Source: CIS4 Eurostat tables for Iceland. Shares for Technical business services not shown due to insufficient observations.

## 5. Dual innovators

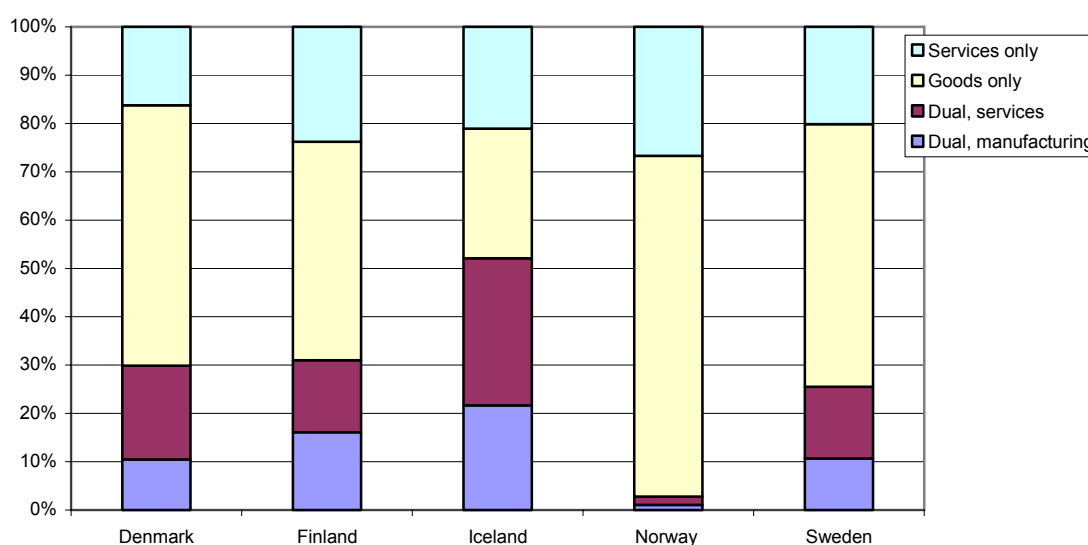
Service innovation, or the development of new services, is not a phenomenon that is restricted to the service sector. 'Traditional' manufacturing enterprises appear to be devoting an increasingly greater share of their activities towards the production of services. However, there is a lack of statistical data on this trend and its scope, nor has there been much analysis of innovation processes for service development in manufacturing enterprises<sup>6</sup>. The development and delivery of services may pose a whole new set of challenges for manufacturing enterprises, in terms of knowledge competences, organizational practices and distribution channels.

A special feature of the CIS4 survey is that it separates product innovations into goods innovations and service innovations. This allows us to identify service innovating enterprises across industrial classes in both the manufacturing and service sectors. Furthermore, we are able to identify those enterprises that are active in both good and service innovation.

Dual innovators refer to enterprises that have implemented both a good and service innovation. An analysis of dual innovators can help provide a picture of how prevalent service innovation is in manufacturing enterprises (and likewise the prevalence of goods innovation in the service sector). In addition, it can help provide some information on how these enterprises innovate.

Figure 13 shows the aggregate shares of product innovators in the five Nordic countries, broken down according to type of product innovation. In some cases it may be interesting to distinguish dual innovators (good and service innovators) in manufacturing from those in services. These two types are identified in figure 13.

**Figure 13. Aggregate shares of product innovators by type of product innovation, CIS4, Nordic countries. In percent.**



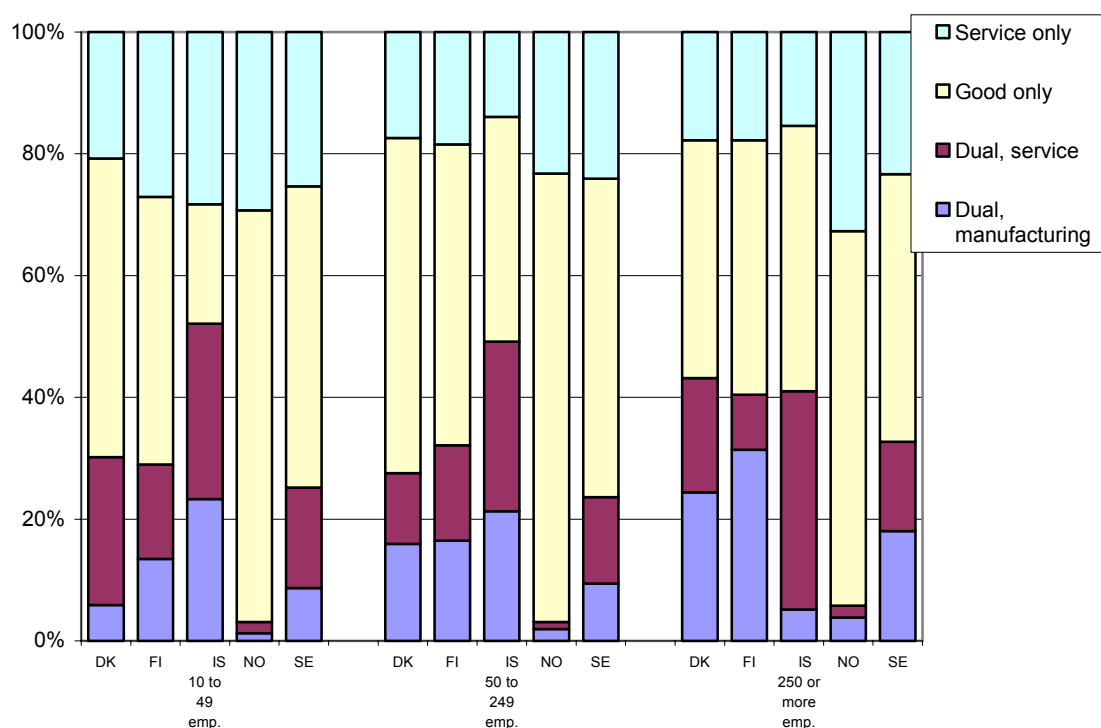
Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater.

<sup>6</sup> See however, Christensen and Drejer (2007).

In Denmark, Finland and Sweden, 9 percent of enterprises have introduced both new goods and services, amounting to from a quarter to a third of all product innovators. In Norway, however, the share of dual innovators is almost negligible. Given the large degree of homogeneity of the Nordic countries in most other aspects, this result is surprising.

Figure 14 shows product innovative enterprises by size in terms of number of employees. As would be expected, large enterprises have the highest shares of dual innovators, around 22 percent in Denmark and Finland, and 18 percent in Sweden. However, it is not only large enterprises that are capable of introducing both new goods and services. Shares of dual innovators among small enterprises are between 7 and 9 percent for Denmark, Finland and Sweden. And, while the majority of dual innovators are within manufacturing for large enterprises, they are mostly found in services for small enterprises.

**Figure 14. Shares of product innovators by type of product innovation and size classes, CIS4, Nordic countries. In percent.**



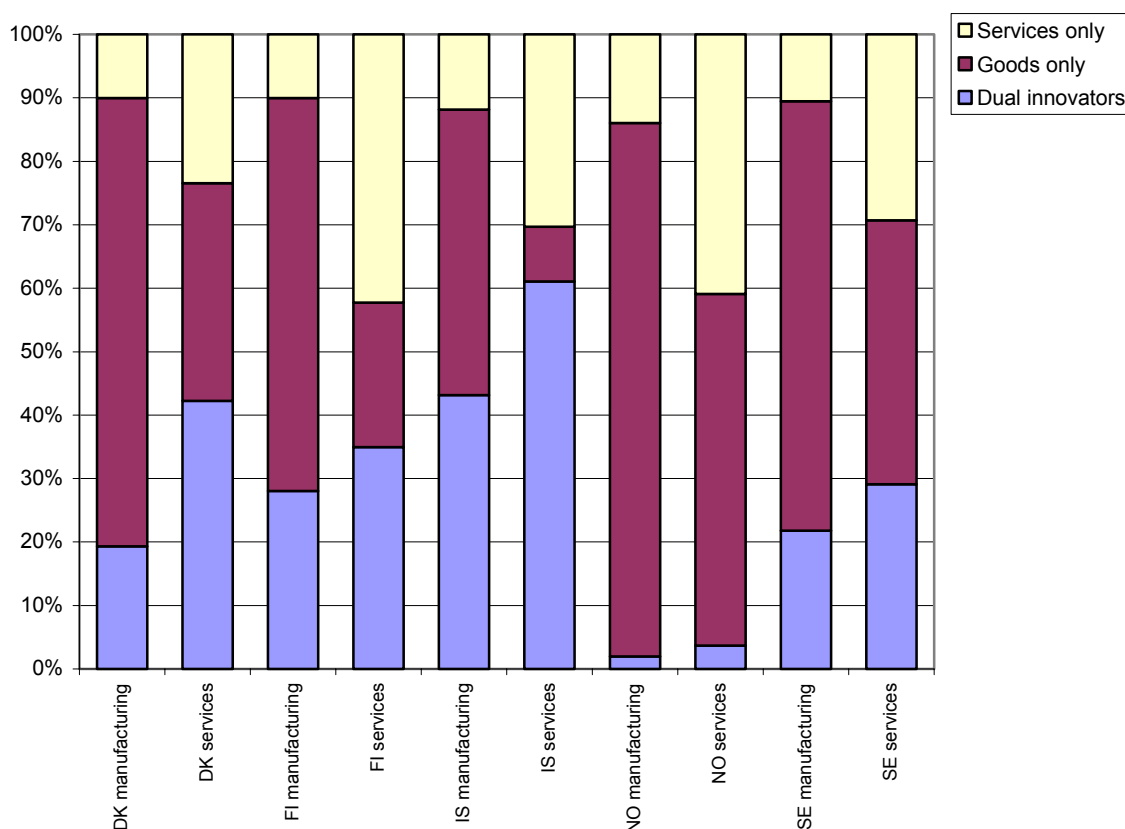
Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater.

As figure 15 shows, the share of product innovators that have implemented both good and service innovations is higher within the service sector than manufacturing for all Nordic countries. For Denmark the share of dual innovators in services is twice as high as for manufacturing, while the difference is somewhat smaller for the other countries. Note also that in all countries around 10 percent of product innovators in manufacturing have only implemented service innovations. This may for some enterprises reflect an ‘incorrect’

industrial classification (ie. these enterprises should actually be classified as service enterprises), but may also indicate manufacturing businesses that produce both goods and services, but have placed focus on service development.

Correspondingly, the share of goods innovators in services is also high, and for Norway, Sweden and Denmark, the share of goods innovators in services actually exceeds the share of service innovators.

**Figure 15. Shares of product innovators by type of product innovator within services and manufacturing, CIS, Nordic countries. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater.

For individual sectors<sup>7</sup>, by far the highest share of dual innovators is in IT services, where combined goods and services development appears to be more the rule than the exception. Close to 40 percent of Danish enterprises in IT consulting have introduced new goods and services, while shares for Sweden and Finland are between 20 and 30 percent. Shares of dual innovators in IT services are very low for Norway, though, interestingly, product

<sup>7</sup> Table A.2 in the annex shows shares of product innovators by industry groups. Manufacturing is divided into 4 groups: high tech, medium high tech, low medium tech and low tech manufacturing. For the service sector we use the same industrial classification as in the rest of the paper.

