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Working Party on Innovation and Technology Policy

PROMOTING INNOVATION IN SERVICES

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FOREWORD

This report was prepared as part of the OECD horizontal project on *Enhancing the Performance of the Service Sector*. It was presented to the Working Party on Innovation and Technology Policy in December 2004 and was declassified by the Committee for Scientific and Technological Policy in April 2005.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

This document presents work on innovation in services that is conducted as part of the OECD's horizontal project "Enhancing the Performance of the Service Sector". It draws on existing STI statistics, recent innovation surveys, and a policy questionnaire circulated to TIP and CSTP delegates to characterise innovation in service sector industries and identify policy measures being implemented in OECD countries to improve innovation in services. It is a revised and extended version of Chapter 4 of the OECD's *Science, Technology and Industry Outlook 2004*, entitled "Promoting Innovation in Services", that includes a more detailed examination of the role of IPR protection in the service sector.

As indicated, the service sector is of growing importance in OECD economies. Productivity and employment growth are highly dependent on the success of service industries, and services are strong drivers of recent economic growth in most OECD economies. Statistical evidence supports the notion that services are increasingly knowledge-based, innovative and drivers of growth. Service-sector firms in general are less likely to innovate than manufacturing firms, but they are becoming more innovative and knowledge-intensive, and services such as financial intermediation and business services show above-average levels of innovation.

Enhancing innovation in the service sector requires attention to a number of policy areas, with different emphases than for manufacturing as listed below.

- Service-sector innovation derives less from investments in formal R&D and draws more extensively on acquisition of knowledge from outside sources that is acquired through purchases of equipment and intellectual property, as well as via collaboration.
- Human resource development is especially important to service firms, given their high reliance on highly skilled and highly educated workers, as well as indications that a lack of highly skilled personnel is a major impediment to service innovation in most OECD economies.
- The role of newly established firms in innovative activity is greater in services than in manufacturing, so that entrepreneurship is also a key driver of service innovation. Nonetheless, small firms tend to be less innovative than larger firms.
- IPR protection has also drawn considerable attention, especially as relates to software and business method patents, which seem to have strong links to innovation in services. While the effect of different policy regimes on service sector innovation is uncertain, it is clear that changes in policy regimes governing software-related patents and business method patents would have an effect on the service-sector firms, regardless of their main activities.

To date, however, innovation policy measures in most OECD countries have not been attuned to the service sector. Only a few countries have integrated services-related concerns into their innovation policies, and participation of service-sector firms in sector-neutral programmes remains low. The few policies targeting service innovation aim primarily at ICT development and use. Clearly, greater effort is needed to raise awareness of innovation policies and programmes among service-sector firms, as well as to design or adapt support programmes to be more relevant and useful to the service sector.

PROMOTING INNOVATION IN SERVICES

Introduction

Services play a key role in developed economies. They have expanded rapidly over recent decades and accounted for 70% of total OECD value added in 2000; market services (*i.e.* excluding government services) accounted for 50% of the total.[1] Market services have become the main driver of the economy and the major contributor to productivity growth, especially as the use of information and communications technology (ICT) services has grown. Services are also the main source of job creation across the OECD area. While the service sector accounts for a lower share of total employment than of total output, market services was the only sector to make a positive contribution to job creation over the past decade in all OECD member countries. Job creation in services often compensated for job losses in the manufacturing sector. Although service-sector jobs are often viewed as labour-intensive and characterised by low productivity, skills in the sector have undergone a rapid process of upgrading. As a result, the service sector attracts increasing attention from policy makers interested in boosting economic growth and job creation.

Boosting innovation in service industries is central to improving the performance of the service sector. The sector has traditionally been seen as less innovative than manufacturing and as playing only a supportive role in the innovation system. As a result, national innovation policies have paid scant attention to services, and service-sector firms have not been active participants in government-sponsored innovation programmes. Recent work confirms, however, that services are more innovative than previously thought; indeed, in some areas, they are more innovative than the average manufacturing industry. In fact, knowledge-intensive business services play an increasingly dynamic and pivotal role in the knowledge-based economy. Innovation surveys suggest that service-sector firms innovate for many of the same reasons as manufacturing firms: to increase market share, to improve service quality and to expand product or service range. However, how innovation occurs in the service sector is less well understood. Compared to manufacturing, most innovations in services appear to be non-technical and result from small, incremental changes in processes and procedures that do not require much formal research and development (R&D). Developing policy to support service-sector innovation may therefore require new policies and programmes.

This document aims to inform policy making to promote innovation in services. It begins by examining what is known about innovation processes in services — including both drivers and impediments — highlighting how these differ from those in manufacturing, where possible. It also analyses the role of patent protection in service-sector innovation, concentrating on both patenting by

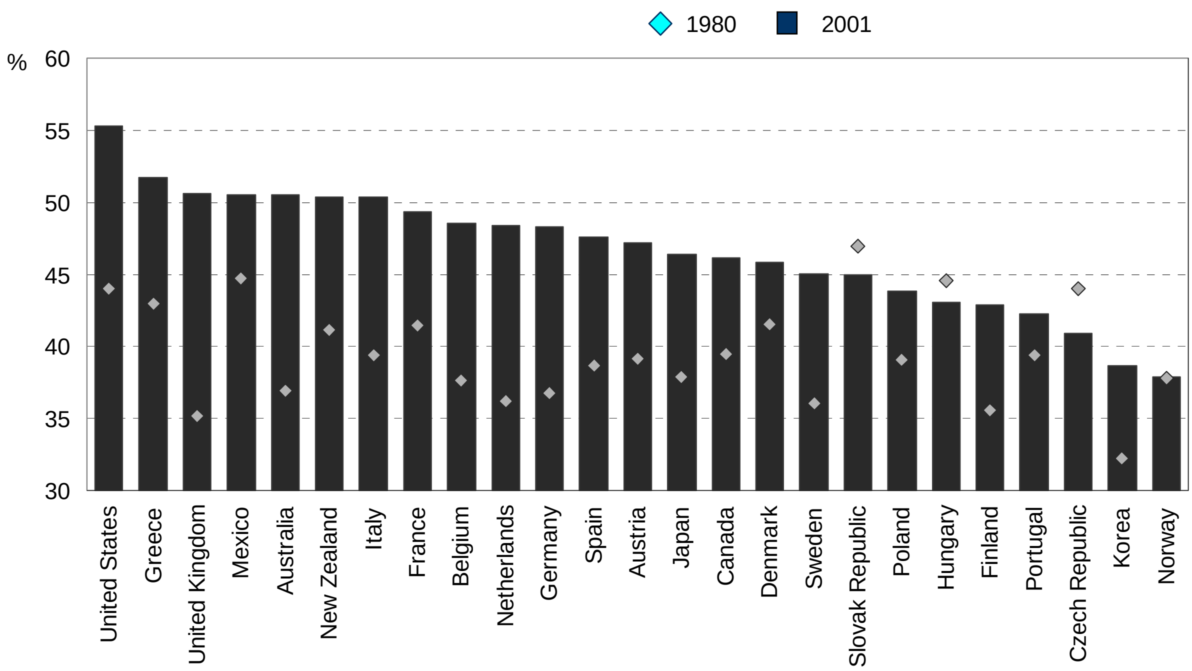
1. Throughout this paper, the term “market services” refers to the following service sector industries: wholesale and retail trade (ISIC 50-55); transport and communication (ISIC 60-64); and finance, insurance, real estate and business services (ISIC 65-74). The term “business services” refers to the renting of machinery and equipment, computer and related activities, research and development, and other business services (ISIC 71-74). “ICT services” include post and communications (ISIC 64) and computer and related activities (ISIC 72). Total services (ISIC 50-99) includes all market services plus community social and personal services (ISIC 75-99).

service-sector firms and business-method patenting. Main statistical data comes from several OECD databases — the Structural Analysis (STAN) Database for industrial analysis, the Analytical Business Enterprise Research and Development (ANBERD) Database and the Patents Database — and the third European Community Innovation Survey (CIS3). Findings from innovation surveys conducted in non-European countries, including Australia, Japan, Korea and New Zealand, are incorporated to the extent possible. Finally, drawing from the results of an OECD questionnaire, the paper reviews policy measures adopted in OECD member countries to boost innovation in their economies. Together this analysis illustrates that levels and patterns of innovation differ significantly from one service sector industry to another and that intellectual property protection plays a small but growing role in innovation. Policy makers need to take a broad approach to encouraging innovation in the services sector that aims not only at stimulating knowledge creation and diffusion, but also at developing human resources and entrepreneurship. Efforts will be needed to encourage service-sector firms to participate more actively in innovation programmes and to better tailor such programmes to their needs.

Services are of growing importance in OECD economies

OECD economies are increasingly services-oriented. That is, they are increasingly dominated by industries that aim to deliver help, utility or care, and experience, information or other intellectual content. Most of their value added is intangible rather than incorporated in a physical product. The service economy has grown rapidly in recent years. In 2001, market services represented between 45% and 55% of total value added in most OECD countries, up from 35% to 45% in 1980 (see Figure 1). Growth in the share of market services is apparent in almost all OECD countries, with the exception of some in eastern Europe (the Czech Republic, Hungary and the Slovak Republic) that have recently undergone significant structural reforms.

Figure 1. Share of the market services in total value added, 1980 and 2001

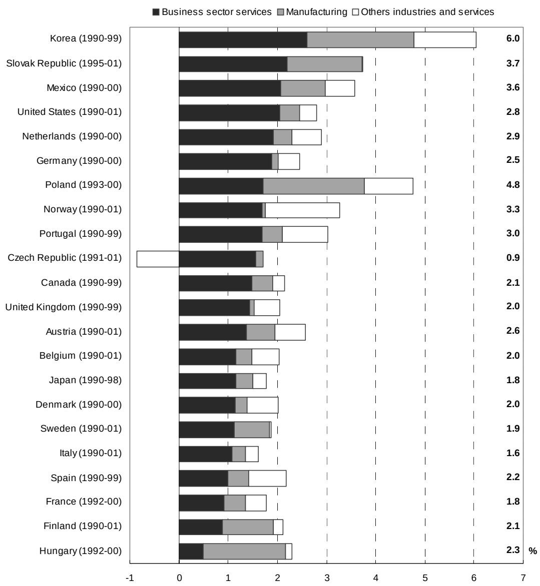


Source: OECD, *STI Scoreboard 2003.*

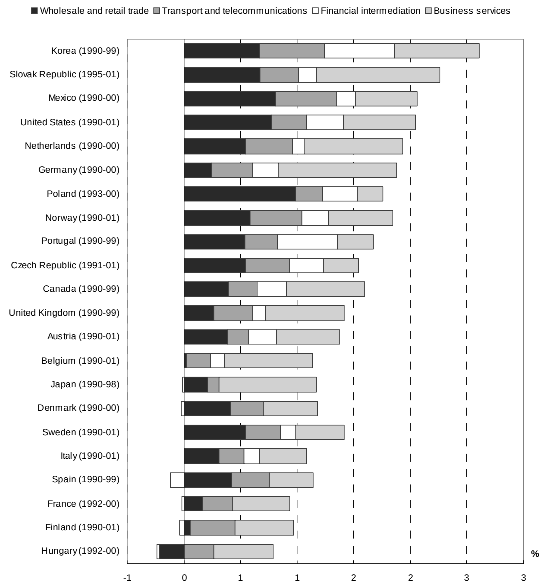
Over the past decade, services have been the main driver of economic growth. Between 1990 and 2001 they contributed approximately two-thirds of the increase in value added in OECD economies (see Figure 2). Two sectors, wholesale and retail trade and business services, made large contributions to GDP growth. Wholesale and retail trade generated over a quarter of output growth in many countries, and more than a third in Mexico, Poland, Spain, Sweden and the United States. Business services accounted on average for a third or more of output growth and more than two-thirds in Belgium, Hungary and Japan. This is partly due to the prominent size of these sectors in national economies, but also to their sharp rises in output.

Figure 2. Contribution of the market services to GDP growth, 1990-2001

Market services versus manufacturing and other industries
Average annual growth rates (%)



Market services alone, by service
Average annual growth rates (%)

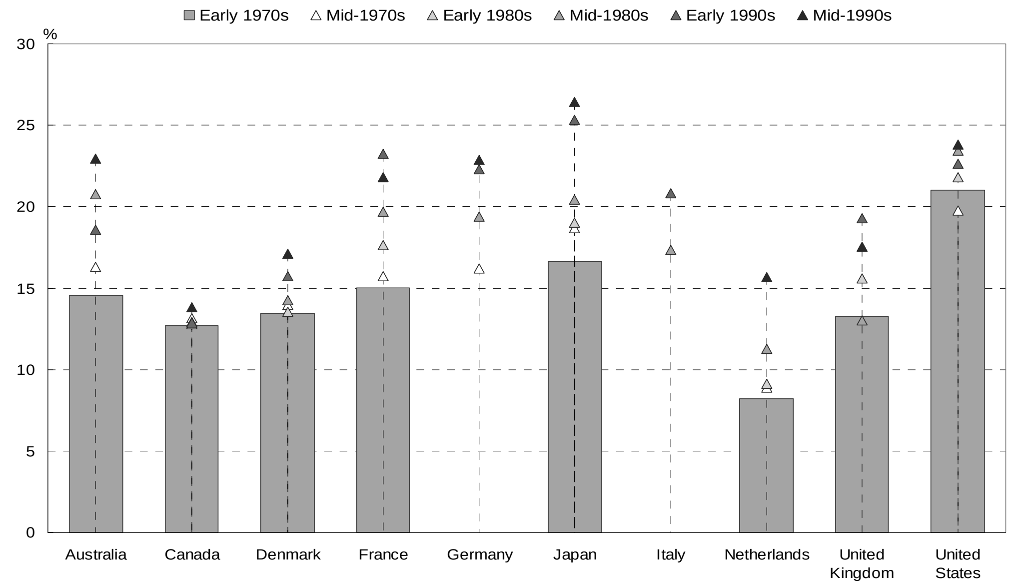


Source: OECD, STAN database, March 2004.

Growth in business services has benefited from recent changes in corporate management: increased investment in intangible activities, growing emphasis on knowledge management, renewed focus on core competencies, outsourcing of some activities and greater reliance on external service providers. In the manufacturing sector, services previously produced in house are increasingly obtained via outsourcing. By the mid-1990s, services accounted for nearly 25% of the value added embodied in final demand for manufactured goods in most countries for which data are available, compared to 15% or less in the early 1970s (see Figure 3). The rise in embodied services was particularly strong in Australia, Japan and Netherlands, all of which saw gains of 7 percentage points or more. It was less marked in Canada and the United States, although services already accounted for more than 20% of US manufacturing value added in the early 1970s. In most countries, the manufacturing sector now relies more heavily on telecommunications, business and computer services with a view to stimulating greater productivity. Manufacturing firms have also moved more and more to link products and services as a central element of their broad competitive strategy. They are providing *product-service packages*, in which products and services are linked together in one package for clients, and selling *solutions* rather than what are traditionally thought of as *products* (AEGIS, 2002).