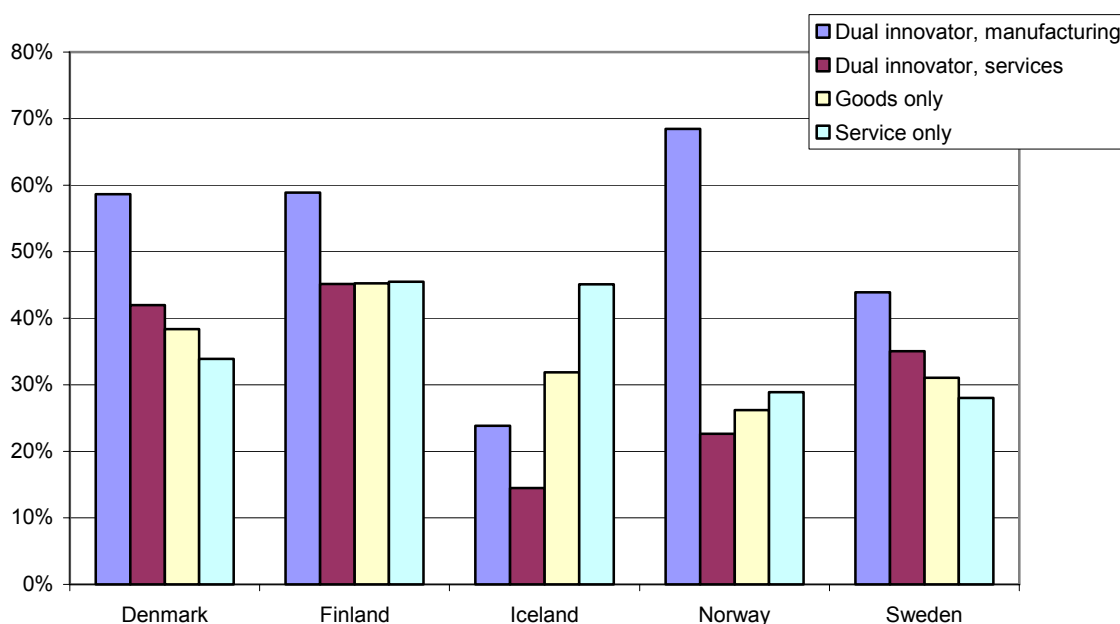
innovators are evenly divided between goods and service innovators and the overall share of product innovators is very similar to the other countries. However, this result does not hold for other sectors in Norway. Generally, the share of service innovators in manufacturing is very low, as is the share of goods innovators in services.

In Wholesale trade the share of dual innovators is around 13 percent in Sweden, Finland and Denmark. However, the remaining product innovators in wholesale trade are almost entirely goods innovators; only a very small share are service innovators.

With a few exceptions, shares of dual and service innovators in manufacturing are fairly constant across industries. Around 10 percent of enterprises in each manufacturing industry group are dual innovators and around 3 to 5 percent are service innovators only. This suggests that service development takes place across a broad range of manufacturing enterprises, both high tech and less R&D intensive.

Goods and service development can be argued to pose very different challenges for enterprises in terms of organizational practices, knowledge exchange and required capabilities. This makes it interesting to examine the use of linkages to access external knowledge. The question here is whether dual innovation places additional demands on enterprises' innovation processes, in particular in terms of external linkages. Figure 16 shows shares of product innovative enterprises that have cooperation with customers or competitors, for the four types of product innovative enterprises: goods only, services only, dual manufacturing and dual services. More detailed results on innovation cooperation use of external information sources and technology acquisitions can be found in table A.2 in the annex.

**Figure 16. Shares of product innovators engaged in innovation cooperation with customers or competitors by type of product innovator, CIS4, Nordic countries. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater.

In all countries, dual innovators in manufacturing are more active in accessing external knowledge and also tend to consider external sources of information as greater in importance (see table A.3 in the annex). The difference is largest for client interaction, as illustrated in figure 16. A possible reason for this is that service development may require much greater client interaction than for the development of goods, implying that manufacturing enterprises that develop and offer service products will tend to have a greater need for client interaction than enterprises that mainly produce goods.

Cooperation with customers and competitors is significantly lower for dual innovators in services, though these cooperation shares are slightly higher than those for enterprises with only service innovations. Also in broader terms, use of external linkages for dual innovators in services does not differ from product innovators in general. This could potentially indicate that service innovation places additional requirements on manufacturing enterprises, but the reverse is less the case: innovative service enterprises may be more easily able to integrate goods development into their innovation activities.

## **6. Subtypes of innovations – technological and non-tech innovation**

The Oslo Manual innovation concept includes four different subtypes: product, process, organizational and marketing innovations. An examination of simple combinations of innovation types may be useful to investigate a number of issues, particularly the prevalence of non-technological (ie marketing and organizational) innovation among technological (ie product and process) innovators. In order to simplify comparison across countries and industry groups, we classify enterprises into three groups:

- Technological innovators (product and/or process innovation only)
- Non-tech innovators (marketing and/or organizational innovation only)
- Tech and non-tech innovators

The concepts of marketing and organizational innovation are new and not all EU countries included them in CIS4. Hence, results using non-technological innovation may to some extent be considered exploratory. Though, given the importance attached to the role of organizational innovation, it is worthwhile to attempt to examine these factors. Of the five Nordic countries, Norway, Denmark and Iceland included non-technological innovations in CIS4. Finland, however, included in CIS4 questions on organizational and marketing changes along the lines of those used in CIS3. While it should be emphasized that these questions are not fully comparable with those for Denmark, Norway and Iceland, we include them to give a rough comparison<sup>8</sup>.

Figure 17 shows distributions in the four countries for the service sector as a whole. Denmark stands out among the countries in having a markedly higher share of service enterprises with non-tech innovations, both in total and for enterprises with non-tech

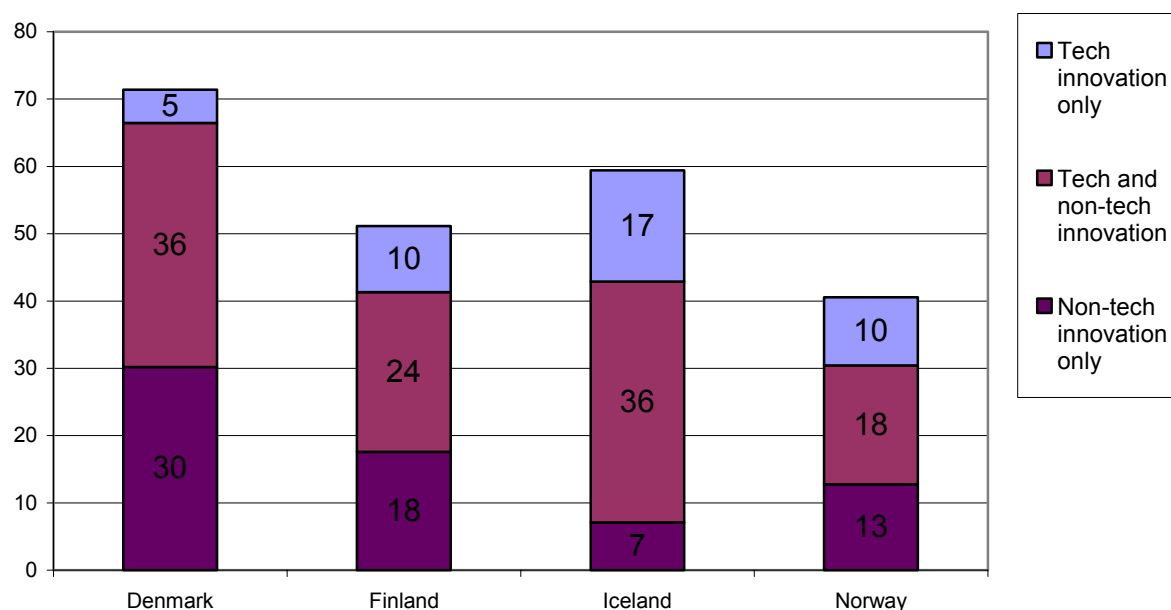
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<sup>8</sup> Data on organizational and marketing innovations are not available for Sweden.

innovations only. 41 percent of Danish service enterprises have implemented a product or process innovation (with or without non-tech innovation) and around half of non-(product/process) innovators have implemented a marketing or organizational innovation. While this share is much lower in Finland, Norway and Iceland, it is still the case that a high share of tech innovators have also implemented non-tech innovations.

A fairly general conception of innovation in service enterprises compared to manufacturing is a greater reliance on non-technological (in particular, organizational) innovation in their innovation activities. Of the Nordic countries, Denmark seems to best fit this view: compared to manufacturing enterprises<sup>9</sup>, a greater share of Danish service enterprises have only non-tech innovations (30 percent to 21 percent) and a lower share of service enterprises have implemented technological innovations only (5 percent to 12 percent). This tendency can also be seen for Finland, Norway and Iceland, though differences between manufacturing and services are somewhat smaller.

**Figure 17. Shares of innovators by type of innovation in the service sector, CIS4, Nordic countries. In percent**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Shares based on total number of enterprises with any of the four types of innovations, product, process, organizational or marketing. Data on organizational and marketing innovations not available for Sweden. Note also that for Finland, non-technological innovation refers to questions of organizational and marketing changes. Thus, results for Finland may not be fully comparable to those for the other countries.

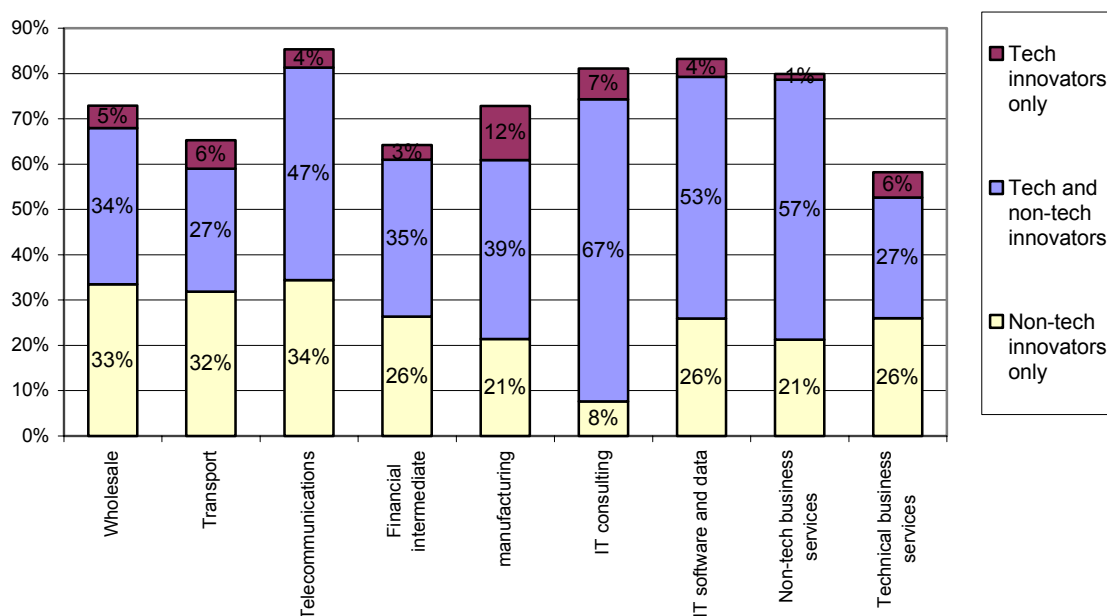
Figure 18 shows shares of enterprises with tech and non-tech innovations for Denmark. In general, shares of enterprises with organizational and/or marketing innovation only ('soft innovators') and those with product-process innovations only are fairly stable across service

<sup>9</sup> Results for manufacturing enterprises can be seen in the figures for individual countries below.



sectors. However, the data does show a number of interesting points. First, in relative terms, shares of soft innovators are very high in less innovative sectors. For Wholesale trade, Transport and Financial intermediates, shares of soft innovators are almost as high as shares of product-process innovators. Second, organizational innovation appears to be a particularly important part of product and process innovations in knowledge intensive sectors. In IT consulting, which likely includes IT service enterprises with more specialized products, almost all product and process innovation is accompanied by non-tech innovation. Shares are somewhat smaller though still high in IT software and data, and Non-technical business services, both of which may tend to offer more standardized products. Shares of combined tech and non-tech innovations are notably lower for Technical business services.

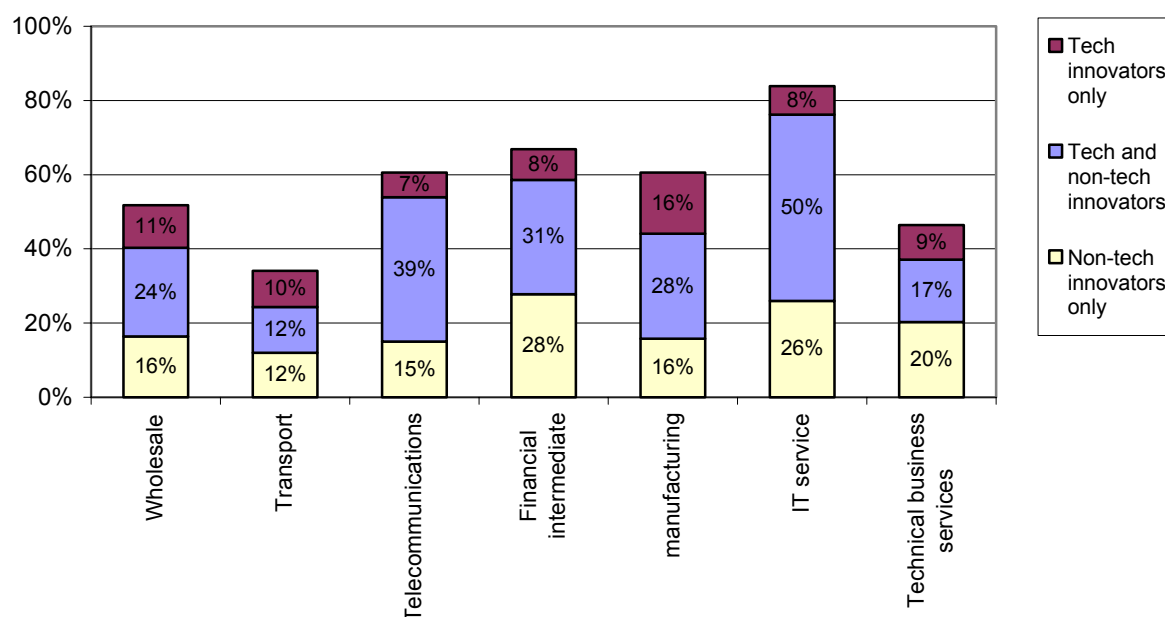
**Figure 18. Shares of innovators by type of innovation and sector, CIS4, Denmark. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Shares based on total number of enterprises with any of the four types of innovations.

Figure 19 shows shares for Finland, where it should again be noted that information on non-tech innovations is based on questions concerning changes in organizational and marketing practices (which are somewhat different from those used for the other countries). While the overall share of enterprises with non-tech innovations is lower than in Denmark, it can be seen that non-tech innovation activity is quite high in selected Finnish sectors such as IT service, Financial intermediates and Technical Business Services. In other service sectors the share of soft innovators (ie with non-tech innovation only) is similar to that in manufacturing, though it is still that case that a higher share of service enterprises with product-process innovations, have also implemented non-tech innovations.

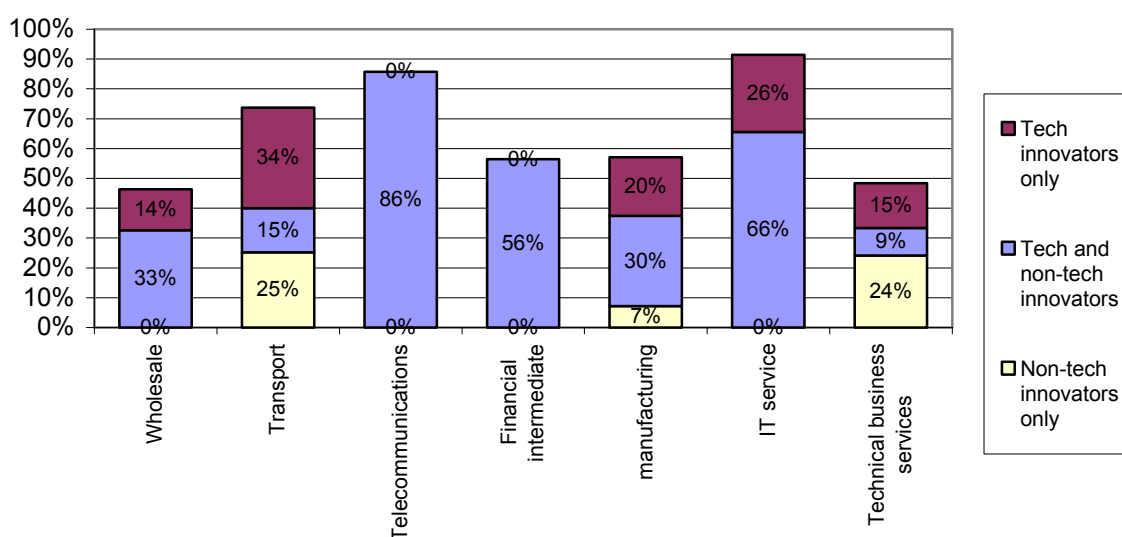
**Figure 19. Shares of innovators by type of innovation and sector, CIS4, Finland. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Shares based on total number of enterprises with any of the four types of innovations. Note that for Finland, non-technological innovation refers to questions of organizational and marketing changes. Thus, results for Finland may not be fully comparable to those for the other countries.

For Iceland there is a large amount of variation across sectors, with all product-process innovative enterprises having implemented non-tech innovations in some sectors (Telecommunications and Financial intermediates) and a small share in others (Transport and Technical Business Services). Soft innovators are found in only two service sectors, Transport and Technical Business Services.

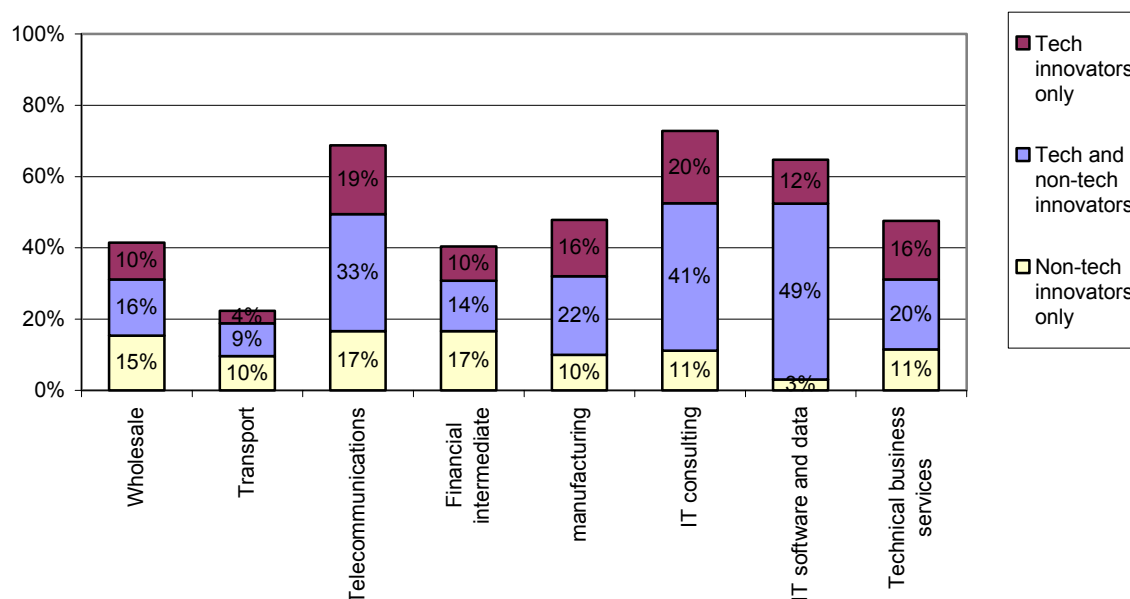
**Figure 20. Shares of innovators by type of innovation and sector, CIS4, Iceland. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Shares based on total number of enterprises with any of the four types of innovations.

In terms of totals, shares of non-tech innovations among Norwegian enterprises are slightly higher in services than in manufacturing. 64 percent of product-process innovators within services have also implemented a non-tech innovation compared to 58 percent in manufacturing, and 13 percent of service enterprises are soft innovators compared to 10 percent in manufacturing. The highest share of soft innovators are in Financial intermediates and Telecommunications, while the highest shares of non-technological innovation are found in IT consulting and IT software.

**Figure 21. Shares of innovators by type of innovation and sector, CIS4, Norway. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Shares based on total number of enterprises with any of the four types of innovations.

## 7. R&D and acquisitions of technology

This section examines the development and acquisition of new technologies for service enterprises. A general perception is that service enterprises are less R&D intensive than manufacturing enterprises. At the same time it is also recognized that R&D in services may be more poorly captured in statistics. There has been considerable focus on R&D in services, with the goal of emphasizing the need for creative innovation activity in service development and to identify the creative innovation activities that are already taking place.

Table 1 shows shares of innovation active enterprises that engage in intramural R&D, across Nordic countries and service sectors. The table shows that for Finland, Iceland, Norway and Sweden, high shares of innovation active enterprises (enterprises that either have implemented a product or process innovation or have been in the process of doing so) have R&D across all service sectors and size classes. In almost all cases, over half of the enterprises in each sector have own R&D activities, and for knowledge intensive services (telecommunications, IT services and business services) shares are generally greater than

shares for the manufacturing sector. Shares in other sectors are slightly lower than for manufacturing.

Shares of innovation active enterprises with R&D for Denmark are lower than the other four Nordic countries in almost all sectors and size classes. This is particularly the case for Wholesale trade, Transport and for small enterprises. The transport sector provides an interesting example. Denmark has a relatively high share of product-process innovative enterprises (37%) in Transport, but a very low share of these enterprises have R&D. Finland, Norway and Sweden on the other hand have lower shares of product-process innovative enterprises (24%, 16% and 22% respectively), but around half of these enterprises are R&D active. Iceland has a high share in both cases. One interpretation to this is that Finland, Norway and Sweden have a high degree of creative activity in this 'low tech' sector, while Denmark has a much lower level of creative activity, but a higher degree of adoptive innovation.

**Table 1. Shares of innovation active enterprises with intramural R&D, CIS4, Nordic countries. In percent.**

	Denmark	Finland	Iceland	Norway	Sweden
<b>Sector</b>	Share innovation active enterprises with intramural R&D				
Wholesale	15%	52%	14%	40%	47%
Transport	17%	46%	59%	47%	54%
Telecommunications	49%	53%	67%	79%	54%
Financial intermediate	28%	52%	89%	31%	52%
IT consulting*	57%	90%	91%	86%	92%
IT software and data processing	54%			88%	76%
Non-tech business services	43%	NA	NA	NA	51%
Technical business services	57%	83%	NA	85%	75%
Manufacturing	46%	75%	59%	77%	75%
<b>Enterprise size</b>					
10 to 49 employees	32%	64%	55%	62%	63%
50 to 249 employees	46%	75%	57%	75%	71%
250 or more employees	68%	88%	67%	79%	78%

Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Innovation active enterprises include all enterprises with either a product or process innovation or innovation activities over the period 2002-2004.

NA: Data on Non-tech business services not available for Finland, Iceland and Norway. Data on Technical business services not available for Iceland.

\*For Finland and Iceland, sectors IT consulting and IT software and data processing are combined.

Included in the annex are tables showing shares of innovation active enterprises that have acquired disembodied technology (either extramural R&D or other knowledge acquisitions such as licenses or consultancy) or embodied technology (machinery, equipment or software related to product or process innovations)<sup>10</sup>. This provides information on sectors' reliance on external knowledge sources, either to supplement in-house development activities or to

<sup>10</sup> See tables A.5 and A.6.

adopt technologies that enterprises are unable to develop in-house. In general shares of enterprises that have acquired disembodied technology are more equal across countries. One exception is higher shares for Finland within knowledge intensive services.