Figure 3. Service-sector value-added embodied in manufacturing goods

Percentage of total value added of manufactured goods in final demand

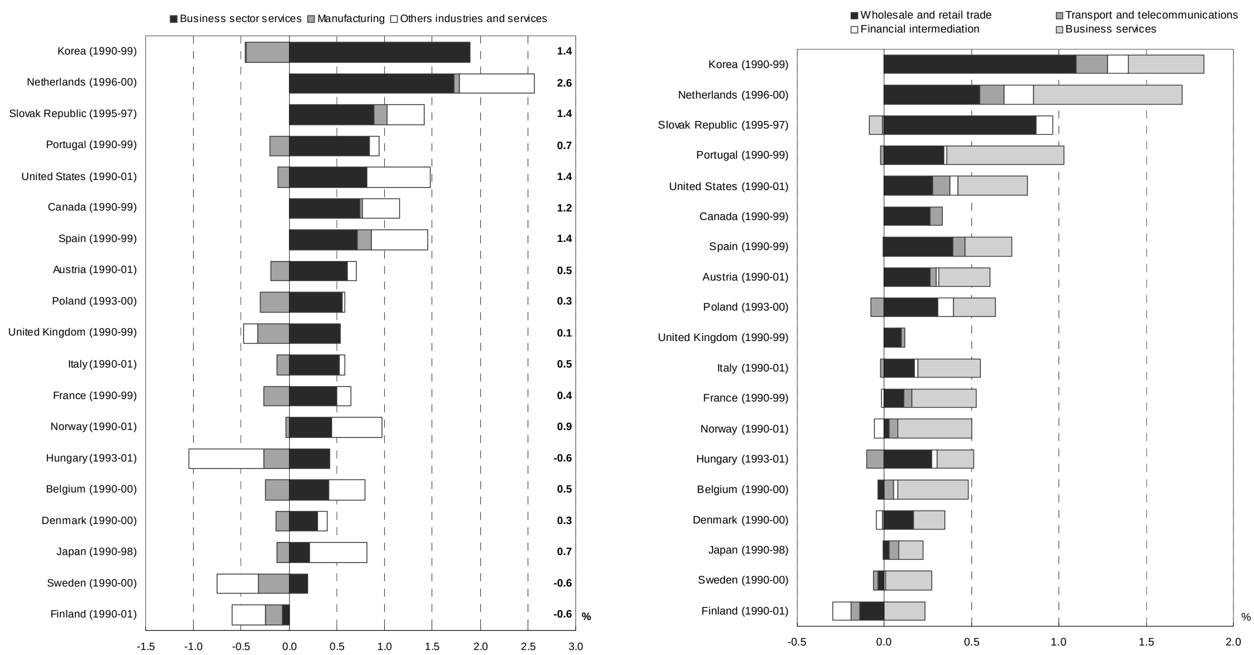


Source: OECD, *STI Scoreboard 2003.*

Figure 4. Contribution of market services to job creation, 1990-2001

Market services versus manufacturing and other industries
Average annual growth rates (%)

Market services, by industry
Average annual growth rates (%)

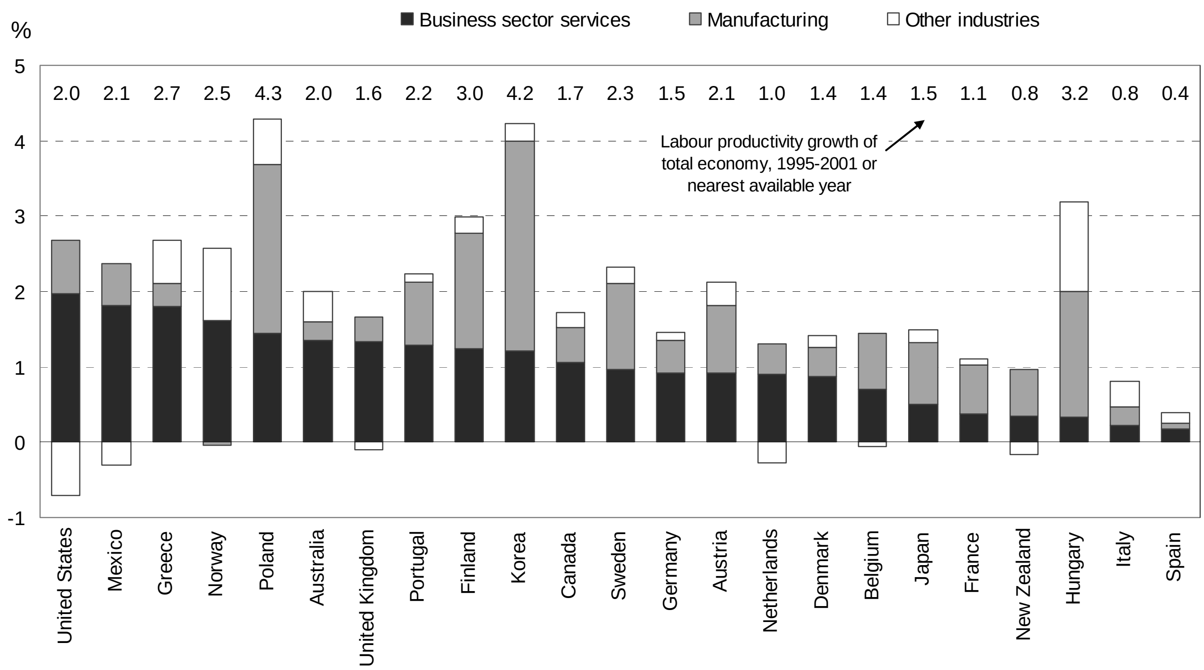


Source: OECD, STAN database, March 2004.

The service sector also makes sizeable contributions to job creation. Across the OECD, most employment growth in the 1990s was due to services, in particular business services, which generated more than half of all employment growth in most countries and often compensated for job losses in manufacturing (see Figure 4). Within the service sector, the largest relative job growth was in wholesale and retail trade and business services. In the 1990s, the former supported more than half of employment growth in Eastern Europe (Hungary, Poland and the Slovak Republic), Canada, Denmark, Korea, Spain and the United Kingdom. The latter were a significant source of employment growth in Europe (Belgium, France, Italy, Netherlands and Portugal), the Nordic countries (Finland, Norway and Sweden) and Japan.

Services also make a major contribution to labour productivity growth. While the service sector has traditionally been viewed as a sector with poor productivity growth, measurement problems are to some extent responsible: services output is difficult to define, and changes in services quality are hard to measure. Market services, however, account for the bulk of labour productivity growth in many OECD countries, including Germany, the United Kingdom and the United States (see Figure 5). The manufacturing sector remains important in some of the newer member countries, including Hungary, Korea and Poland, which had the highest levels of labour productivity growth. In other countries, increases in total labour productivity tend to be driven by the service sector. The growing contribution of market services to productivity is linked both to their growing share in total value added and to a strong rise in their labour productivity.

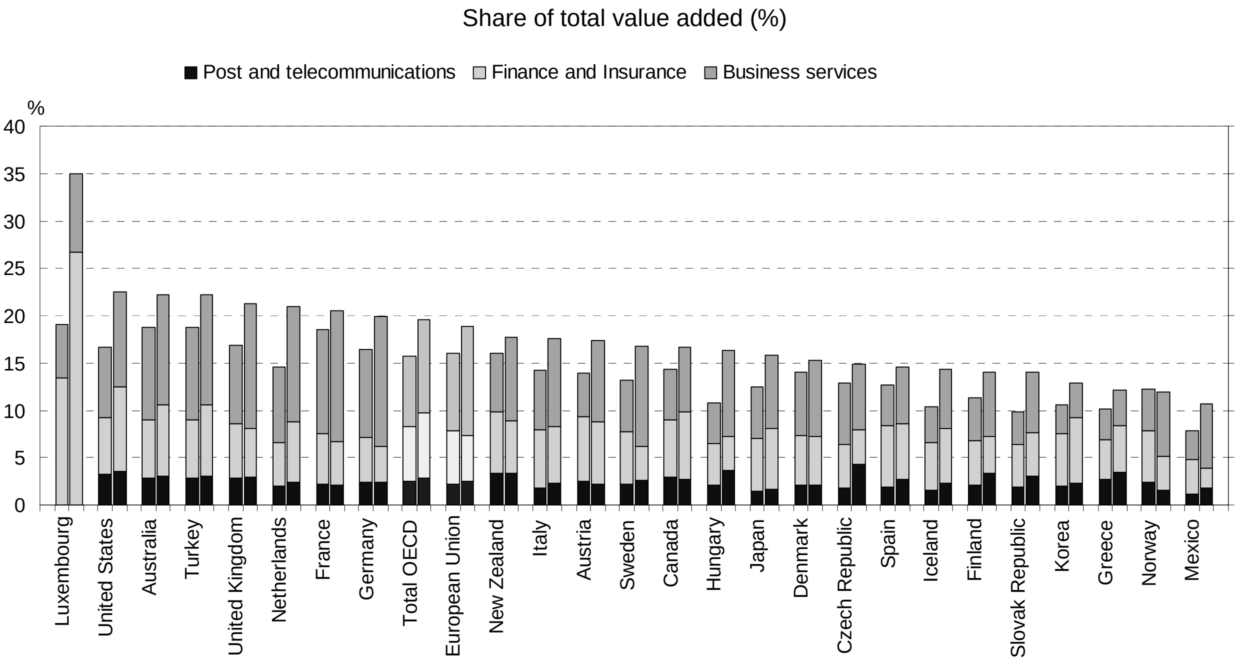
Figure 5. Breakdown of labour productivity growth by main industrial sector



Source: OECD, STI *Scoreboard 2003.*

The so-called knowledge-based market services have been particularly important: post and telecommunications, finance and insurance, and business services. These sectors tend to have the largest investments in R&D among service-sector industries, as illustrated below, and the greatest reliance on highly skilled workers. In 2000 knowledge-based market services accounted for 19% of total value added (OECD, 2003). Moreover, the share of knowledge-based market services in total value added increased between 1990 and 2001 (see Figure 6). Growth was particularly marked in Eastern Europe (Hungary and the Slovak Republic), Iceland, Luxembourg, Netherlands and the United States. Much of this growth derived from business services, which grew faster than post and telecommunications or finance and insurance.

Figure 6. Expansion of knowledge-based market services, 1990-2001 or nearest available year



Note: The European Union aggregate includes Austria, Denmark, Finland, France, Germany, Ireland, Italy, Portugal, Spain, Sweden, and the United Kingdom.

Source: OECD, STAN database,March 2004.

Innovation in services

Innovation has been recognised as a key to growth (OECD, 2001a), but the role of service-sector innovation has long been under-appreciated. This is due to some extent to the difficulty of measuring innovation in the service sector, a patchwork of different industries with significantly different innovation processes. R&D expenditures are often employed as a proxy for innovation, although they measure just one input into the innovation process. An increasing number of innovation surveys, however, have made it clear that expenditure on R&D is only one element of firms' expenditures on innovation. Even in manufacturing, R&D generally amounts to only about half of total investment in innovation (OECD, 2001a); in services the share is even smaller. Other components of innovation appear more important for services, where most innovation is linked to changes in processes, organisational arrangements and markets. There is evidence that innovative activity in services is organisational and disembodied in nature so that it escapes standard measures of innovation (de Laat, Callon and Laredo, 1997). Various innovation surveys attempt to capture these complementary dimensions (see Box 1 for information on the Community Innovation Survey used in many European countries).

Box 1. Interpreting the results of innovation surveys

The Community Innovation Survey aims to gather information on business innovation across the European Union (EU) area. It attempts to capture the nature of innovation activities, the characteristics of innovative firms and the factors hampering innovation. Detailed results of CIS3 are available from 15 European countries – EU members prior to 1 May 2004, less the United Kingdom, plus Iceland.[2] Responses refer to the period 1998-2000 and come from 488 000 respondent firms in the manufacturing, market services and other industry sectors that employ more than ten persons.

The CIS3 survey defines innovation as “a new or significantly improved product (goods or service) introduced to the market or the introduction within the enterprise of a new or significantly improved process”. Innovation is based on the results of new technological developments, new combinations of existing knowledge or utilisation of other knowledge acquired by the enterprise. Product innovation is defined as a good or service which is either new or significantly improved with respect to its fundamental characteristics, technical specifications, incorporated software or other immaterial components, intended uses or user friendliness. Process innovation includes new and significantly improved production technology, new and significantly improved methods of supplying services and of delivering products. The outcome should be significant with respect to the level of output, quality of products (goods/services) or cost of production and distribution. The innovation should be new to the enterprise; it is not necessarily new to the market. The enterprise is not necessarily the first to introduce this process. It does not matter whether the innovation was developed by the enterprise or by another enterprise. Changes of solely an aesthetic nature, resale of inventions wholly produced and developed by other enterprises, and solely organisational or managerial changes are not included.

Results of the CIS3 survey can be analysed to compare responses by country, industry and size class, but care must be taken in interpreting the results. Aggregate indicators are influenced by the structural characteristics of the set of responding firms, which differ from those of the total firm population. The set of CIS3 respondents contains an over-abundance of German and Italian firms, which together account for almost half of all respondents (see Figure a). German firms account for a third of all service-sector enterprises, whereas Italian firms represent a third of manufacturing firms. German respondents are particularly over-represented in business services and in transport and communications, and the latter sector contains no responses from French firms (see Figure b). A breakdown by size class indicates a similar bias in the population of small- and medium-sized firms (firms with fewer than 250 employees), with an over-representation of French and German firms. By design, firms with fewer than ten employees are not included.

Similar innovation surveys have been launched in several non-European countries, including Australia, Japan, Korea and New Zealand. Despite a common basis in the OECD’s Oslo Manual, results of CIS3 and these other innovation surveys are not fully comparable. Several factors, including differences in sector and firm coverage and differences in interpretation of definitions limit comparability. The report of the Japanese innovation survey, for example, suggests that Japan’s innovative density is underestimated because of a low response rate (21%). A study of non-respondents found that those firms are more innovative than the respondents (MEXT, 2004). Described above, such response biases affect CIS3 results as well, implying that the results of the innovation surveys must be interpreted with caution, especially when attempting to extrapolate to national or sectoral aggregates of firms.