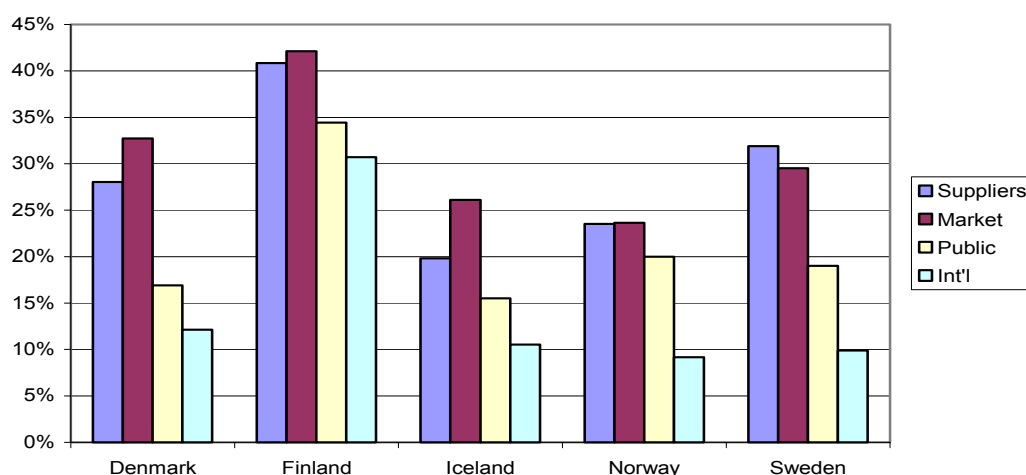
It would generally be expected that acquisitions of embodied technology are most important for innovation in both technical sectors and less R&D intensive sectors that rely mainly on technology adoption. This is generally also the case; shares of enterprises that have acquired machinery or software are generally higher than shares with R&D within Wholesale trade, Transport, Telecommunications and Financial intermediation. An exception to this is Norway, where shares that have acquired embodied technology are around half of the shares of enterprises with R&D.

## 8. Linkages

The innovation systems literature has long highlighted the importance of external knowledge sources for innovation activities. Interaction with other enterprises or public research institutions may be valuable throughout the innovation process, from early development to product launching. The more recent concept of open innovation also emphasizes the need for use of external knowledge in order to innovate successfully.

Figure 22 shows shares of innovation active enterprises in the service sector with innovation cooperation for the Nordic countries. Market cooperation includes cooperation with customers or competitors, while public cooperation includes cooperation with universities or government research institutions. Figures for suppliers, market and public include cooperation regardless of geographic location of cooperation partner. International cooperation includes cooperation with any external partner located abroad, public or private.

**Figure 22. Shares of innovation active enterprises with innovation cooperation, service sector, Nordic countries, CIS4. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Innovation active enterprises include all enterprises with either a product or process innovation or product-process related innovation activities over the period 2002-2004.

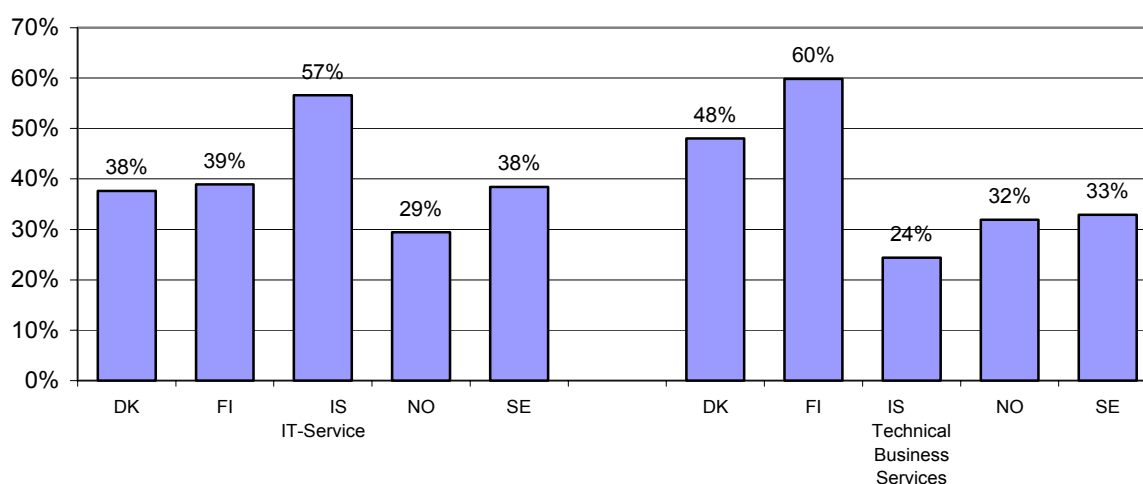
As can be seen in the figure, Finland has by far the highest shares of innovation active enterprises with cooperation, regardless of type of partner. This difference is particularly large for cooperation with public research or international partner. Shares with cooperation with either of these types is over 30 percent for Finland, while corresponding shares in the other countries are around 15 percent for public research institutions and 10 percent for international partners.

With the exception of Sweden, customers and competitors are the most frequent cooperation partner for Nordic service enterprises, followed by suppliers.

### 8.1. Innovation cooperation in knowledge intensive services

Figures 23, 24 and 25 examine cooperation with individual types of sources for the five Nordic countries. These figures focus on two sectors, IT service<sup>11</sup> and Technical Business Services. Table A.7 in the annex below shows more complete results for all service sectors, both for innovation cooperation and for use of information sources in innovation activities.

**Figure 23. Shares of innovation active enterprises with cooperation with customers or competitors, Nordic countries, CIS4. In percent.**



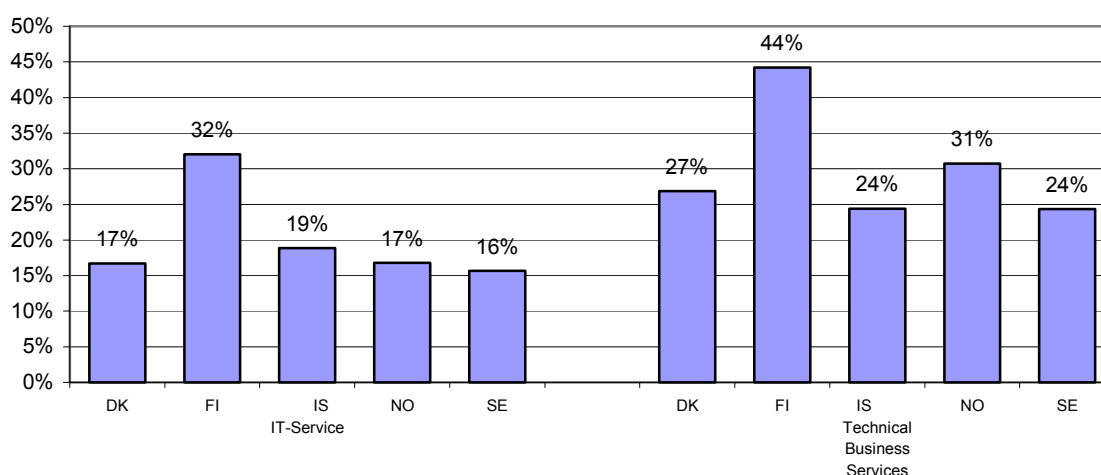
Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Innovation active enterprises include all enterprises with either a product or process innovation or innovation activities over the period 2002-2004.

Figure 23 shows shares of enterprises with market cooperation, ie cooperation with customers or competitors, while figure 24 shows shares that cooperation with public research institutions. Generally, cooperation with customers and competitors is much higher than with public research, particularly for service enterprises. While market cooperation is also higher for these two sectors, a fairly high share of knowledge intensive service enterprises also actively cooperate with universities and government research. This is particularly the case for Finland and Denmark. Within IT services, Icelandic enterprises have

<sup>11</sup> Note that IT service is a combination of IT consulting and IT software development.

the highest rate of cooperation with customers and competitors (57 percent), while shares with cooperation are slightly under 40 percent in Finland, Sweden and Denmark. Within Technical Business Services, enterprises in Denmark and Finland most actively cooperate with customers and competitors.

**Figure 24. Shares of innovation active enterprises with cooperation with public research institutions, Nordic countries, CIS4. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Innovation active enterprises include all enterprises with either a product or process innovation or innovation activities over the period 2002-2004.

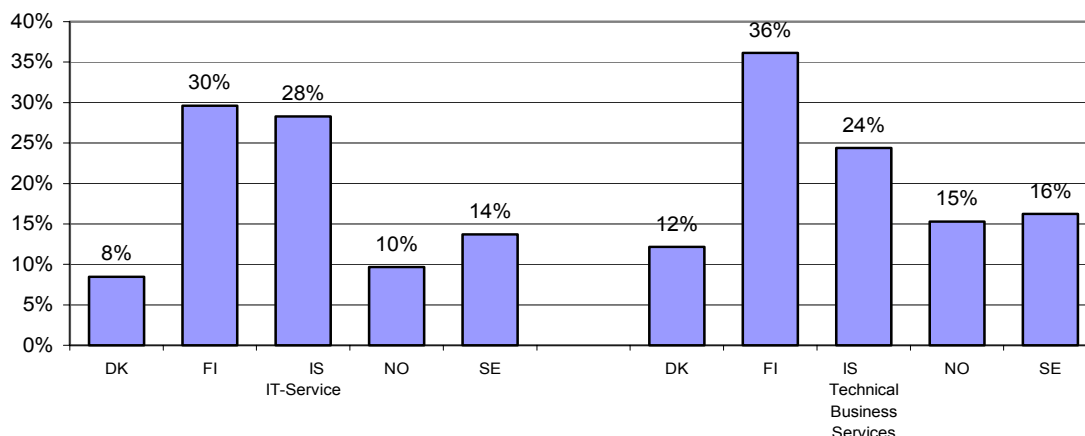
An important topic for service innovation and service innovation policy is the internationalisation of services. One dimension to internationalisation is linkages to external partners abroad. In Finland and Iceland, a fairly large share of innovation active enterprises have innovation cooperation with international partners, while shares are much lower in the other Nordic countries, particularly for Denmark. However, for all countries except Iceland, cooperation shares for knowledge intensive services are similar to shares for manufacturing. Hence, international cooperation for service enterprises is not generally lower than for manufacturing enterprises.

Table A.7 in the annex shows innovation cooperation and use of external information sources for all service sectors<sup>12</sup>. Suppliers and customers/competitors appear in many cases to be equally important as cooperation partners. Enterprises in sectors such as Wholesale Trade, Transport and Telecommunications have a slight tendency to cooperate more with suppliers, while market cooperation partners are somewhat more frequently used in knowledge intensive services. Cooperation is generally lower in Financial intermediates than for example IT services, Telecommunications or Business services, and cooperation with suppliers is just as likely as with customers and competitors. However, in particular market

<sup>12</sup> Results for information sources are given in shares of innovation active enterprises that cite a source as either important or highly important. Note that data on information sources is not available for Sweden.

sources are cited as highly important for innovation activities in Financial intermediates, suggesting that many financial businesses access external knowledge through other means that collaborative arrangements.

**Figure 25. Shares of innovation active enterprises with cooperation with international partners, Nordic countries, CIS4. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Innovation active enterprises include all enterprises with either a product or process innovation or innovation activities over the period 2002-2004.

A much lower share of service (and manufacturing) enterprises cite public research institutions as important information sources for their innovation activities. However, for those that do cite them as important, a high share engages in active cooperation with public research (ie shares for important information sources and cooperation and fairly similar concerning public research institutes). With the notable exception of Finland, cooperation with international partners (of any type) is much lower across service sectors, though shares are similar to manufacturing averages.

Finland stands out as having very high shares of innovation cooperation across both types of external partners and sectors. In particular, very high shares of innovation active enterprises in Telecommunications and Technical Business Services have cooperation with other enterprises and public research institutes. And, as already noted, Finnish service (and manufacturing) enterprises are much more actively engaged in cooperation with international partners. With the exception of Transport and Financial intermediates, around a third or more enterprises have an international cooperation partner.

Shares of enterprises with innovation cooperation are generally significantly lower in Norway. Shares with cooperation in knowledge intensive services are roughly similar to manufacturing averages and lower in other sectors. Patterns of innovation cooperation in Sweden are fairly constant across service sectors and generally quite high in Nordic comparison. For Danish service enterprises, cooperation is generally higher in knowledge



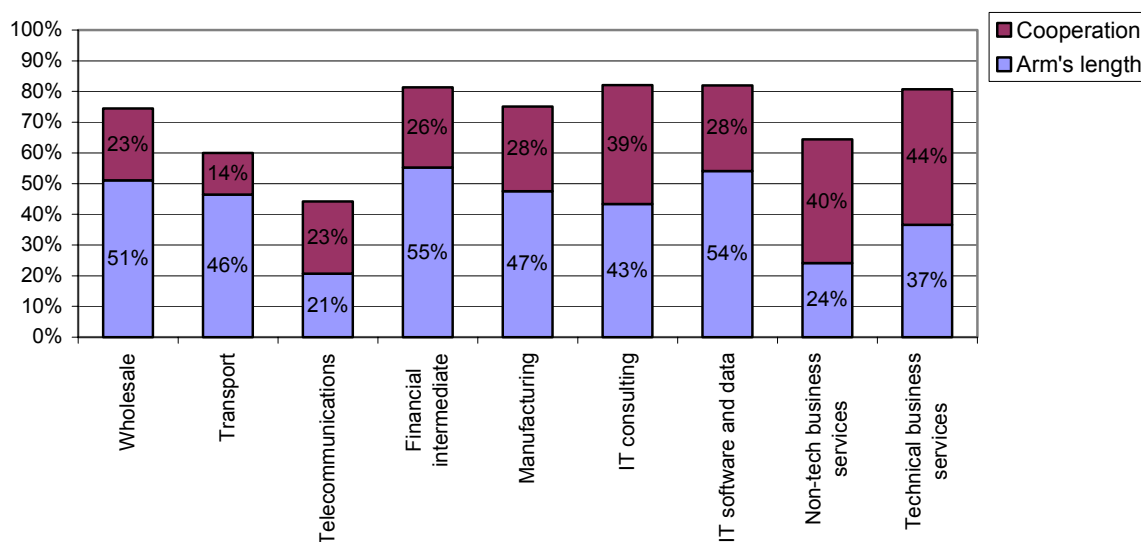
intensive sectors. Also within IT services, there is a significant difference in cooperation for IT consulting compared to IT software development, where enterprises in IT consulting have a much higher propensity to cooperate with other enterprises. This difference, however, is not found for Norwegian or Swedish enterprises.

## 8.2. Client interaction in Nordic service enterprises

An important dimension for service innovation is the degree of client interaction. The nature of many service activities may imply a much closer interaction with clients. In some cases, the actual production of the service will coincide with delivery to customers.

CIS4 data on information sources that are useful for innovation activities and on active innovation cooperation both provide information on enterprises' accessing and use of external knowledge. Data on innovation cooperation indicates what types of collaborative partners enterprises have for their innovation activities and their geographic location. This data however does not indicate the importance of these partners for enterprises' overall innovation activities. A general assumption is that collaborative partners are the most important sources of external knowledge. However, this may not always be the case. Data on information sources on the other hand shows which types of sources are important for enterprises' innovation activities. However, this indicator does not provide information on what type of interaction was mainly involved, for example whether the interaction was one-way transfer of knowledge at 'arm's length' or if it involved active cooperation.

**Figure 26. Market interactions for service sectors, Denmark, CIS4. In percent.**



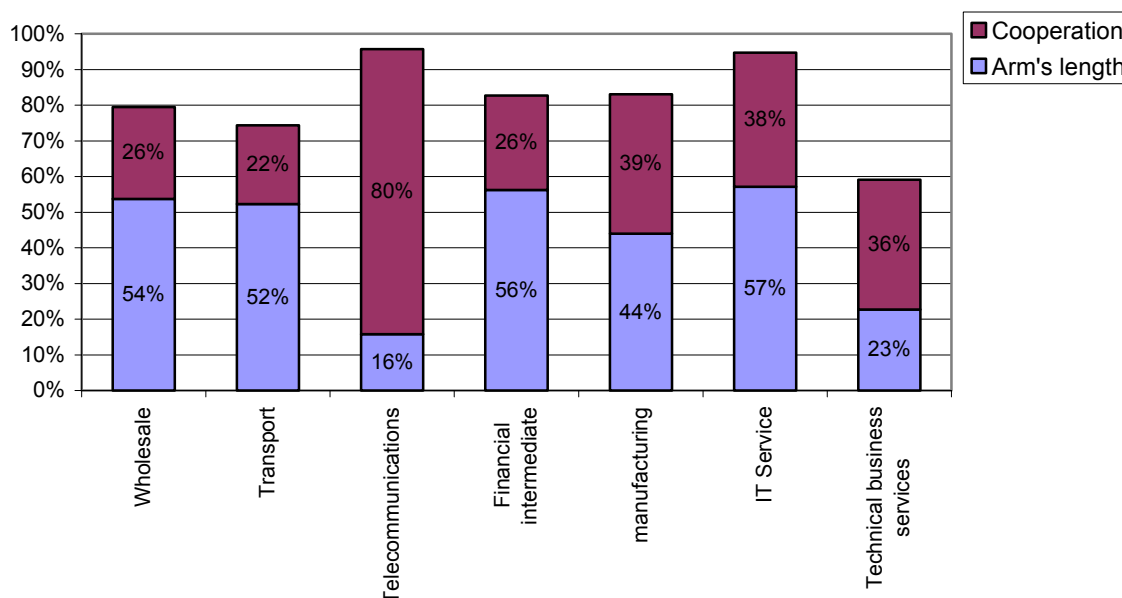
Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Arm's length interaction gives shares of innovation active enterprises that cite clients or competitors as important or highly important information sources, but are not engaged in cooperation with them. 'Cooperation' gives the share both cites market sources as important or highly important and is engaged in cooperation with them.

A combination of data on information sources and on innovation cooperation allows us to examine in greater detail service enterprises' interaction with clients. Figures 26 to 28 below for Denmark, Finland and Norway identify shares of enterprises that cite market sources (clients and competitors) as (medium and highly) important types of information sources and classify them according to those that use the source at arm's length (ie. no active cooperation) and those that engage in active cooperation with market sources.

For Denmark, the highest shares with cooperation are in business services. For non-technical business services, a relatively low share of enterprises cite market sources as important for their innovation activities, but among those that do, a very high share actively cooperates with them. A higher share of enterprises in Technical business services utilizes market sources at arm's length. Market sources are also very important in IT services, though a higher share of enterprises are engaged in active cooperation with market sources in IT consulting compared to IT software and data processing. This can potentially reflect that enterprises in IT consulting offer more specialized services involving a greater degree of client interaction.

For Finland, shares with market interaction are particularly high in Telecommunications and IT service. Within Telecommunications, 96 percent of innovation active enterprises cite market sources as important and 80 percent are also engaged in active cooperation with market sources. This is more than double the share with market interaction (in telecommunications) in Denmark. On the other hand, market interaction for Technical business services is relatively low in terms of share with arm's length interaction.

**Figure 27. Market interactions for service sectors, Finland, CIS4. In percent.**

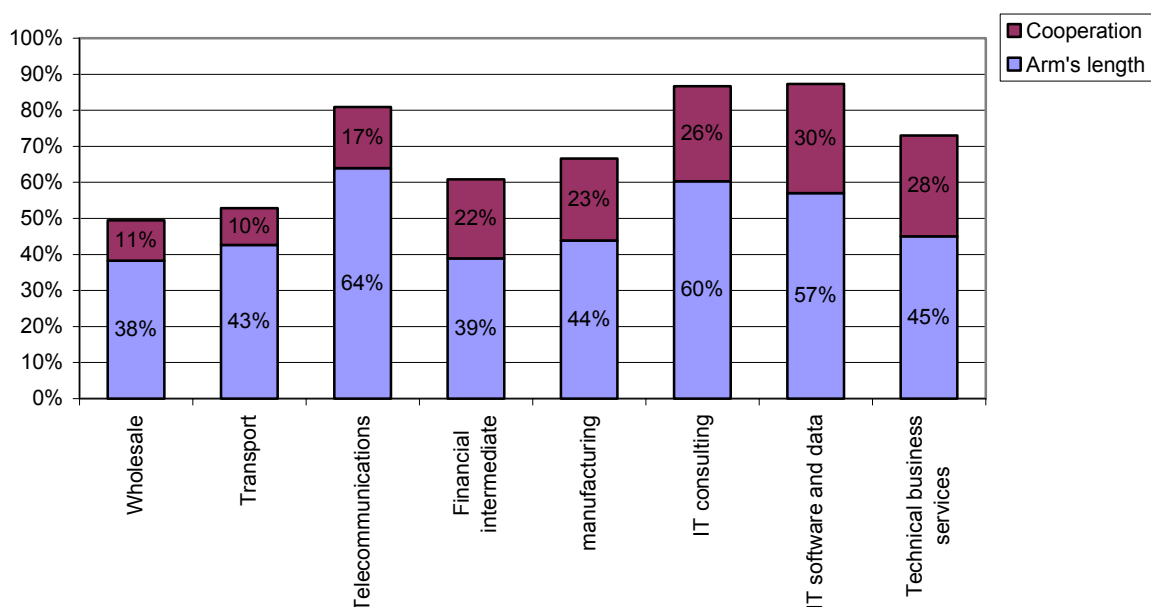


Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Arm's length interaction gives shares of innovation active enterprises that cite clients or competitors as important or highly important information sources, but are not engaged in cooperation with them. 'Cooperation' gives the share both cites market sources as important or highly important and is engaged in cooperation with them.

For Norway, market interaction is highest for the ICT service sector, though a relatively higher share utilizes market sources at arm's length compared to Finland and Denmark. This is particularly the case for Telecommunications in comparison with Finland. And, in contrast to Denmark, market interaction is very similar for IT consulting and IT software and data processing, with little difference in shares with active cooperation.

Market interaction is fairly similar across countries for the other sectors. Within Financial intermediation, a high share cites market sources as important, but a relatively lower share is engaged in active cooperation. A similar pattern is found for Wholesale trade, though a smaller share cites market sources as important in Norway. Market interaction is generally lower within Transport, particularly in terms of active cooperation.

**Figure 28. Market interactions for service sectors, Norway, CIS4. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Arm's length interaction gives shares of innovation active enterprises that cite clients or competitors as important or highly important information sources, but are not engaged in cooperation with them. 'Cooperation' gives the share both cites market sources as important or highly important and is engaged in cooperation with them.

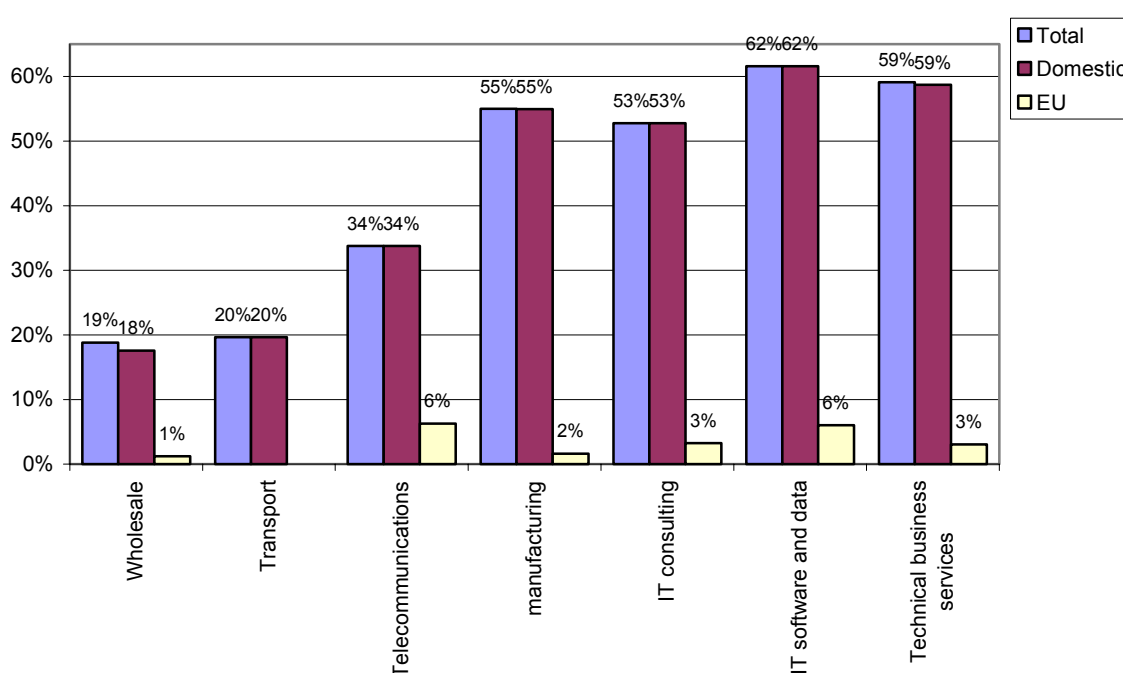
## 9. Innovation funding

As discussed above, service enterprises have been largely neglected in the design of innovation policy measures, though this appears to have been changing in recent years. Though, this does not necessarily mean that many service enterprises have not been impacted by innovation policy initiatives. Many initiatives are general measures that do not explicitly target specific sectors. However, there may be a bias in many of these measures, with their design predominantly being directed towards goods producing enterprises.