2. The United Kingdom participated in CIS3 but did not provide detailed microdata to Eurostat, only aggregated data tables.

Figure a. CIS3 respondents by sector and country

As % of all responding firms

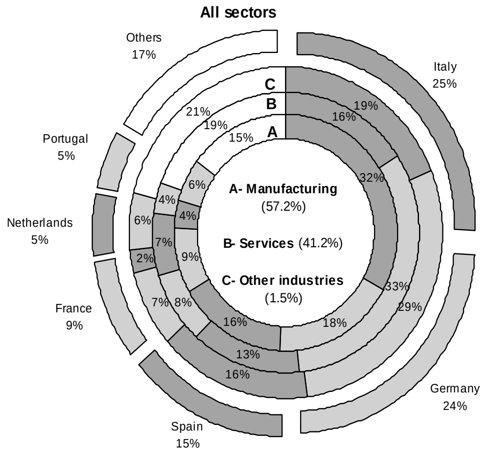
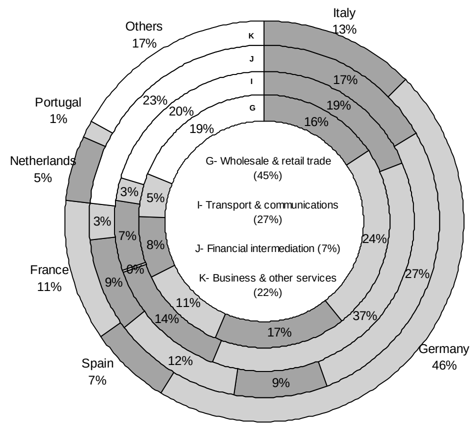


Figure b. CIS3 respondents by service sector and country

% of all responding service firms



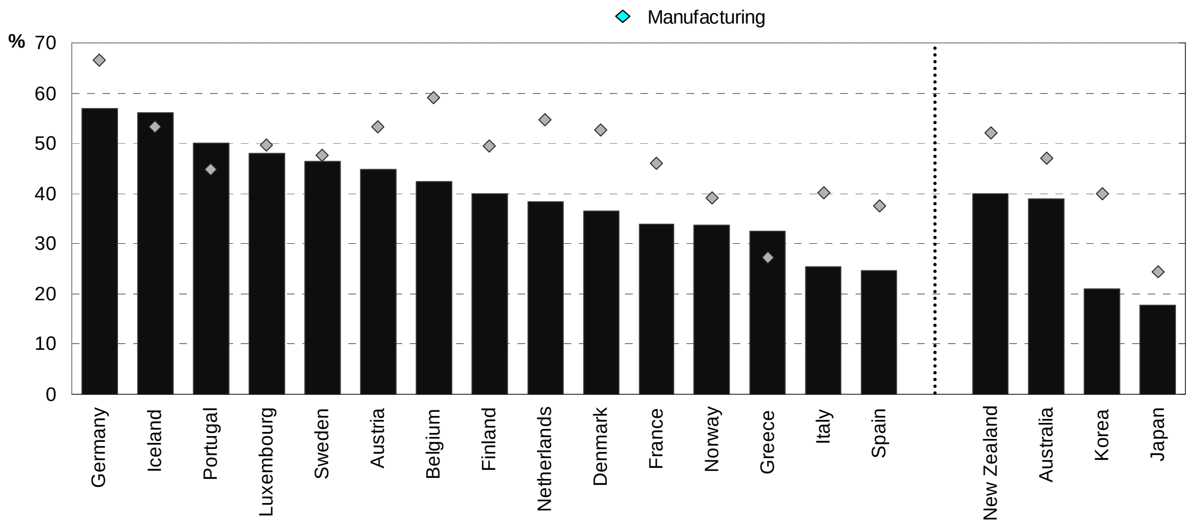
Service-sector innovation varies considerably by sector and firm size

Innovation surveys indicate that service-sector firms are innovative, although less so, in aggregate, than firms in manufacturing industries. In the CIS3 Survey, the share of service-sector firms reporting that they were innovative between 1998 and 2000 (*i.e.* that they had introduced an innovation during the period) ranged from more than 55% in Germany to about 25% in Spain (see Figure 7). In nearly all participating countries, however, the share of innovative service-sector firms in the population of service-sector firms (*i.e.* the innovative density of service-sector firms) was below that of manufacturing firms.[3] In Germany, for example, 65% of manufacturing firms reported that they had introduced an innovation *versus* 55% of service-sector firms; in Spain, almost 40% of manufacturing firms were innovative *versus* 25% of service firms. The largest gaps are found in Belgium, Denmark and the Netherlands, where the difference in innovative density between manufacturing and service-sector firms approaches 20 percentage points. Only in Iceland, Portugal and Greece was the innovative density of service-sector firms higher than that of manufacturing firms. Similar patterns are seen in the innovation surveys of Australia, Japan, Korea and New Zealand, in which between 18% and 40% of services firms were innovative, and in which innovative densities in the service sector were below those in manufacturing. The largest gap between services and manufacturing is observed in Korea where innovation density in the service sector was approximately half that in manufacturing.

3. In this report, *innovative firms* are a sub-population of firms that have generated and/or implemented new products/processes. *Innovative density* refers to the share of innovative firms in the total population of firms.

Figure 7. Innovative density in the service sector and the manufacturing sector

Share of innovative firms in each sector, as a % of firms in each sector



Note: Results of CIS3 and the innovation surveys in other countries are not fully comparable (see Box 1). Time period is 1999-2001 for Japan, 2000-2002 for New Zealand, 2001-2002 for Korea, 2001-2003 for Australia; 1998-2000 for all other countries.

Source: OECD based on data from Eurostat, CIS3 Survey, 2004, and innovation surveys of Australia, Japan, Korea and New Zealand.

These average figures mask considerable variation, with some services appearing to be more innovative than the manufacturing sector average. In the CIS3 Survey, reported innovative density is highest in business services and financial intermediation, with results indicating that more than 60% and 50% of firms, respectively, were innovative (see Figure 8*a*). In wholesale and retail trade and transport and communication, fewer than 40% and 30% of firms, respectively, reported that they were innovative. These figures compare to an average of just below 50% in manufacturing industries. The two least innovative service industries, wholesale and retail trade and transport and communication, account for 60% to 80% of the population of service-sector firms in the CIS3 Survey and thus contribute heavily to the service sector's lower average level of innovation. A similar pattern was found in the Japanese survey, with both business services and financial intermediation industries reporting higher innovation densities than manufacturing (see Figure 8*b*). Australia and New Zealand exhibit somewhat different patterns, with financial intermediation showing innovation densities just below those of manufacturing, and business services even lower.[4]

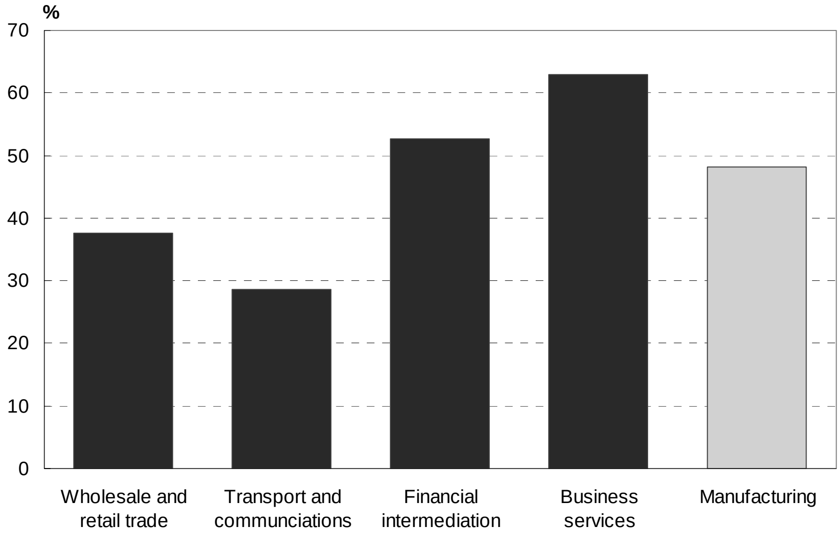
Greater distinctions emerge with deeper analysis, in particular with regards to the communications services sector, which is aggregated with transportation services in the CIS3 Survey. Japan's innovation survey found an innovative density of 30% in the post and telecommunications sector, which is less than in business services but higher than financial intermediation. The transport sector, which includes 30 times the number of firms as in post and telecommunications reported an innovation density of just 9%. In the Australian innovation survey the share of innovating businesses in communication services (53%) exceeded that of manufacturing (47%) as well as financial intermediation (44%). Innovative density in the transport and storage sector was 35%; much lower than the service sector average of 39% (Australian

4. In the case of Australia, the lower innovation density in business service may result from the inclusion of property services firms in the business services category.

Bureau of Statistics, 2005). In New Zealand, 41% of communications services firms were innovative versus 33% in transportation and storage, compared to an average of 52% in the manufacturing sector.

Figure 8a. Average innovative density among EU firms, by industry, 1998-2000

Innovative firms as a % of firms of each sector

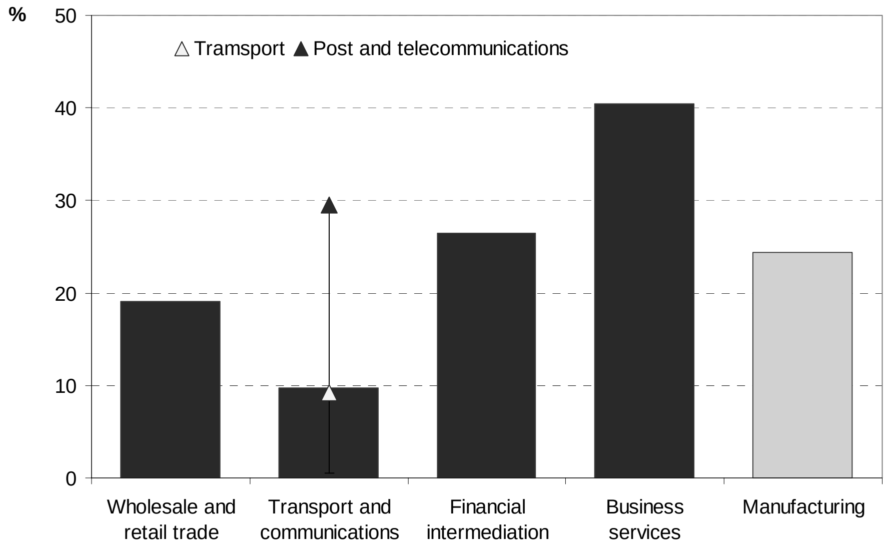


Note: The data shown in this chart reflect an average for all responses to the CIS3 Survey. They have not been weighted to account for sampling bias outlined in Box 1.

Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

Figure 8b. Average innovative density among Japanese firms, by industry, 1999-2001

Innovative firms as a % of firms of each sector



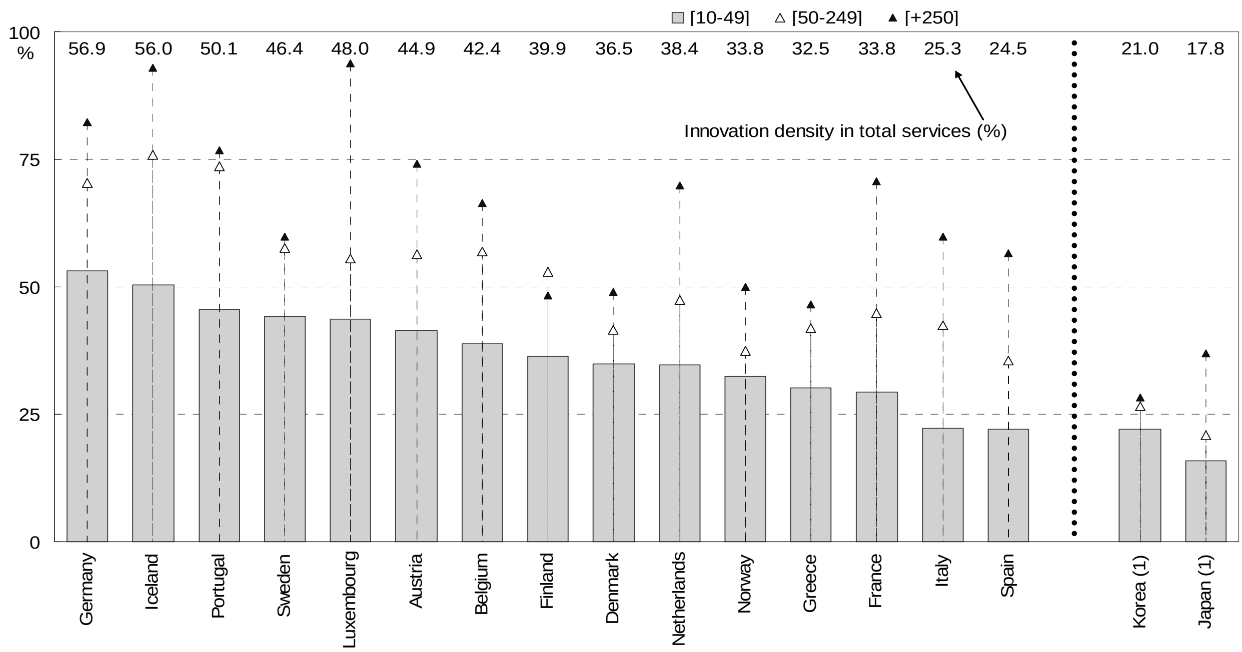
Note: Results of CIS3 and the innovation surveys in other countries are not fully comparable (see Box 1).

Source: OECD based on data from the national innovation survey of Japan, 2004.

Significant differences in innovative performance also exist across firm size. Large service-sector firms (250 or more employees) appear to be considerably more innovative than small firms (fewer than 50 employees) and medium-sized firms (50-249 employees). In the CIS3 Survey, for example, some 75% of large services firms reported that they were innovative, compared to less than 40% of small firms (see Figure 9). In the Japanese and Korean surveys, respectively, 35% and 27% of large services firms reported that they were innovative, compared to 15% and 20% of small firms.[5] The widest gaps in innovative density between large and small firms tended to be in larger European economies — France, Germany, Italy and Spain — where the gaps tended to exceed 30 percentage points; in smaller, Nordic countries the gaps were 20 percentage points or less. Not surprisingly, the vast majority of firms in the service sector are small; in the CIS3 Survey, small firms accounted for more than 80% of all service-sector firms, compared to 75% in manufacturing. Other studies have found that the relationship between firm size and innovation is weaker in services than in manufacturing, suggesting that economies of scale may be less important in the service sector (European Commission, 2004).

Figure 9. Innovative density by size class, 1998-2000

As a % of all firms



Note: 1. 1999-2001 for Japan, 2001-2002 for Korea.

Size classes for Korea differ from other countries: small firms are defined as those with 1-49 employees, medium-sized firms are an average of those with 50-99 and 100-299 employees; and large firms are an average of those with 300-499, 500-999 and more than 1 000 employees. Results of CIS3 and the innovation surveys in other countries are not fully comparable (see Box 1).

Source: OECD based on data from Eurostat, CIS3 Survey, 2004, and innovation surveys of Japan and Korea.

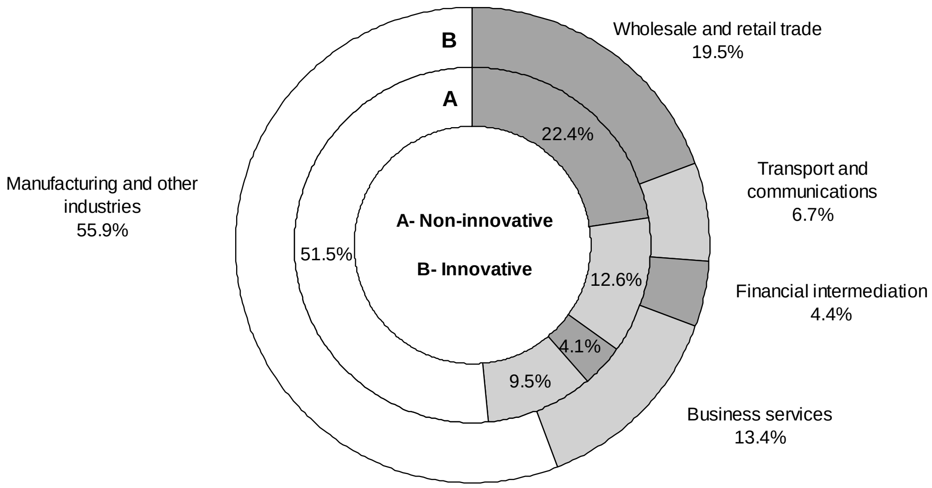
As with the general population of firms, the innovativeness of small firms varies considerably by industry sector. Small firms tend to be more innovative in knowledge-intensive services: business services

5. Available statistics do not allow firm-size comparisons to be made between service and manufacturing firms in Australia. Nevertheless, Australia shows a similar pattern for all firms: 61% of businesses employing 100 or more persons were innovative, compared to 46% of businesses employing 20-99 persons and 30% of businesses employing 5-19 persons.

and financial intermediation. In the CIS3 Survey, these two sectors accounted for 14% of non-innovative small firms and 18% of innovative small firms between 1998 and 2000 (see Figure 10). The relatively large size of the wholesale and retail trade and transport and communications sectors again weighs down the overall average of small firms in the service sector. Nevertheless, there is evidence that small firms in the computer services sector (a sub-element of business services) are as likely to innovate as large firms in that sector (European Commission, 2004).

Figure 10. Breakdown of small firms by sector, innovative versus non-innovative firms, 1998-2000[1]

As a % of all small innovative/non-innovative firms



Note: 1. Firms employing between 10 and 49 persons.

Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

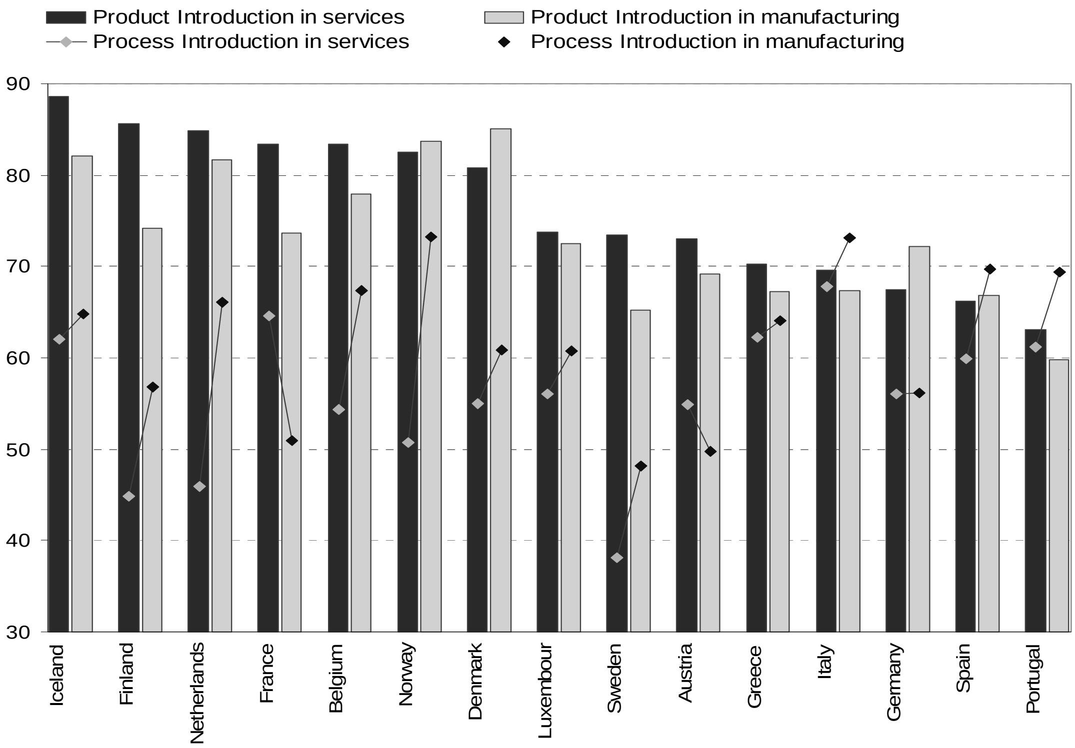
The nature of innovation differs in services

It has long been recognised that innovation in the service sector differs from innovation in the manufacturing sector. Some have characterised the process of service innovation as a "reverse product cycle" (Barras, 1986; OECD, 1996; OECD, 2001*b*) in which a firm first adopts new technology (*e.g.* ICT) to improve the efficiency of an existing process; next, the improved process generates a significant improvement in the quality and delivery of the services provided; and finally the new technology provides the basis for an entirely new service, usually in a different field. Others suggest that innovation in services is mostly non-technical and occurs with small and incremental improvement in processes and procedures (OECD, 2000). Sundbo and Gallouj (1998) distinguish among four types of innovation — product innovation, process innovation, organisational innovation and market innovation — and highlight the latter two as being most pronounced in the service sector. *Ad hoc* innovation, *i.e.* a specific solution to a particular problem posed by a customer, is a fifth type of services innovation, typically made in interaction with the client (OECD, 2001*b*). Innovation by service firms relies heavily on communication with clients, and they frequently engage in *ad hoc* innovation (Kuusisto and Meyer, 2003).

Innovation surveys do not cover the full spectrum of innovation models, but they do suggest that few firms engage in only one type of innovation. Generally product, process and organisational innovation occurs together. In the CIS3 Survey, between 60% and 90% of innovative firms introduced new products on the market; between one-third and two-thirds also introduced new processes (see Figure 11). Although product innovation is more frequent, many innovative firms engage in both types of innovation. Moreover, the innovation surveys indicate that: *(i)* firms in both the manufacturing and service sectors engage in product innovation; *(ii)* in many countries, innovative service firms are more likely than innovative manufacturing firms to introduce new products; and *(iii)* the largest differences between service firms and manufacturing firms relate to process innovations, which were reported more frequently by manufacturing firms. It would be hasty to conclude from these results that service-sector firms are more strongly oriented towards product innovation than manufacturing firms. Several interpretations may be offered to explain these results, including *ad hoc* innovation, which mainly stimulates product innovation. De Jong *et al.* (2003) suggest that the usual distinction between product and process innovations does not apply in service sectors.

Figure 11. Product and process innovation in service and manufacturing sectors, 1998-2000

As a % of all innovative firms

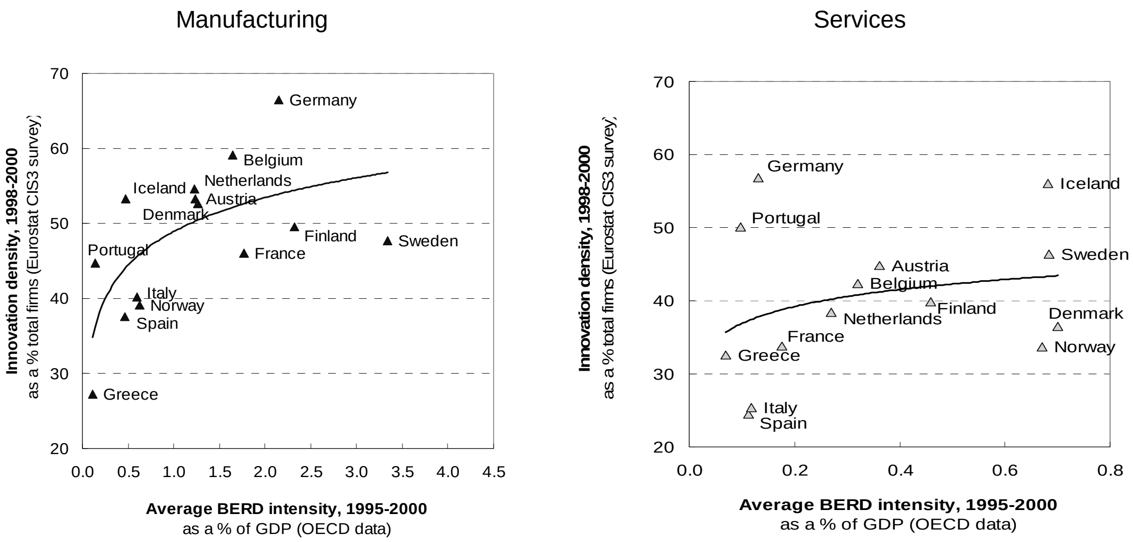


Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

One clear difference between innovation in services and manufacturing is that services appear to rely less on R&D as a key driver of innovation. Although R&D is only one element of innovation in manufacturing, investments in R&D are closely correlated with innovative performance. In countries with higher levels of business R&D as a share of gross domestic product (GDP), the share of innovative firms is also larger (see Figure 12). The correlation is weaker in the service sector, where levels of R&D spending as a share of GDP are far below those of the manufacturing sector. Similar results have been found in other studies as well (DTI, 2003). In many countries, the R&D intensity of the service sector is less than 10% that of the manufacturing sector. This does not mean that R&D is not important to service-sector firms, but that other factors may also play a significant role in service-sector innovation.

Figure 12. Average intensity of business R&D expenditure (1995-2000) and innovative density (1998-2000), by sector

Average BERD as a % of value added in industry and innovative density as a % of all firms



Source: OECD based on data from Eurostat, CIS3 Survey, 2004, and OECD ANBERD Database, 2004.

Innovation surveys provide some insight into other factors that contribute to innovation and their relative importance in service and manufacturing industries. Business innovation depends on firms' ability to create, acquire and manage knowledge. They can do this in a variety of ways, ranging from conducting R&D internally to financing R&D in other organisations, acquiring know-how from other firms via licensing, deploying new machinery and deploying it in novel ways, or investing more in training, design or marketing (see Box 2). Important distinctions appear to exist between manufacturing and service firms in their reliance on these different mechanisms.

Box 2. Activities which contribute to innovation

Intramural research and experimental development (internal R&D): all creative work undertaken within the enterprise on a systematic basis in order to increase the stock of knowledge, and the use of this stock of knowledge to devise new applications, such as new and improved products (goods/services) and processes (including software research).

Acquisition of R&D (external R&D): activities as above, but performed by other companies (including other enterprises within the group) or other public or private research organisations.

Acquisition of machinery and equipment: any advanced machinery, computer hardware specifically purchased to implement new or significantly improved products (goods/services) and/or processes.

Acquisition of other external knowledge: purchase of rights to use patents and non-patented inventions, licences, know-how, trademarks, software and other types of knowledge from others for use in the enterprise's innovations.

Training: internal or external training of personnel directly aimed at the development and/or introduction of innovations.

Market introduction of innovations: including internal or external marketing activities directly aimed at the market introduction of the enterprise's new or significantly improved products. It may include preliminary market research, market tests and launch advertising, but it excludes the building of distribution networks to market innovations.

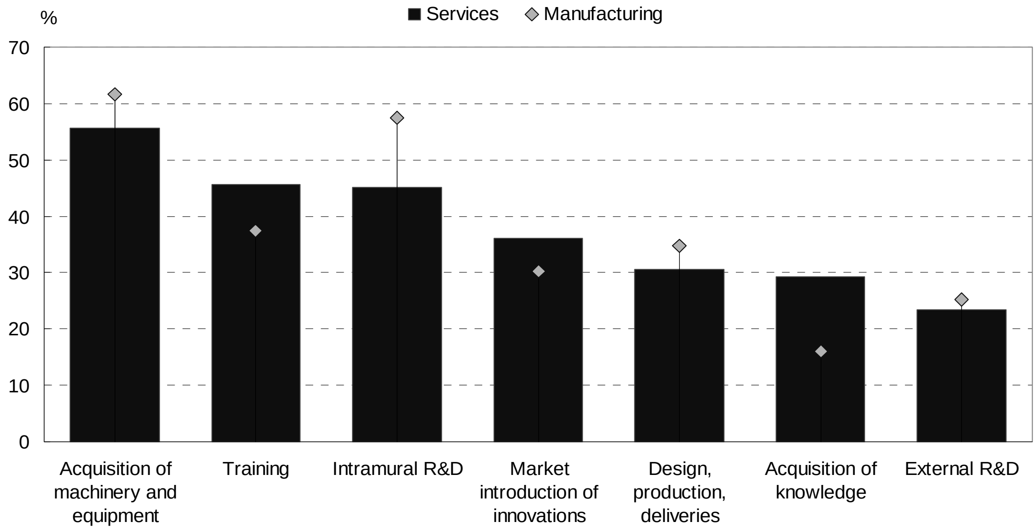
Design, other preparations for production/deliveries: procedures and technical preparations to realise the actual implementation of products and process innovations not covered elsewhere.

Source: CIS3 Survey.