The aim of this section is draw on CIS4 data to examine the extent to which existing innovation policies have been utilized by service enterprises. CIS4 contains data on which enterprises have received funding for their innovation activities, both from domestic sources and from the EU<sup>13</sup>.

Figures 29 to 31 show shares of enterprises with innovation activity which have received public funding for Denmark, Finland and Norway<sup>14</sup>. They indicate a very wide variation in the extent of innovation funding across countries, service sectors and in relation to manufacturing enterprises.

**Figure 29. Shares of innovation active enterprises that have received domestic public funding or funding from the EU, Norway, CIS4. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Shares for Financial intermediates and EU funding for Wholesale and Transport not shown due to insufficient observations.

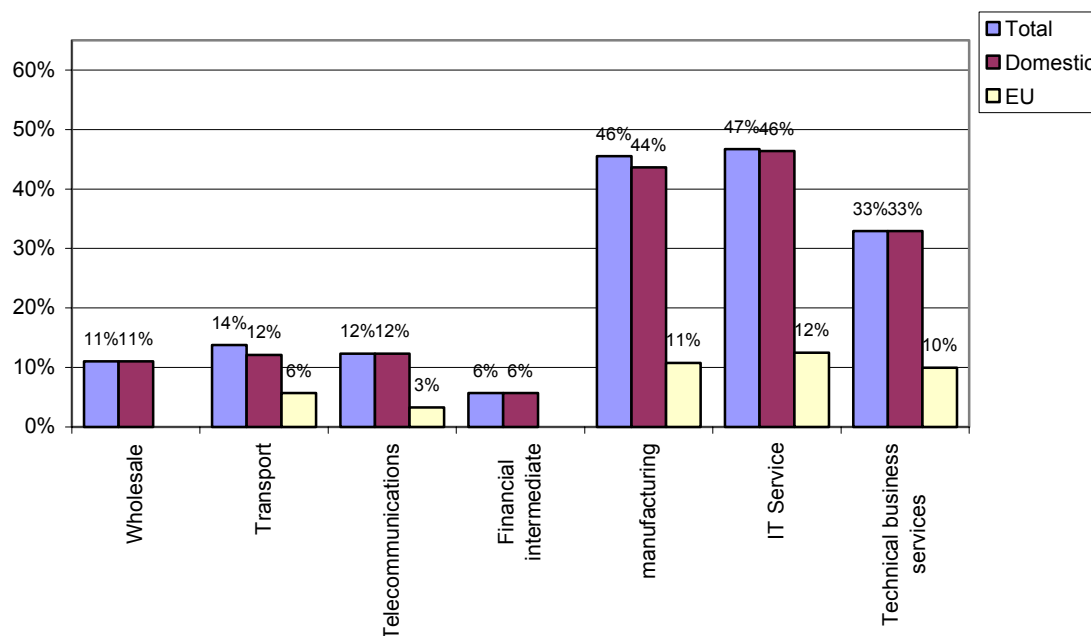
Figure 29 shows the results for Norway. Norway has by far the highest shares of innovation active enterprises with public funding. For knowledge intensive services, the share is over 50 percent, 62 percent in IT software and data processing. Shares for knowledge intensive services are comparable or higher than manufacturing averages. Shares are lower for other sectors such as Wholesale trade, Transport and Telecommunications, but are still substantially higher than in other countries (with the exception of financial intermediates, where very few enterprises received funding).

<sup>13</sup> Data on innovation funding is not available for Sweden.

<sup>14</sup> Figure not shown for Iceland due to insufficient observations.

While somewhat lower than in Norway, shares of enterprises with public funding are also high in Finland. Just under half of innovation active enterprises in IT services have received funding and a third of enterprises in Technical business services. A little over 10 percent have received funding in Wholesale trade, Transport and Telecommunications, and around 6 percent in Financial intermediates.

**Figure 30. Shares of innovation active enterprises that have received domestic public funding or funding from the EU, Finland, CIS4. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. Shares with EU funding for Wholesale and Financial intermediates not shown due to insufficient observations.

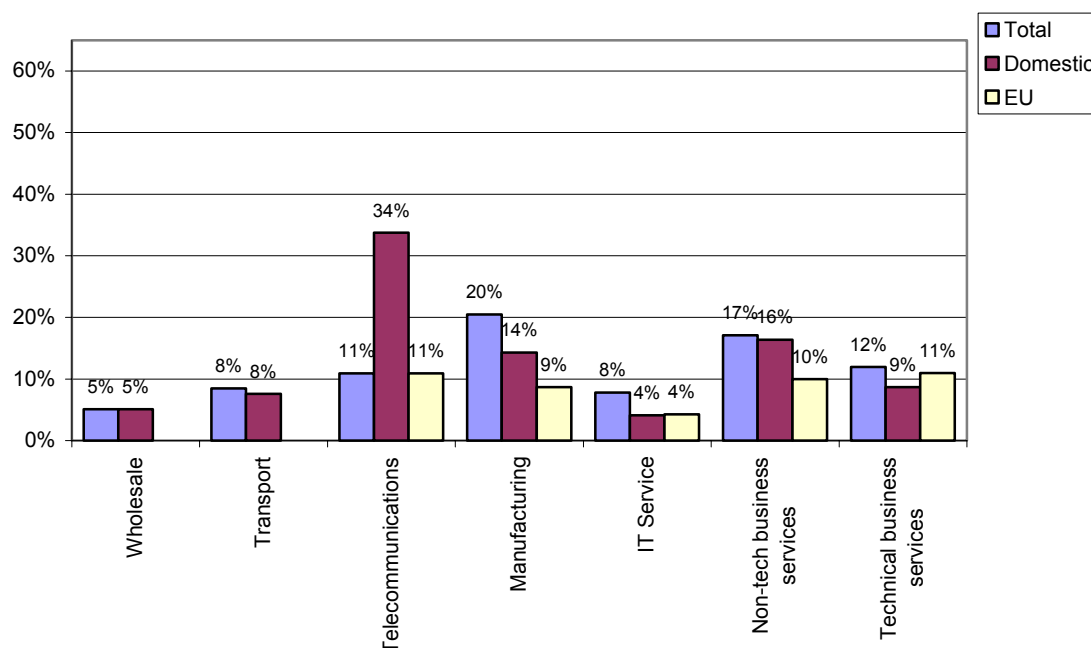
For Iceland, public funding for service enterprises is almost exclusively focused on one sector, IT service, with almost no enterprises in other service sectors having received public funding. Due to the insufficient number of observations in a number of service sectors, the figure for Iceland is not shown here. Around 39 percent of innovation active enterprises in IT services, 30 percent from domestic sources and 9 percent from the EU. This is substantially higher than manufacturing averages, where a total of 12 percent have received funding, 10 percent from domestic sources and 4 percent from the EU<sup>15</sup>.

Shares of service enterprises with funding are substantially lower in Denmark than in Norway or Finland, particularly within knowledge intensive services. This is also the case for manufacturing enterprises. Shares are fairly similar across service sectors, with around 10 percent of innovation active enterprises receiving public funding in most sectors and 17 percent receiving funding in Non-tech business services. In contrast to the other Nordic countries, a large share of enterprises with funding have received funding from the EU. For

<sup>15</sup> Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater.

Technical business services, Telecommunications and IT software and data processing, the share of enterprises receiving EU funding is actually higher than for domestic funding.

**Figure 31. Shares of innovation active enterprises that have received domestic public funding or funding from the EU, Denmark, CIS4. In percent.**



Source: Own calculations, CIS4 data. Based on Eurostat Core industries, 10 employees or greater. IT consulting and IT software and data combined (IT service) due to confidentiality requirements. Shares for Financial intermediates and EU funding for Wholesale and Transport not shown due to confidentiality requirements.

## 10. Methods to protect intellectual property rights (IPR)

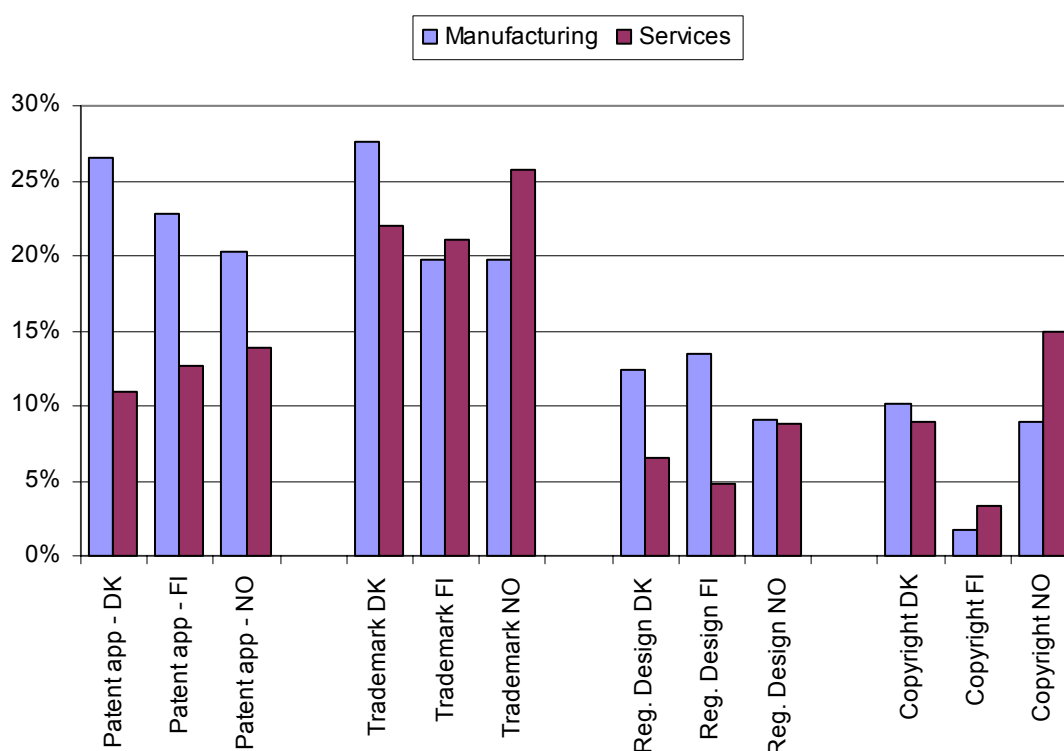
An often cited obstacle to innovation for service enterprises is a lack of possibilities for protecting their innovations, due primarily to the intangible nature of many service products. This section examines the use of various methods to protect innovations in service enterprises, using CIS4 data<sup>16</sup>.

On the whole, the use of legal protection methods is just as prevalent in services as in manufacturing. However, reliance on specific types of methods differs to a larger extent. As figure 32 shows, patenting is less used in service enterprises, while registration of trademarks and copyrights are used just as often for service enterprises. While use of legal protection methods such as patenting and trademarks among manufacturing enterprises is highest in Denmark, concerning service enterprises shares are highest in Norway.

<sup>16</sup> Data on use of legal protection methods is not available for Sweden and Iceland.

Table A.8 in the annex contains country shares across service sectors. In general, the highest shares of innovation active enterprises that use legal protection methods are found in Technical business services, followed by IT services. A relatively high share of enterprises in Wholesale trade use protection methods in all three countries, though shares are particularly high in Norway. A higher share of Finnish enterprises within Telecommunication and IT services have applied for patents, while for Transport legal protection methods are more often used by Danish enterprises.

**Figure 32. Shares of innovation active enterprises that have used legal methods to protect their innovations, Denmark, Finland and Norway, CIS4. In percent.**



Source: CIS4 Eurostat tables for Denmark, Finland and Norway.

## 11. Discussion and Conclusion

This final section makes an overall assessment of innovation activity in the Nordic countries based on the various indicators presented in this report.

In comparing several service sectors across countries, it can be difficult to see overall patterns in the data. To aid in this, table 2 shows some simple correlations of sector level indicators for the Nordic countries. While one should be careful not to over interpret these correlations, it may be useful to see if there is a relation between different innovation indicators. For example, do sectors with high share of innovation cooperation also tend to

have high levels of innovation performance? Or are sectors with high shares of dual innovators also characterized by high shares of non-technological innovation?