Although acquisition of machinery and equipment was the top innovative activity reported by manufacturing and service firms in the CIS3 Survey (see Figure 13a), it was not cited as frequently by service companies as by manufacturing companies (61% *versus* 57% among service firms). More importantly, manufacturing firms place much greater emphasis on internal R&D, ranking it a close second to acquisition of machinery; service firms place it third, just behind investments in training. Compared to manufacturing firms, service firms also tended to report higher reliance on the external acquisition of knowledge, although they were about equally likely to finance external R&D. R&D, internal or external, remains a privileged knowledge resource for manufacturing firms, whereas training or knowledge acquisition — patents, software or licences — better fit services' needs. Likewise, service firms seem to put more emphasis on marketing of innovations (35% of innovative service firms *versus* 30% of innovative manufacturing firms), while manufacturing enterprises focus instead on production, delivery or design improvements.

Figure 13a. Share of innovative firms by activity, 2000

As a % of all innovative firms, country average from CIS countries reviewed



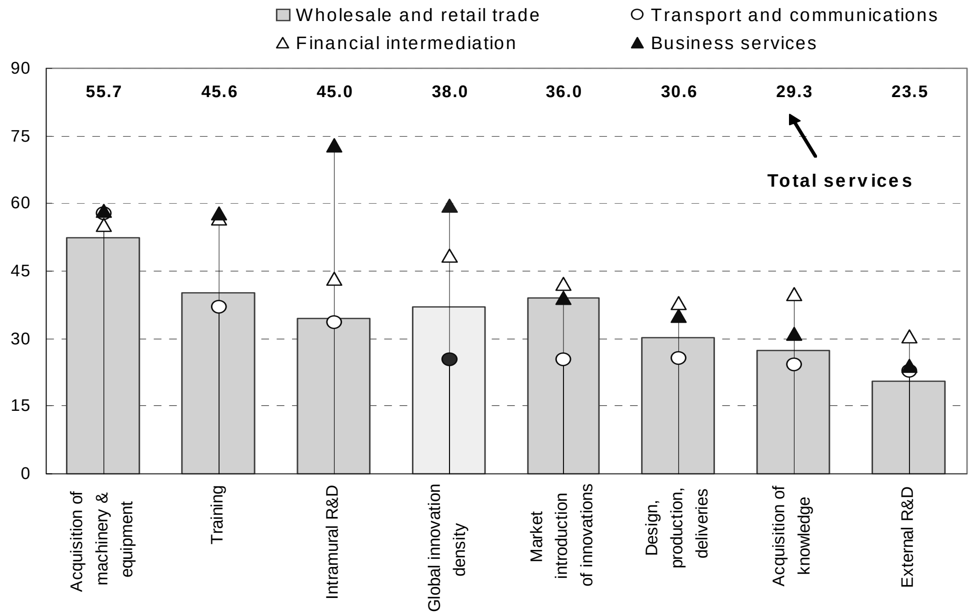
Note: It is not possible to compute a reliable European average as the CIS sample does not take into account country weights. For readability purposes, indicators have been aggregated to illustrate common behaviour. Figures are indicative and should be interpreted as such.

Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

The relative importance of different innovative activities varies considerably from one service-sector industry to another. Consistent with their higher overall levels of innovation, business services and financial intermediation firms make greater use of virtually all mechanisms than do firms in wholesale and retail trade or transport and communications (see Figure 13*b*). The largest differences arise in use of intramural R&D and training. In the CIS3 Survey, approximately three-quarters of responding business services firms conducted intramural R&D, compared to 45% or less of firms in other service industries and less than 60% of responding manufacturing firms. Some 60% of business service and financial intermediation firms engage in training, compared to about 40% of other services firms and less than 40% of manufacturing firms. Such figures reflect differences in innovation processes across service-sector industries and signal that policies aimed at improving service-sector innovation will have different effects on different sectors. They also suggest that some portions of the service sector — in particular business services — innovate in ways that are perhaps more similar to high-technology manufacturing firms than to other service-sector firms.

Figure 13b. Innovative mechanisms used by service sector industry

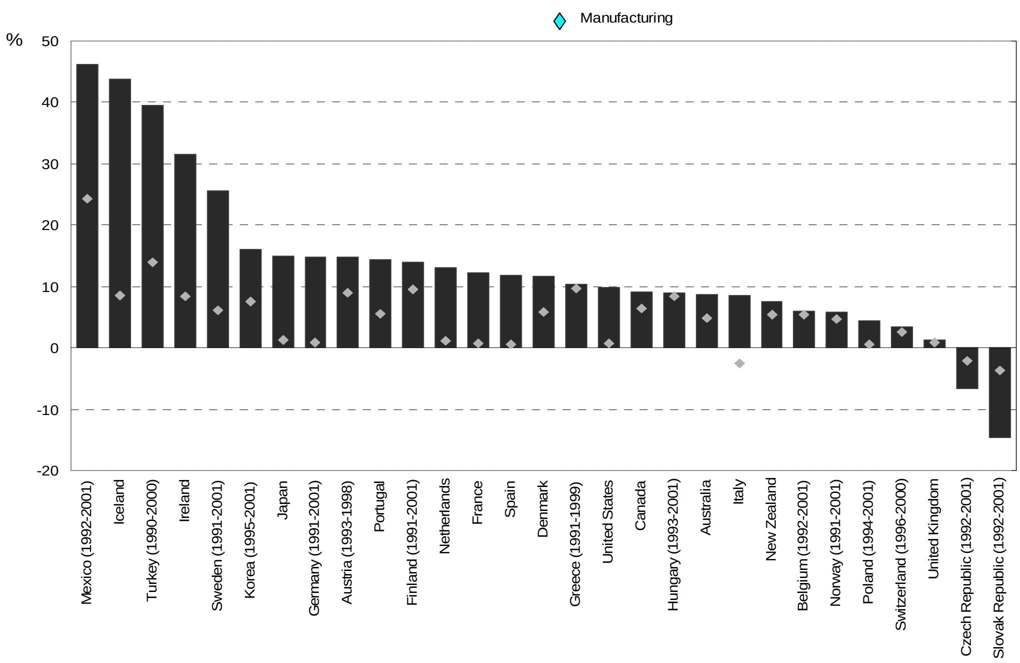
As % of all innovative firms



Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

Figure 14. Growth of business R&D expenditures, 1990-2001

Average annual growth rates (%)



Note: Differences in data collection and reporting methodologies for services R&D limit the comparability of statistics across countries. Total OECD and European Union are estimates. The European Union aggregates include EU member states except Luxembourg, plus the Czech Republic, Hungary, Poland and the Slovak Republic (since 1 May 2004).

Source: OECD ANBERD Database, 2004.

R&D performance supports services innovation

In spite of the fact that the service sector relies less on R&D for innovation, service-sector investments in R&D appear to be rising. Between 1990 and 2001, service-sector R&D increased at an average annual rate of 12% across OECD member countries, compared to approximately 3% in manufacturing (see Figure 14). Large differences between growth rates in services and manufacturing are most pronounced in countries such as France, Germany, Japan, Netherlands, Spain and the United States. While it is clear that a portion of the rapid growth in service-sector R&D is a statistical artifact reflecting better measurement of R&D in the service sector and a possible reclassification of some R&D-intensive firms from manufacturing to services (as their service activities have expanded), it also appears to reflect real increases in R&D by service-sector firms, driven by competitive demands or by increased outsourcing of R&D by manufacturing firms and government.

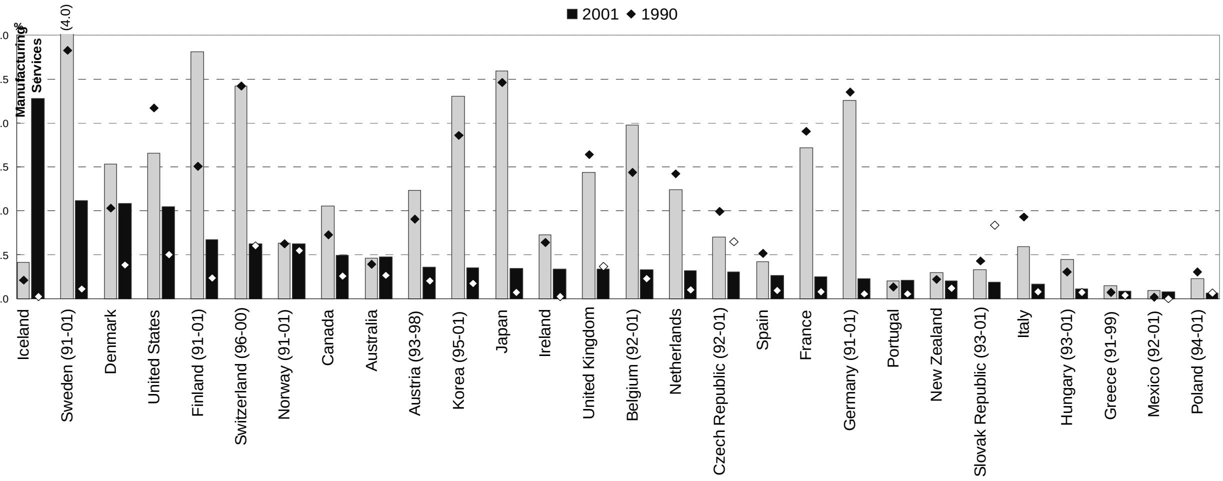
Moreover, R&D appears to have grown faster than value added in services, reflecting its increased importance. R&D spending as a share of value added (R&D intensity) in services is still considerably below that in manufacturing. Whereas R&D spending in the manufacturing sector is above 1% of total value added in half of all OECD member countries for which data are available — and 2% or more of value added in seven countries — R&D intensity in the service sector remains below 0.5% in most countries (see Figure 15). However, available statistics indicate that R&D intensity in services has increased quickly in most OECD member countries, even in many in which manufacturing R&D intensity has declined. Denmark, Iceland, Sweden and the United States show relatively high R&D intensity in the service sector (more than 1%) and high rates of growth, as each added a half-point or more of R&D intensity during the decade. In Australia, Norway and Portugal, R&D intensities in services and manufacturing are about equal.[6]

Service-sector R&D remains highly concentrated. In most countries, business services and post and telecommunications account for more than three-quarters of R&D intensity. Within these broad categories, computer and related services, R&D services and telecommunications services account for almost the entirety. These three sectors, and computer and related services in particular, account for most of the growth in R&D intensity over the last decade (see Figure 16). In Germany, Korea, Netherlands and Portugal, R&D intensity in the computer and related services industry increased more than 25% annually in recent years, and the Korean R&D service sector has seen increases of the order of 75% a year. This highlights the fact that service-sector R&D varies considerably across industries, as is also the case in manufacturing.

6. Differences in data collection and reporting methodologies for services R&D limit the comparability of statistics across countries.

Figure 15. Business R&D intensity[1] in services and manufacturing, 1990 and 2001[2]

As a % of total value added in industry (%)



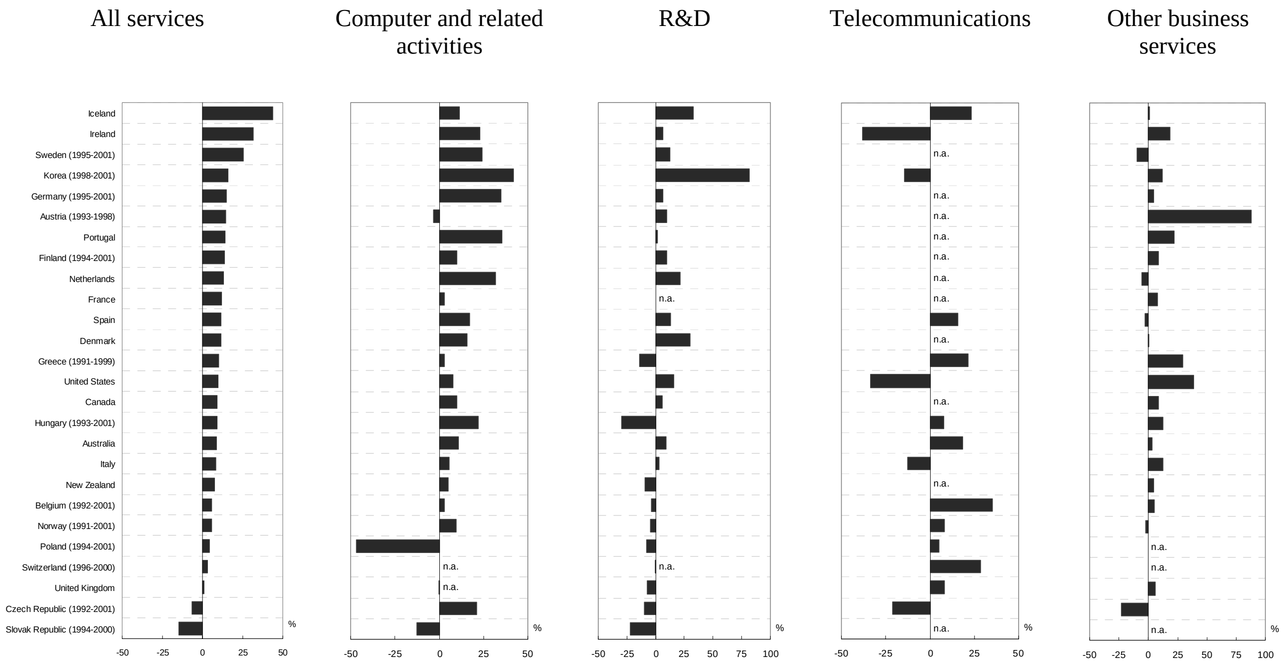
Notes: 1. R&D intensity is defined as business enterprise expenditure on R&D (BERD) as a share of total value added in industry.

2. Differences in data collection and reporting methodologies for services R&D limit the comparability of statistics across countries.

Source: OECD ANBERD and STAN Databases, 2004.