**Table 2. Correlations of innovation indicators across service sectors in the Nordic countries**

	Share innovative sales	Product-process innovation	Acquisition of external knowledge	Acquisition of machinery and software	Intramural R&D	Dual innovation	Share employees in innovation active enterprises	Cooperation with suppliers	Market cooperation	Cooperation with public research	International cooperation	Non-tech innovation
Share innovative sales	1.00											
Product-process innovation	0.33	1.00										
Acquisition of external knowledge	0.14	-0.04	1.00									
Acquisition of machinery and software	0.38	0.12	0.36	1.00								
Intramural R&D	0.50	0.38	-0.09	0.21	1.00							
Dual innovation	0.19	0.77	-0.16	0.24	0.30	1.00						
Share employees in innovation active enterprises	0.20	0.59	0.17	0.28	0.15	0.48	1.00					
Cooperation with suppliers	0.27	-0.14	0.57	0.59	0.05	-0.12	0.31	1.00				
Market cooperation	0.33	0.07	0.38	0.48	0.16	0.06	0.40	0.83	1.00			
Cooperation with public research	0.16	-0.12	0.40	0.41	0.15	-0.13	0.26	0.80	0.78	1.00		
International cooperation	0.25	-0.01	0.31	0.49	0.20	0.05	0.16	0.76	0.77	0.85	1.00	
Non-tech innovation	0.20	0.67	0.11	0.20	-0.02	0.53	0.73	-0.01	0.13	-0.11	-0.10	1.00

Source: Own calculations based on CIS4 data for the Nordic countries. All variables are shares for service sectors in the Nordic countries. Non-tech innovation not available for Sweden. Share innovative sales is share total sector turnover due to product innovations. Product-process innovation, dual innovation and non-tech innovation are expressed as share of total enterprises in each service sector. All other variables expressed as share of innovation active enterprises.

We can note here a few of the correlations. First, there is no correlation between shares of innovation cooperation and innovation performance on the sector level. One possible interpretation of this is that high cooperation levels and the knowledge transfer that it



involves do not promote innovation in other enterprises. On the other hand, this may simply reflect the large variation in innovation cooperation across countries. Second, there is high correlation between product-process innovation or dual innovation and non-technological innovation<sup>17</sup>. Hence, sectors with high shares of non-technological innovation also tend to have high shares of product-process innovators. And, as seen above, a high share of enterprises have implemented both technological and non-technological innovations.

Third, there is a low correlation between non-technological innovation and shares of innovative sales. This result suggests that, at least at the sector level, non-technological innovation does not seem to be strongly related with higher innovation output in terms of innovative sales. Fourth, there is not a strong correlation between shares of innovative sales and shares of employees in innovation active enterprises. This may reflect that there are often large differences in innovation performance measured by shares of innovative sales versus shares of product-process innovators, and also large variation in innovative sales across countries.

The remainder of this section summarizes the results presented in this report. There is significant variation in the degree of innovation activity across service sectors. The ICT service sector has the highest share of enterprises with product and/or process innovations, around 2 out of 3 in IT services and around half in Telecommunications. The lowest levels of innovation activity are generally found in the Transport sector. In comparison with manufacturing, shares of innovative enterprises in IT service and Telecommunications are generally higher than manufacturing averages, while innovation shares in other service sectors are typically lower than manufacturing averages.

All five Nordic countries have strong innovation performance in IT service and Telecommunications. However, there is much greater variation across countries in other service sectors, such as Wholesale trade, Transport, Financial intermediates and Technical business services.

A large share of innovative service enterprises also engage in intramural R&D. Generally, shares of innovative enterprises with R&D are higher in knowledge intensive service sectors than in the manufacturing sector, and shares in other service sectors are also high, with around half of innovative enterprises conducting in-house R&D. Shares of R&D active enterprises are however, somewhat lower in Denmark than in the other Nordic countries.

A sizable share of product innovative enterprises within both manufacturing and services has introduced both new goods and new services. This activity is not limited to a few select sectors, but it prevalent both in high and low tech manufacturing and across service sectors. This result illustrates the increasingly blurring boundaries between manufacturing and services with manufacturing enterprises active in service development and service enterprises developing new goods along with their service products.

It is generally thought that non-technological innovation is more important for service enterprises. Based on the results here, non-technological innovation does not appear to be

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<sup>17</sup> Note that correlations involving non-technological innovation do not include Swedish service sectors.

important for service enterprises' innovation activities. A very large share of technological (product-process) innovators have also implemented organisational and/or marketing innovations, and an additional non-negligible share relied solely on non-technological innovation. Shares of enterprises with non-technological innovations are particularly high in Denmark. However, these shares are generally only slightly higher for service sectors than for manufacturing. This suggests that non-technological innovation may be important for manufacturing and service enterprises alike.

Innovation policy is often argued to neglect service enterprises, with policy measures designed to promote innovation in manufacturing. However, this does not necessarily mean that innovation policies do not impact or are used by service enterprises. In terms of public funding of innovation projects, funding is mainly concentrated on IT service enterprises and to a lesser extent technical business services. There is also large variation in funding across countries, with particularly high shares of innovation active enterprises receiving funding in Norway and Finland.

The most common form of protection of intellectual property rights for service enterprises is trademarks, with around 25 percent of innovative enterprises having registered a trademark. This is similar to levels in manufacturing. Shares of innovative service enterprises that have applied for patents or registered an industrial design are lower, around half the levels in manufacturing.

Overall innovation performance in the Finnish service sectors is somewhat lower than for Denmark, Sweden and Iceland. However, a general characteristic among Finnish service enterprises compared to other Nordic countries is a very high outward orientation, particularly in Telecommunications. A very high share of enterprises in Telecommunications have innovation cooperation with a number of different types of sources, and over half cooperate internationally. This is substantially higher than any other sector in the Nordic countries. Only half of Finnish Telecommunications enterprises have in-house R&D, but a high share have acquired external technology, and a very high share have both product, process and non-technological innovation. This indicates a high reliance on external knowledge and the ability to access it. Shares of innovative enterprises in Finland are quite low in Technical business services, however among those that do innovate, there is again a strong outward orientation, similar to that for Telecommunications.

Iceland is characterised by high innovative performance across all service sectors, with the exception of Technical business services. In particular IT services has a high share of innovative enterprises, with a strong focus on customers and competitors as cooperation partners and external information sources. Innovation performance is also high within Financial intermediates.

Overall innovation performance in the Norwegian service sector is low in comparison with other Nordic countries. However, a notable exception to this is the ICT sector, with high innovation performance in both Telecommunications and IT service. In comparison, for example with Finland, Norwegian service enterprises are less outward oriented, with high share of enterprises conducting in-house R&D, but relatively lower shares with innovation cooperation or acquisitions of external technology.

Innovation activity is also high in the Swedish IT service sector, but notable for Sweden is high innovation performance in other service sectors, particularly Wholesale trade and Technical business services. In both these sectors, shares of innovative enterprises are over 50 percent, exceeding manufacturing averages. An exception here is the Transport sector, with just over 20 percent of enterprises having product or process innovations.

Shares of innovative enterprises for Denmark are generally slightly lower than for Sweden, though innovation activity is more balanced across sectors, with no Danish service sector having less than a third with product or process innovations.

One of the reasons for dividing IT services into two sub sectors, IT consulting and IT software and data processing, in this report was to examine whether differences in innovation activity could be identified based on general characteristics of enterprises in these sectors. While this is a very rough approximation, one would expect enterprises in IT consulting to have greater interaction with their clients, and that their products tend to be customized to individual customers' needs. IT software on the other hand may tend to include enterprises with more standardized products for which there is perhaps a lesser degree of client interaction.

In comparing these two sectors for Denmark, both have similar shares of enterprises with in-house R&D. IT consulting has greater cooperation with clients and competitors and is more product innovative, in particular concerning dual innovation (ie. both good and service innovation). In both sectors, the far majority of product-process innovations have also implemented non-technological innovations, but IT software has a much higher share with non-technological innovation only. Hence, while product development is central in the innovation activities of both sectors, there seems also to be significant focus in IT software on 'back-office' and internal process (including organisational) innovations.

However, the differences that can be seen for Danish enterprises in these two sectors do not seem to be present in Norway and Sweden. For Norway, market interactions are equally important in both sectors and in Sweden a greater share of enterprise have market cooperation in IT software (compared to IT consulting). In Norway, a higher share of enterprises in IT consulting are engaged in technological (product-process) innovation only than is the case for IT software. And for both Norway and Sweden, a very high share of enterprises in both sectors conduct in-house R&D.

When discussing service innovation, a large amount of focus is on knowledge intensive services, which are assumed to have the greatest potential for innovation and growth. It is thus somewhat surprising that innovation performance is generally quite low in Technical business services. A notable exception here is Sweden, with a substantially higher share of product-process innovative enterprises. It would be of great interest to delve more deeply into what factors (e.g. policy, infrastructure, etc.) lie behind this difference.

For Non-tech business services, we can compare the cases of Denmark and Sweden, and also with Technical business services. In comparing the Non-tech business service sector for Denmark and Sweden, there are strong similarities in the results. Market interactions are important in both cases, though market cooperation is greater for Danish enterprises.

Suppliers are less important external sources for Non-tech business services than Technical business services, and a lower share has acquired embodied technology or conducted in-house R&D. Hence, as might be expected, new technology, whether adopted or developed in-house, is less important for innovation activities in Non-tech business services. Non-technological innovation is however of greater importance for Non-tech business services. For Danish enterprises with Non-tech business services, a much higher share of enterprises has implemented an organisational or marketing innovation (than for Technical business services), and almost no enterprise in this sector has implemented a product or process innovation without also having implemented a non-technological innovation.

The Danish transport sector is characterised by a relatively high share of product-process innovative enterprises (in particular process innovative), a low share with in-house R&D, a low share engaged in innovation cooperation, and a high share having acquired machinery, equipment or software (embodied technology). This suggests a high degree of adoption of existing technologies by Danish transport enterprises. While the introduction of new products does not appear to be any greater in Denmark than other countries, there seems to be a greater degree of in-bound diffusion of new technologies to the Danish transport sector.

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## Annex

**Table A.1 Basic statistics for service sectors, CIS4, 2004.**

	Number enterprises	Share turnover (% Core NACE)	Number employees	Share employees in innovation active enterprises
<b>Denmark</b>				
Wholesale trade	2908	27%	113099	52%
Transport	253	6%	59858	61%
Telecommunications	75	4%	44968	92%
Financial intermediation	450	16%	69198	73%
IT service	504	3%	32981	85%
Technical business services	458	2%	25778	74%
Services total (core)	4647	57%	345882	68%
Manufacturing total (Core)	4737	39%	351341	79%
<b>Finland</b>				
Wholesale trade	1308	21%	75830	58%
Transport	1205	6%	73066	50%
Telecommunications	123	3%	41718	90%
Financial intermediation	398	5%	38574	67%
IT service	439	2%	29648	79%
Technical business services	484	1%	21395	50%
Services total (core)	3957	39%	280232	63%
Manufacturing total (Core)	3955	57%	473318	82%
<b>Norway</b>				
Wholesale trade	2018	19%	70479	29%
Transport	1234	9%	81731	31%
Telecommunications	86	3%	11704	75%
Financial intermediation	322	11%	40384	58%
IT service	498	2%	24111	55%
Technical business services	556	1%	20410	56%
Services total (core)	4713	45%	248790	41%
Manufacturing total (Core)	3626	27%	224832	59%
<b>Sweden</b>				
Wholesale trade	3420	21%	122765	63%
Transport	2318	9%	148802	48%
Telecommunications	101	6%	84368	34%
Financial intermediation	410	5%	63448	81%
IT service	1052	3%	63859	76%
Technical business services	788	1%	40632	65%
Services total (core)	8090	46%	523874	58%
Manufacturing total (Core)	7253	48%	640753	77%

Source: CIS4 Eurostat tables for the Nordic countries. Data not available for Iceland.