Figure 16. Growth of R&D intensity, services sector, 1990-2001

Average annual growth rates (%)



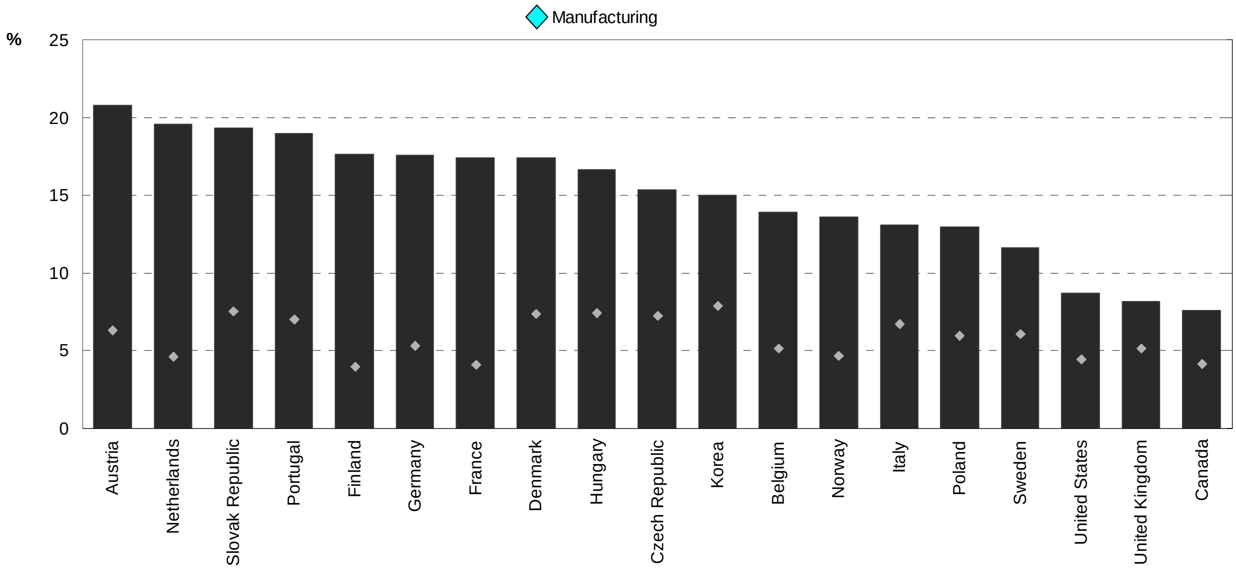
Source: OECD ANBERD and STAN Databases, 2004.

Embodied knowledge is a key driver of innovation in the service sector

As indicated above, investment and equipment are a main source of innovation in service-sector firms. The service sector has traditionally furnished the bulk of tangible investments in buildings, structures and equipment. It accounts for the largest share of economic output, and its investment intensity (ratio of gross fixed capital formation to gross value added) has been substantially higher than that of the manufacturing sector over the past decades (see Figure 17). In 2000, manufacturing firms in the OECD area devoted on average around 5% of value added to investments, whereas services invested between 10% and 20% of value added. Real estate is responsible for most of these investments. However, services such as transport and communication are highly capital-intensive owing to their large investments in infrastructure. Others, such as wholesale and retail trade or financial and business services, are becoming more capital-intensive over time.

Figure 17. Investment intensity in market services, 2001

Gross fixed capital formation as a % of total value added



Source: OECD STAN Database, April 2004.

ICT-related expenditures have been the most dynamic component of investment in recent years. The share of ICTs in total non-residential investment doubled, and in some cases quadrupled, between 1980 and 2000 (see Figure 18). In 2001, the share of ICTs was particularly high in the United States, the United Kingdom and Sweden. The growth of investments in ICT products has been accompanied by a boom in investments in ICT services; software has been the fastest-growing component of ICT investment. In many countries, its share in non-residential investment multiplied several times between 1980 and 2000. In Sweden, Denmark and the United States, software accounted in 2000 for over 15% of total investments (see Figure 19).

Empirical evidence also highlights the importance of ICT in service sector innovation. Management reforms that fuse ICT with a business model were found to be a common element among top-performing service sector firms in Japan in a recent study (METI, 2004). These firms use ICT-supported business models for management of their large-scale organisations, efficient and speedy delivery of their services, and effective and quick response to customers' individual needs. However, the report also stresses that ICT use by itself is not enough to make companies innovative: complementary reforms of management and organisational strategy are indispensable for fostering innovation in service companies. A UK study also highlights that excellent businesses (including service companies) have clear business strategies with particular goals or objectives, and develop their ICT strategies accordingly (Foley, *et al.*, 2003).

Figure 18. ICT investment[1] in OECD countries, 1980-2001

Percentage of non-residential gross fixed capital formation, total economy (%)

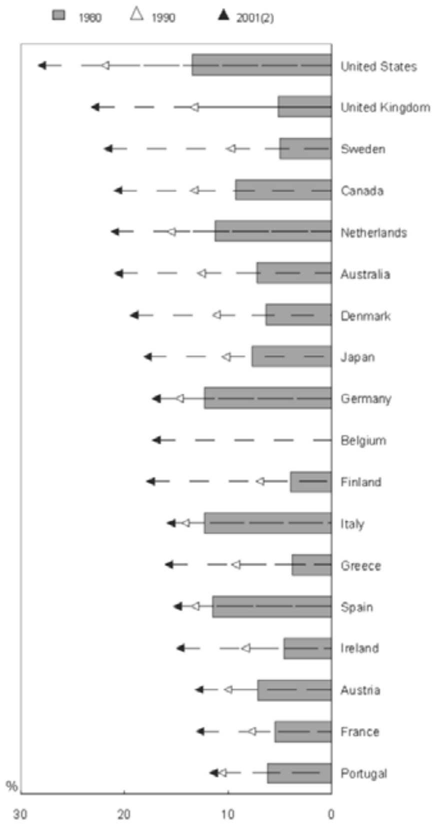


Figure 19. Software investment in OECD countries, 1980-2000

Percentage of non-residential gross fixed capital formation, total economy (%)

Notes: 1. ICT equipment is defined as computer and office equipment and communication equipment; software includes both purchased and own account software. Software investment in Japan is likely to be underestimated, owing to methodological differences.

2. 2001 for Australia, Belgium, Canada, France, Germany, Italy, Spain and the United States. 2000 elsewhere.

Source: OECD (2003), *STI Scoreboard 2003*, OECD, Paris.

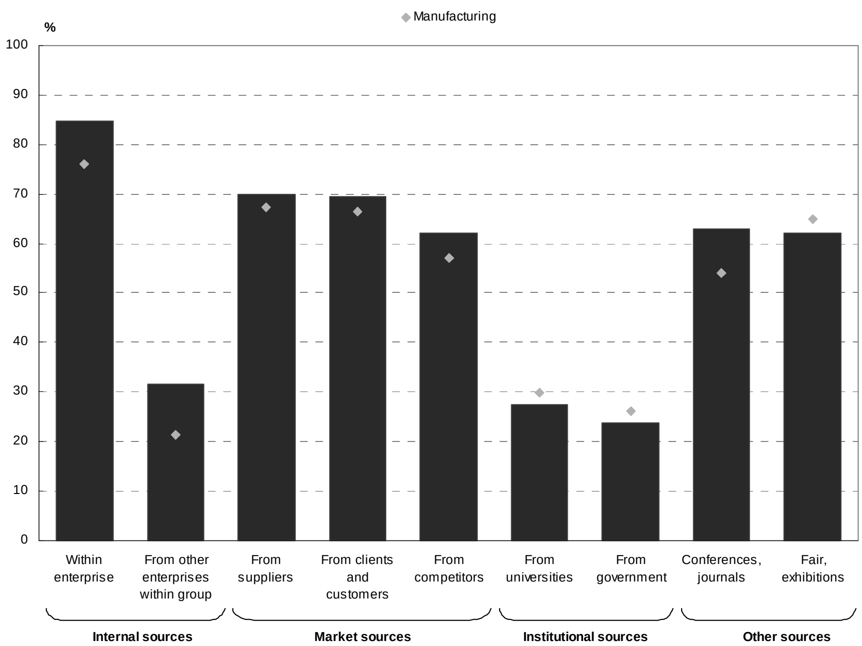
Tapping into outside sources of knowledge

Acquisition of external knowledge (patents, copyrights, software, licences, etc.) feeds non-technical innovation, particularly in knowledge-intensive business services where this type of innovation is increasingly dynamic. Sources of information can be diverse, but access to information networks is vital. Manufacturing and services firms that are involved in innovation tend to use similar sources of information (see Figure 20); they rely most on their own resources, followed by their suppliers, customers and even competitors. Previous European surveys found that the more innovative the firm, the more important are customers as a source of information (Sundbo and Gallouj, 1998). Previous OECD work (2001b) indicated that research in services may be aimed at improving the interface with customers. Improvement of connections between firms and customers develops a two-way exchange of knowledge. Service and manufacturing firms differ most in their use of information from other enterprises within their group. Both types of firms rank this source of information relatively low in the CIS3 Survey, but more than 30% of innovative services firms report using it, compared to 20% of manufacturing firms. This result may highlight the greater importance of inter-firm technology transfer in the service sector, particularly as service firms report less reliance than manufacturing firms on internal R&D for innovation.

Neither sector reports significant use of information from public sector organisations (governments or universities) in the CIS3 Survey, but firms that rely more heavily on science-based innovation are likely to interact with such institutions more frequently. Indeed, strengthening industry-science linkages is a main focus of policy makers concerned with innovation. In most countries, more than three innovative firms out of four in the service sector did not use university or government resources. The public sector is effectively the least important actor in services innovation (Sundbo and Gallouj, 1998). Two explanations have been advanced. One is that public research institutions, including universities, business schools and government administrations, are not oriented towards satisfying the demands and solving the problems of service firms. The other is that a weak relationship exists between service firms and the public sector.

Figure 20. Sources of information used by innovative firms in the service sector, 1998-2000

As a % of total innovative firms



Note: Iceland and Sweden are excluded due to limitations on the quality of the data.

Source: OECD, based on data from Eurostat, CIS3 Survey, 2004.

Human capital remains a cornerstone of services innovation

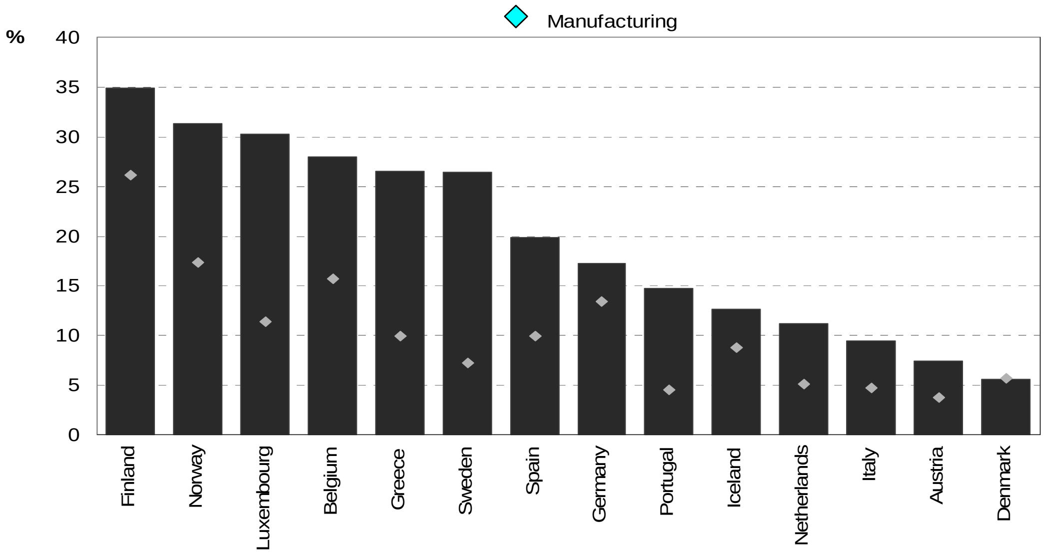
Skills upgrading and human capital are pillars of the innovation process, especially in knowledge-based economies. Reliance on human capital is crucial in the labour-intensive services sector. Employment in services is no longer considered low-skilled and low-paid, and the shift in employment towards services cannot be regarded as a move towards less desirable employment (OECD, 2001*b*). With the increasing involvement of highly skilled workers, growth in service employment accelerated solidly between the early

1980s and the early 1990s (OECD, 1998). The shift towards more high-skill jobs and the increase in activity have increased the risks of shortages and misallocations. At present, while some of the best-paid and most high-skill jobs are in services, many low-skill jobs remain.

The share of employees with higher education is larger in market services than in manufacturing, according to the CIS3 Survey, although results vary across countries (see Figure 21). In Finland, more than one employee out of three in the service sector is a university graduate, compared to one out of four in manufacturing. In many countries the share of highly skilled employees in manufacturing is often less than half of the share in services. The gap is particularly striking in Greece, Luxembourg, Portugal and Sweden.

Figure 21. Share of employees with higher education in the service sector, 2000

As a % of total employment



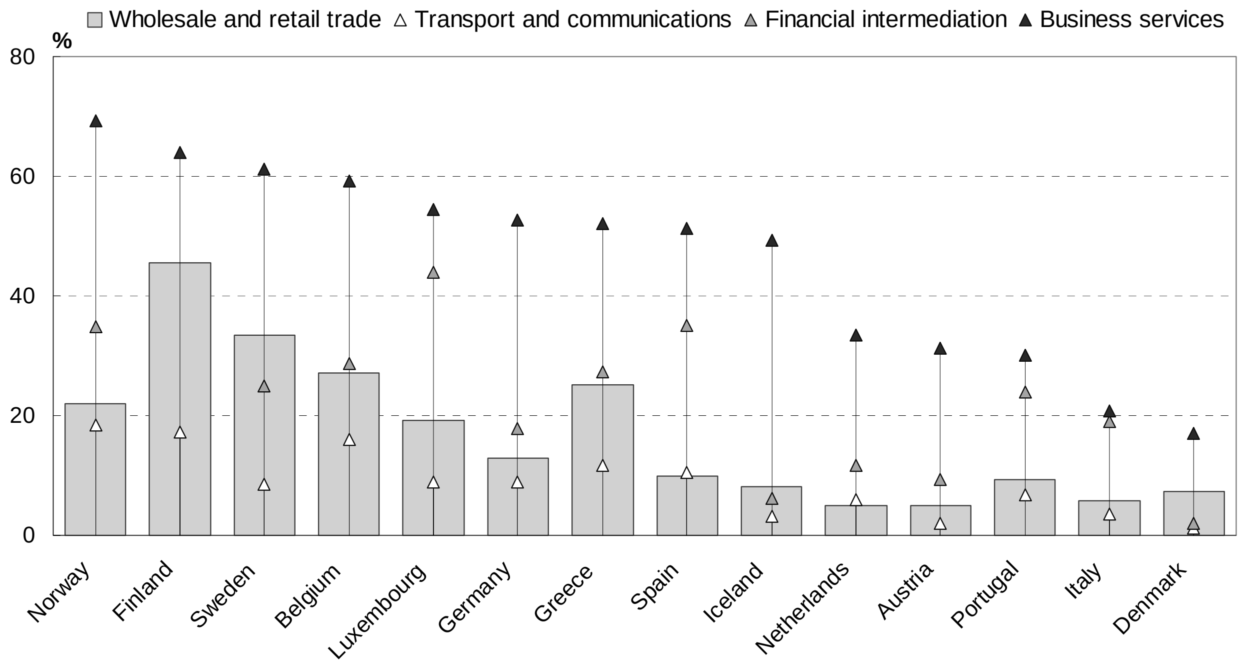
Note: The dot for Iceland is the share of highly skilled employees in the total business sector instead of manufacturing.

Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

Wholesale and retail trade and transport and communications appear to be the main employers in the services. Most highly skilled workers, however, are concentrated in business services and financial intermediation (Figure 22). The proportion of university graduates in business services varies considerably across countries: in Finland, Norway and Sweden, over 60% of business services jobs are occupied by highly skilled personnel, but in Denmark, university graduates account for 20% of such employment. In contrast, the share of highly skilled workers is fairly consistent at around 10% in transport and communications. The high concentration of graduates in the Finnish service sector is related to an unusually high concentration of skills in wholesale and retail trade. To some extent this is also the case in Belgium and Sweden.

Figure 22. Concentration of highly skilled employees in the services, by industry, 2000

As a % of all employees in each service sector



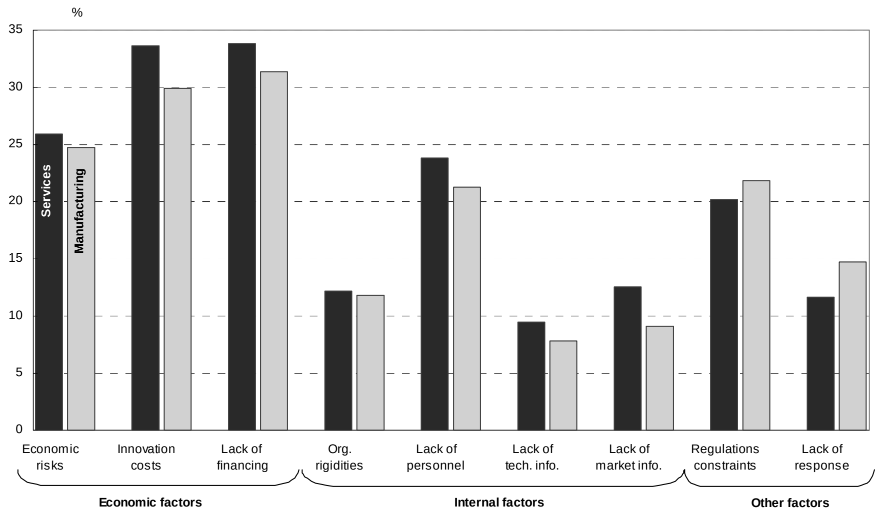
Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

The service sector also accounts for a large share of the employment of scientists and engineers. In the United States, for example, 61% of the 2.7 million employed scientists and engineers worked in the services sector in 1998, compared with 36% in manufacturing (NSF, 2001). This represents significant growth over the previous two decades, as in 1980, manufacturing employed 55% of all US scientists and engineers. As with highly skilled workers, scientists and engineers are most numerous in the financial intermediation and business services sectors, which together accounted for 40% of the service sector total in 1998. Interestingly, scientists accounted for more than half of all service sector scientists and engineers in 1998, compared to less than 20% of manufacturing scientists and engineers. Most held degrees in computer science.

Lack of suitably trained human resources can be a significant impediment to service-sector innovation. In the CIS3 Survey, costs associated with innovation risks and funding difficulties were identified as the main impediments to innovation in both manufacturing and services. However, lack of qualified personnel was frequently mentioned as a highly relevant barrier in European countries (see Figure 23). It was identified as the second largest barrier in the Korean innovation survey and as the third largest in New Zealand. An earlier survey of European service firms also concluded that the lack of highly educated personnel was an obstacle, especially for knowledge-intensive services (Sundbo and Gallouj, 1998). Innovative firms are particularly sensitive to a lack of skilled personnel and frequently point this out. The study on New Zealand's top-performing service companies stressed the importance of human resource development in the service sector. Motivated, skilled staff was identified as the most common source of competitive advantage by senior managers of 44% of the top-performing companies, more than any other factor (Gray, *et al.*, 2001). Training often comes with the introduction of a new product or process.

Figure 23. Factors impeding innovation in services and manufacturing

Percentage of firms checking the factor as highly relevant as a share of all firms expressing any relevance (%)



Source: OECD, based on data from Eurostat, CIS3 Survey, 2004.

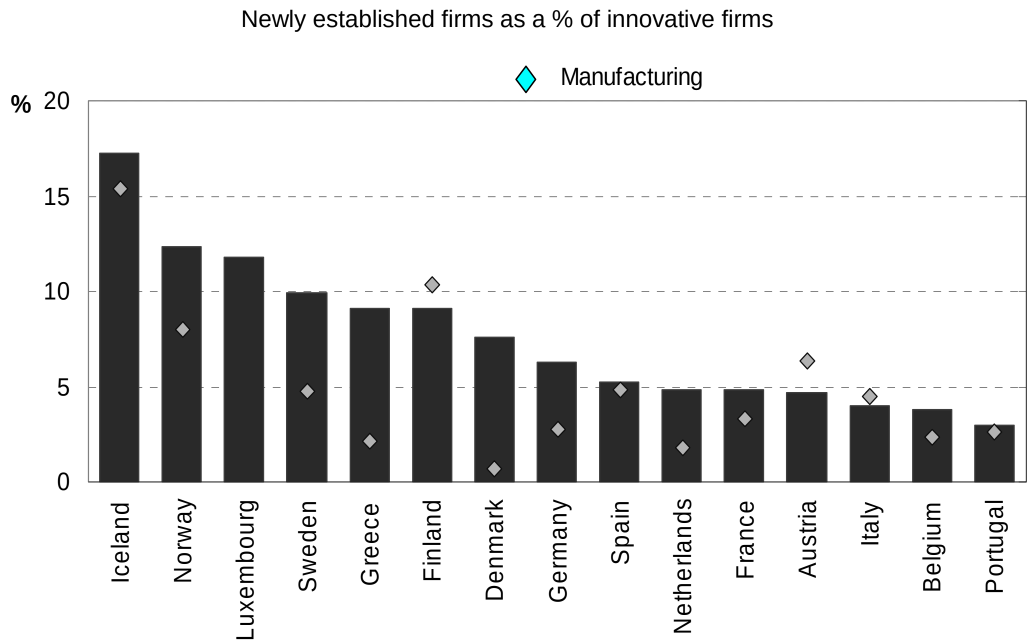
The importance of highly skilled labour for the service sector implies that policies to encourage service-sector innovation will need to emphasise education and training. This need goes beyond the training of human resources for science and technology that play a significant role in R&D to include a much larger segment of the working population. Governments have a significant role to play in providing basic education and in increasing the share of national populations with tertiary education, but co-operation with the private sector may also be necessary to ensure that education programmes remain relevant to industry needs and keep pace with developments in fast-moving fields, such as ICT.

Entrepreneurship is a key driver of services innovation

The process of firm entry and exit plays a significant role in productivity growth by reallocating resources from units with lower productivity to units with higher productivity (OECD, 2001*a*; Scarpetta, *et al.*, 1992). Recent studies indicate that in Europe between 12% and 19% of all non-agricultural firms enter or exit the market every year (OECD, 2003). This process of creative destruction facilitates innovation and the adoption of new technology (Brandt, 2004). Research demonstrates several additional points: *i)* entries and exits are highly correlated, illustrating a process of search and experimentation, but entries exceed exits in most countries; *ii)* new firms typically start small and do not survive very long, but those that do usually grow rapidly over time.

Entrepreneurship plays an important role in service-sector innovation. First, firm renewal is generally more intense in services than in manufacturing. In particular, entries are substantially higher in dynamic service sectors, such as business services or ICT-related industries, than in mature industries (OECD, 2003). Second, innovation surveys indicate that new firms account for a larger share of innovative firms in the service sector than in manufacturing (see Figure 24). In Sweden, for example, 1 out of every 10 innovative service firms was established after 1998, versus just 1 out of 20 innovative manufacturing firms. In Denmark, approximately 8% of innovative service firms were new compared to only 1% of innovative manufacturing firms. In countries with lower rates of new firm entry, however (*e.g.* Austria, Italy and Portugal), the difference between the service and manufacturing sectors is smaller or even reversed. This may highlight the strong role of an innovative service sector in business dynamism and, beyond a threshold of entries, a shift in firm creation towards innovative service activities.

Figure 24. Share of new firms in the population of innovative firms in manufacturing and services, 1998-2000

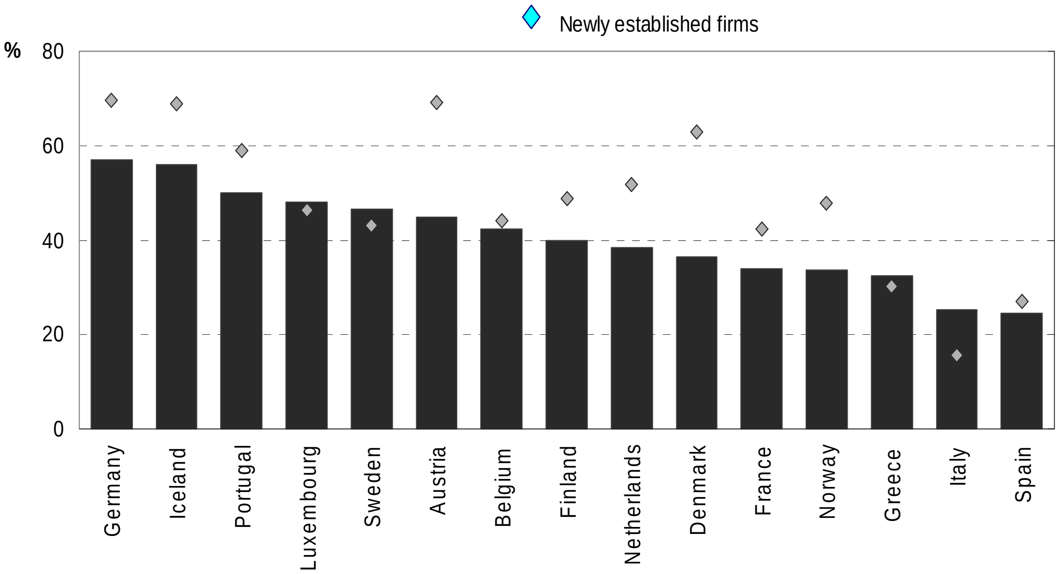


Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

Nevertheless, there appear to be limits to the ability of entrepreneurship to improve innovative performance in the service sector. To some extent, the ability of new firms to innovate is conditioned by the general economic environment in which they operate. In more innovative economies, new firms need to be more innovative to compete and to integrate into the supply chains of established, and often larger, firms. In less innovative economies, the incentives for new firms to innovate may be weaker. Results of the CIS3 Survey provide some support for this hypothesis: countries with higher overall levels of innovation (*i.e.* larger shares of firms reporting the introduction of an innovation) tended to have higher levels of innovation among new firms; countries with low innovative density, such as Greece, Italy and Spain, had the lowest innovative density among small firms. In the cases of Greece and Italy, new firms were less innovative than the general population of service firms (see Figure 25). Interestingly, while the innovative density of new service-sector firms is higher than that of established firms in most countries, the same trend does not hold true in manufacturing.

Figure 25. Innovative density of new and established firms in the service sector, 1998-2000

Innovative firms as a % of all services firms



Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

Intellectual property rights and innovation in services

Protection of intellectual property (IP) plays a limited but growing role in service sector innovation. Although levels of use remain below those in manufacturing, service sector firms increasingly employ formal mechanisms of IP protection, such as patents copyright and trademarks, to protect their inventions from imitation. This is particularly true in the software sector (a service-sector industry), where firms use a combination of copyright and patents to protect software-related inventions, and with regard to business method inventions which are used in a variety of services industries. Differences in patent regimes affect the patentability of software and business methods in major OECD regions, but overall numbers of patents are increasing. While considerable uncertainty remains about the effect of such patents on innovation processes — and on overall levels of innovation[7] — it is clear that firms are taking a more active stance on IP protection through patenting.

7. For further discussion of the relationship between patents, innovation and economic performance see OECD (2004*a*).

Box 3. Analysis of service-sector patenting using the OECD patent database

In order to complement the information available from responses to innovation surveys and to provide insight into patenting patterns outside of Europe, an analysis was performed using data available in the OECD Patents Database of patenting by an international sample of 39 companies whose main activity is related to services. The results of this analysis cannot be considered statistically robust, but they can provide an illustration of patenting patterns by large service sector firms.

The companies selected are headquartered in the United States, Europe and Japan and are among the world's largest service-sector companies as measured in terms of market value or revenues as reported in the 2004 *Business Week* Global 1000 and the 2004 *Fortune 500* rankings. They are grouped according to their general service-sector industry, using classifications consistent with those available in the CIS3 Survey. One relatively new small company, Amazon.com, was added to the sample to provide insight into the patenting practices of an Internet-based retailer. The resulting sample contains 17 US firms, 15 European firms and 7 Japanese firms that together were granted more than 8 000 patents between 1978 and 2002 (see Table a).

Information on the patents held by these firms was extracted from the OECD Patents Database to indicate: the name of applicants, priority date of the patent application, patent class (based on the International Patent Classification [IPC]), and patent title. Data were compiled for patents filed in the European Patent Office (EPO) and Japan Patent Office (JPO) and granted in the US Patent and Trademark Office (USPTO), as well as for triadic patent families that reflect patents applied to all three offices to cover the same invention. Efforts were made to clean the data by identifying and consolidating applicant names to take into account changes in the ownership of firms and filing by affiliates during the time period considered. Nevertheless, the resulting patent counts may not be exact, and results should be interpreted with caution.

Additional analyses were conducted of patenting in two areas closely associated with the service sector: software patents and business-method patents. Given the lack of a robust and well-accepted definition of software patents at present, consideration was given to a number of different definitions with the aim to highlight the difficulties encountered by researchers in this field. Patterns of business-method patenting were examined by extracting information on all patents granted by the USPTO in US patent class 705, which is the class most frequently associated with business methods.