**Table A.2 Shares of product innovators for manufacturing and service sectors, Nordic countries, CIS4. In percent.**

	High tech manufacturing	HighMed tech manufacturing	MedLow Tech manufacturing	Low Tech manufacturing	Manufacturing total	Wholesale Trade	Transport	Telecommunications	Financial intermediate	IT consulting	IT software and data processing	Technical business services	Services total
<b>Denmark</b>													
Dual innovators	11%	10%	8%	2%	7%	13%	4%	8%	4%	39%	23%	8%	13%
Goods only	31%	29%	20%	25%	25%	14%	0%	4%	1%	12%	14%	2%	11%
Services only	2%	5%	2%	3%	3%	3%	8%	22%	21%	12%	11%	12%	7%
<b>Finland</b>													
Dual innovators	10%	14%	7%	10%	9%	14%	3%	12%	2%	25%		4%	9%
Goods only	38%	31%	15%	20%	20%	12%	1%	1%	0%	13%		0%	6%
Services only	4%	2%	3%	4%	3%	2%	11%	25%	28%	16%		14%	11%
<b>Iceland</b>													
Dual innovators	75%	37%	21%	16%	19%	14%	16%	57%	43%	66%		15%	27%
Goods only	25%	15%	9%	25%	20%	12%	2%	0%	0%	17%		0%	4%
Services only	0%	17%	8%	2%	5%	2%	22%	29%	14%	9%		0%	13%
<b>Norway</b>													
Dual innovators	2%	1%	0%	0%	1%	1%	0%	1%	0%	5%	2%	1%	1%
Goods only	47%	41%	23%	22%	24%	18%	0%	7%	2%	26%	28%	13%	12%
Services only	5%	5%	4%	3%	4%	3%	6%	28%	15%	27%	25%	18%	9%
<b>Sweden</b>													
Dual innovators	13%	10%	7%	7%	8%	13%	1%	14%	8%	20%	30%	11%	11%
Goods only	37%	35%	23%	22%	25%	27%	2%	7%	2%	18%	18%	7%	15%
Services only	4%	4%	3%	5%	4%	5%	10%	15%	22%	20%	9%	24%	11%

Source: Own calculations based on CIS4 data. For Finland and Iceland, IT consulting and IT software and data processing have been combined.

**Table A.3 Use of external linkages for types of product innovators, Nordic countries, CIS4. In percent.**

	Cooperation with suppliers	Market cooperation	Public cooperation	International cooperation	Supplier as important info source	Market sources as important info source	Public sources as important info source	Open info sources important	Intramural R&D	Acquisition of R&D or other external knowledge	Acquisition of machinery, equipment or software
<b>Denmark</b>											
Dual innovator, manufacturing	42%	59%	29%	17%	71%	89%	43%	63%	79%	74%	66%
Dual innovator, services	38%	42%	25%	18%	59%	71%	16%	55%	48%	56%	56%
Goods only	37%	38%	19%	15%	59%	82%	17%	54%	48%	48%	61%
Service only	29%	34%	23%	10%	62%	82%	22%	57%	36%	46%	41%
<b>Finland</b>											
Dual innovator, manufacturing	54%	59%	49%	52%	80%	93%	31%	68%	88%	71%	85%
Dual innovator, services	45%	45%	32%	37%	63%	87%	18%	70%	72%	60%	77%
Goods only	42%	45%	41%	39%	62%	87%	25%	63%	79%	66%	71%
Service only	42%	45%	35%	23%	58%	88%	20%	64%	66%	65%	82%
<b>Iceland</b>											
Dual innovator, manufacturing	22%	24%	12%	7%	48%	60%	7%	70%	74%	43%	63%
Dual innovator, services	18%	14%	11%	6%	27%	72%	11%	39%	73%	42%	60%
Goods only	17%	32%	9%	6%	40%	59%	8%	26%	65%	34%	64%
Service only	29%	45%	29%	29%	34%	56%	9%	50%	36%	38%	62%
<b>Norway</b>											
Dual innovator, manufacturing	65%	68%	26%	16%	76%	92%	26%	79%	97%	92%	65%
Dual innovator, services	35%	23%	20%	8%	59%	79%	20%	68%	69%	57%	33%
Goods only	25%	26%	23%	13%	49%	70%	22%	48%	71%	50%	32%
Service only	28%	29%	21%	9%	60%	76%	26%	59%	74%	51%	36%
<b>Sweden</b>											
Dual innovator, manufacturing	44%	44%	32%	15%					81%	67%	80%
Dual innovator, services	38%	35%	19%	12%					58%	63%	60%
Goods only	35%	31%	22%	12%					72%	53%	60%
Service only	25%	28%	14%	9%					59%	45%	64%

Source: Own calculations based on CIS4 data.

Note: data on information sources not available for Sweden



**Table A.5 Shares of innovation active enterprises with extramural R&D or acquisitions of other external knowledge (acquisitions of disembodied technology)**

Sector	Denmark	Finland	Iceland	Norway	Sweden
Wholesale	49%	45%	41%	38%	45%
Transport	42%	40%	27%	46%	40%
Telecommunications	42%	83%	42%	49%	65%
Financial intermediate	68%	74%	64%	57%	60%
IT consulting	30%	62%	38%	36%	45%
IT software and data processing	38%			42%	53%
Non-tech business services	55%	NA	NA	NA	46%
Technical business services	35%	62%	*	55%	55%
Manufacturing	45%	66%	31%	54%	57%
<b>Enterprise size</b>					
10 to 49 employees	43%	53%	33%	44%	47%
50 to 249 employees	48%	74%	33%	63%	65%
250 or more employees	71%	88%	56%	75%	71%

Source: Own calculations based on CIS4 data. For Finland and Iceland, IT consulting and IT software and data processing have been combined.

NA: Data not available. \*\*: Not shown due to insufficient observations.

**Table A.6 Shares of innovation active enterprises that have acquired machinery, equipment or software related to their innovation activities (embodied technology)**

Sector	Denmark	Finland	Iceland	Norway	Sweden
Wholesale	56%	61%	47%	21%	49%
Transport	80%	76%	4%	30%	67%
Telecommunications	43%	94%	42%	36%	77%
Financial intermediate	43%	70%	100%	15%	67%
IT consulting	40%	83%	77%	36%	67%
IT software and data processing	60%			39%	62%
Non-tech business services	34%	NA	NA	NA	47%
Technical business services	61%	85%	*	27%	67%
Manufacturing	69%	79%	54%	36%	76%
<b>Enterprise size</b>					
10 to 49 employees	59%	74%	55%	32%	61%
50 to 249 employees	66%	80%	67%	29%	76%
250 or more employees	66%	88%	70%	28%	79%

Source: Own calculations based on CIS4 data. For Finland and Iceland, IT consulting and IT software and data processing have been combined.

NA: Data not available. \*\*: Not shown due to insufficient observations.

**Table A.7 Use of external linkages by service sector, Nordic countries, CIS4, percent.**

	Cooperation with suppliers	Market cooperation	Public cooperation	International cooperation	Supplier as important info source	Market sources as important info source	Public sources as important info source
<b>Denmark</b>							
Wholesale	30%	29%	16%	17%	67%	74%	12%
Transport	17%	15%	3%	*	62%	60%	12%
Telecommunications	33%	23%	9%	3%	73%	44%	11%
Financial intermediate	24%	26%	15%	5%	39%	81%	41%
manufacturing	27%	33%	16%	12%	62%	75%	18%
IT consulting	34%	46%	15%	10%	64%	82%	8%
IT software	18%	28%	19%	7%	76%	82%	10%
Non-tech business services	27%	48%	24%	6%	33%	64%	19%
Technical business services	41%	48%	31%	21%	65%	81%	20%
<b>Finland</b>							
Wholesale	34%	35%	23%	32%	70%	79%	15%
Transport	27%	26%	19%	13%	49%	74%	16%
Telecommunications	84%	82%	74%	55%	87%	96%	21%
Financial intermediate	30%	30%	24%	13%	46%	83%	21%
manufacturing	43%	44%	38%	34%	69%	83%	28%
IT Service	33%	39%	32%	30%	43%	95%	27%
Technical business services	55%	60%	44%	36%	67%	59%	34%
<b>Iceland</b>							
Wholesale	30%	30%	34%	26%	47%	41%	7%
Transport	*	*	*	*	27%	45%	6%
Telecommunications	*	*	*	*	42%	50%	*
Financial intermediate	34%	11%	6%	*	29%	89%	13%
manufacturing	15%	20%	11%	3%	37%	49%	5%
IT Service	28%	57%	19%	28%	28%	98%	28%
<b>Norway</b>							
Wholesale	18%	14%	13%	6%	42%	49%	12%
Transport	14%	13%	9%	3%	56%	53%	15%
Telecommunications	16%	17%	6%	10%	60%	81%	15%
Financial intermediate	28%	24%	8%	2%	55%	61%	8%
manufacturing	26%	26%	23%	11%	54%	67%	25%
IT consulting	18%	28%	16%	7%	49%	87%	24%
IT software	25%	32%	18%	15%	44%	87%	18%
Technical business services	28%	32%	31%	15%	49%	73%	30%
<b>Sweden</b>							
Wholesale	22%	11%	8%	3%	NA	NA	NA
Transport	27%	33%	6%	1%	NA	NA	NA
Telecommunications	41%	36%	14%	28%	NA	NA	NA
Financial intermediate	40%	36%	6%	8%	NA	NA	NA
manufacturing	36%	34%	25%	11%	NA	NA	NA
IT consulting	26%	36%	18%	12%	NA	NA	NA
IT software	27%	44%	12%	17%	NA	NA	NA
Non-tech business services	33%	33%	20%	20%	NA	NA	NA
Technical business services	38%	33%	29%	12%	NA	NA	NA

Source: Own calculations based on CIS4 data. Share innovation active enterprises. For Finland and Iceland, IT consulting and IT software combined. For Iceland, Tech. Bus. services not shown due to too few observations. NA: Data not available. \*\*: Not shown due to insufficient observations.

**Table A.8 Use of legal methods to protect innovations, Denmark, Finland and Norway, CIS4, percent.**

	<b>Applied for a patent</b>	<b>Registered a trademark</b>	<b>Registered an industrial design</b>	<b>Claimed copyright</b>
<b>Denmark</b>				
Manufacturing	27%	28%	12%	10%
Core Services	11%	22%	6%	9%
Wholesale trade	12%	21%	8%	5%
Transport	11%	24%	1%	4%
Telecommunications	2%	26%	0%	0%
Financial intermediation	1%	27%	2%	24%
IT services	11%	26%	9%	15%
Technical business services	18%	17%	1%	11%
<b>Finland</b>				
Manufacturing	23%	20%	13%	2%
Core Services	13%	21%	5%	3%
Wholesale trade	14%	26%	11%	5%
Transport	4%	14%	2%	0%
Telecommunications	11%	13%	0%	2%
Financial intermediation	4%	9%	1%	1%
IT services	19%	33%	3%	8%
Technical business services	22%	12%	2%	1%
<b>Norway</b>				
Manufacturing	20%	20%	9%	9%
Core Services	14%	26%	9%	15%
Wholesale trade	19%	38%	17%	17%
Transport	4%	8%	1%	4%
Telecommunications	4%	17%	4%	15%
Financial intermediation	0%	6%	0%	2%
IT services	6%	29%	3%	23%
Technical business services	26%	15%	7%	14%

Source: Own calculations based on CIS4 data. Share innovation active enterprises.

**Table A.9 Industry classifications**

**Services**

<b>NACE codes</b>	<b>Sector</b>
51	Wholesale trade
60 - 63	Transport
64	Telecommunications
65 - 67	Financial intermediate
72.0 – 72.1, 72.22 – 72.29	IT consulting
72.2 – 72.21, 72.3 - 72.9	IT software and data processing
74.0 – 74.14, 74.4	Business service - technical
74.2 – 74.3	Business service – non technical

**Manufacturing**

<b>NACE codes</b>	<b>Sector</b>
24.4, 30, 35.3, 32 -33	HighTech Manufacturing
24.0 – 24.3, 24.5 – 24.9, 29, 31, 34, 35.2, 35.4 -35.9	MedHighTech Manufacturing
23, 25 – 28, 35.1	MedLowTech Manufacturing
15 – 22, 36 - 37	LowTech Manufacturing