Table a. Service sector companies examined, by industry sector and region

Sector	United States	Europe	Japan
Wholesale & retail trade	Wal-mart, Target, Amazon.com	Carrefour, Metro, Marks & Spencer, Ahold	Ito-Yokado
Transport	AMR, United Airlines	A.P. Moller-Maersk	East Japan Railway
Post and telecommunications	United Parcel Service, Verizon	Vodaphone, Télefónica, Deutsch Telekom, Deutsche Post	NTT DoCoMo, Yamato Transport
Financial services	CitiGroup, Merrill-Lynch, American International Corp.	HSBC, UBS, BNP Paribas, Bank of Scotland	Mitsubishi Tokyo Financial
Business services	AOL Time Warner, Accenture, Sabre Holdings, Ernst & Young, PricewaterhouseCoopers	SAP, T-Online AG	NTT Data, Secom
Food services	McDonald's, Starbucks		

Service firms protect their IP, but less extensively than manufacturing firms

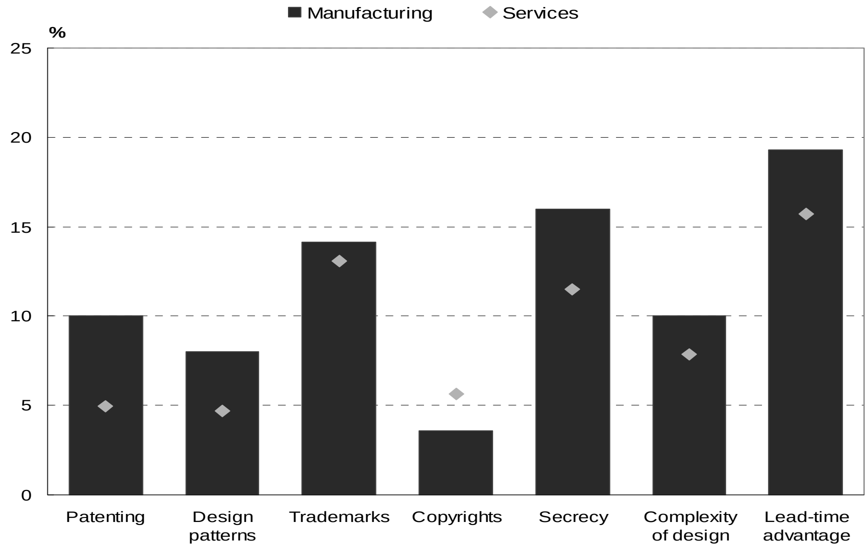
Innovation surveys indicate that service firms rely on formal and strategic methods of protecting their IP, although less so than manufacturing firms. The most frequently used methods by European service firms are lead time, trademarks and secrecy, which are employed by 11% to 16% of all service-sector respondents (see Figure 26*a*). Patents, copyrights and protection of design patterns were employed by only about 5% of responding firms. In the case of Japanese service firms, lead time and secrecy are also used frequently to protect IP, but at levels only slightly above those for formal methods of protection (see Figure 26b). With the exception of copyright, all protection mechanisms appear to be more widely used by manufacturing firms in both Europe and Japan. The largest gap between services and manufacturing in Europe appears in patenting activities, where service firms reported, on average, only half the rate of use as manufacturing firms (5% versus 10%). This gap may reflect, in part, differences in patentability: in the European Patent Office, the patentability of service-related inventions (*e.g.* software and business methods) is more restricted than in the United States or Japan, and firms tend to patent most frequently in their home patent office (national or regional). In Japan, the gap in patent use by manufacturing and service firms is also large, as is the gap in the use of secrecy. Among a sample of service firms examined using the OECD Patents Database, European firms tended to patent less frequently, in general, than US or Japanese firms.

Use of different mechanisms for protecting IP varies considerably across service-sector industries. In the CIS3 Survey, business services firms reported the greatest use of IP protection measures, in particular strategic methods and copyrights. Interestingly, use of three of the formal methods of IP protection (trademarks, registration of design patterns and patenting) was reported by a relatively large share of firms in the wholesale and retail trade sector, with firms in transport and communications showing the least use of all mechanisms (see Figure 27). This latter result may reflect the effect of combining transportation and communications firms into one aggregate grouping. In a firm-level analysis of patenting by service-sector firms (see Box 3), the selection of firms in the communications sector showed extremely high levels of patenting. The telecommunications firms examined were among the largest patent holders in all three patent offices, accounting for 38% of all the patents held by the sampled firms (60% of the EPO patents, 27% of the JPO patents and 42% of the USPTO patents). Business service firms also held large numbers of patents and accounted for another 38% of the sample. The selection of firms in the wholesale and retail trade sector accounted for less than 1% of the total.

The significant differences in patenting found in the CIS3 Survey and the sample of individual firms studied may reflect differences between large and small firms. The sample analysis focuses only on the largest national and multinational companies, while the CIS Survey samples a much larger number of firms. CIS3 results do not take into consideration differences in the size of the patent portfolios held by large firms versus small and medium-sized enterprises. The sample analysis shows that large service sector firms often maintain large portfolios with more than 100 patents. The Australian innovation survey, which contains more disaggregated data by sub-sector, supports this conclusion. The percentage of firms in the communications sector using IP protection measures is far above that in other service industries and in manufacturing (Australian Bureau of Statistics, 2005).

Figure 26a. Use of IP protection mechanisms in manufacturing and services by EU firms: CIS3, 1998-2000

Average % firms reporting use of these methods

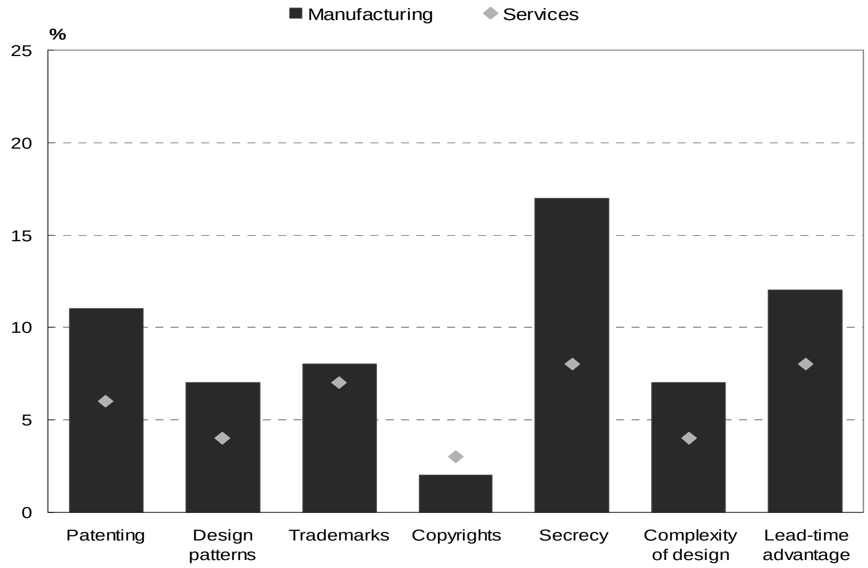


Note: Results of CIS3 and the innovation surveys in other countries are not fully comparable (see Box 1).

Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

Figure 26b. Use of IP protection mechanisms in manufacturing and services by Japanese firms: Japanese national innovation survey, 1999-2001

Average % firms reporting use of these methods

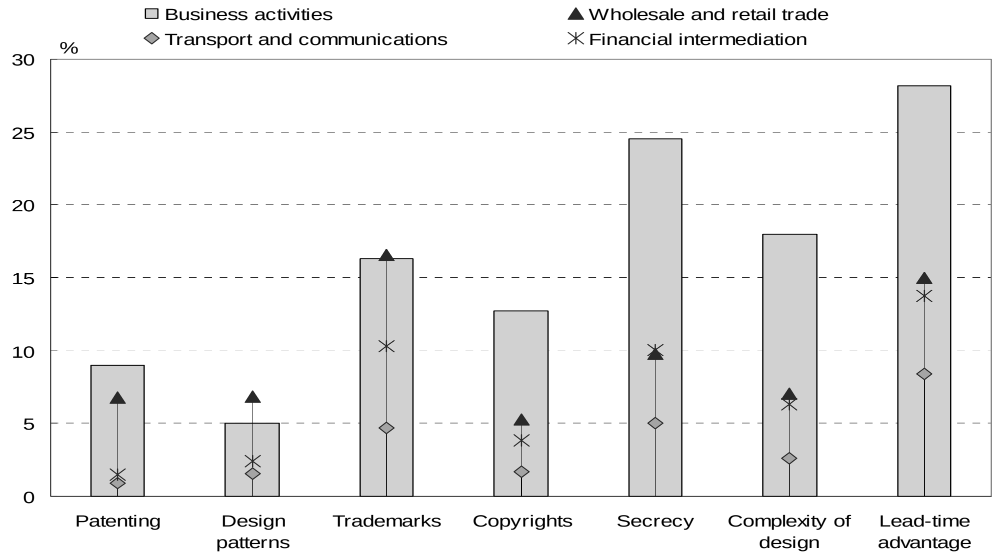


Note: Results of CIS3 and the innovation surveys in other countries are not fully comparable (see Box 1).

Source: OECD based on data from the national innovation survey of Japan, 2004.

Figure 27. Use of IP protection in EU services firms by sector

Average % firms reporting any use of these methods

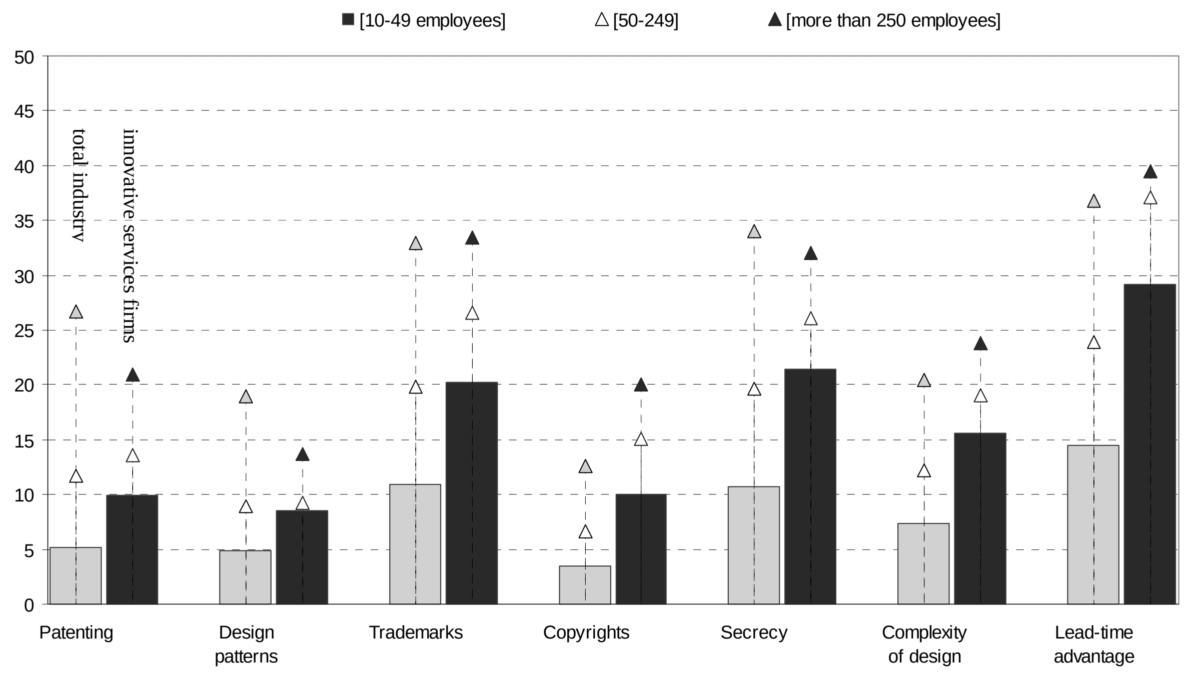


Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

Firm size makes a difference

Consistent with the above findings, the CIS3 Survey reveals considerable differences in the use of IP protection by service sector firms of different sizes. Larger services firms (*i.e*. those with more than 250 employees) are considerably more likely to employ all forms of IP protection than medium-sized and small firms (see Figure 28). However, the gap between large companies and small companies in innovative service firms is smaller than that observed among all firms (innovative and non-innovative) in all industries. Among innovative service firms, the intensity of use of IP protection mechanisms by large firms is less than twice that of small firms. Among all firms, the difference is often a factor of three or four. In general, large, innovative service-sector firms are no more likely to employ the different IP protection mechanisms than large firms in general, but small innovative services firms are twice as likely to use them as small firms, in general. Although more analysis is needed to confirm these results, this observation suggests that small, innovative service firms (including start-ups) actively protect their competitive advantage, where possible, through IP protection.

Figure 28. Use of IP protection by firm size



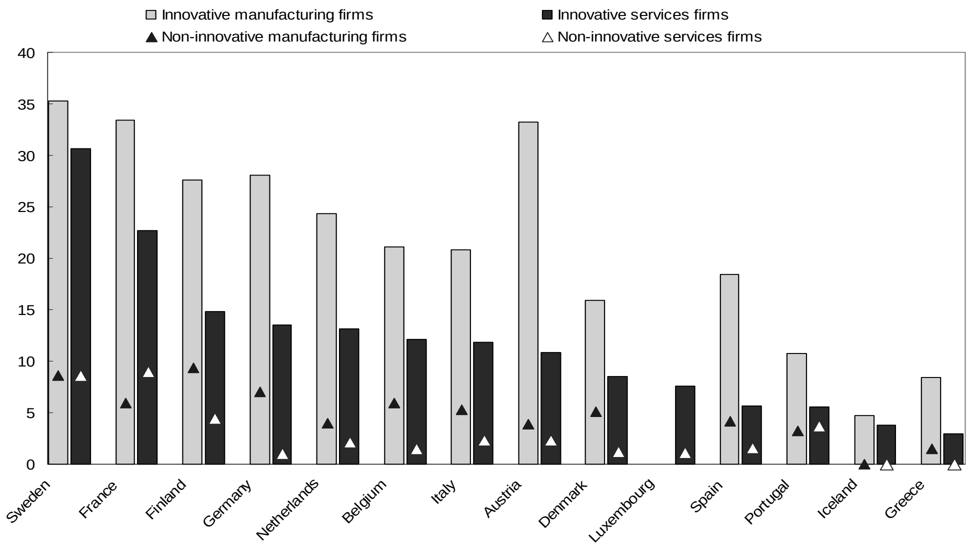
Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

Innovative firms rely more often on patents

Not surprisingly, formal IP protection methods, such as patents, are employed much more frequently by innovative than non-innovative firms. In the CIS3 Survey, the share of innovative manufacturing firms with a valid patent ranged between 20% and 35% in half the participating countries; only 3% to 10% of non-innovative manufacturing firms held a valid patent (see Figure 29). Among service sector firms, the share of innovative firms reporting a valid patent ranged from 10% to 30% in more than half the participating countries; the share of non-innovative services firms with valid patents exceeded 5% in only two countries (Sweden and France). A similar pattern holds among firms that filed for patents in the three-year period from 1998-2000. These findings suggest that innovative services firms behave more like innovative manufacturing firms than non-innovative services firms in their patenting and IP protection behaviours.

Figure 29. Propensity to have valid patents in innovative firms, 2000

% firms that have valid patents among innovative and non-innovative firms, in manufacturing and in the services



Source: OECD based on data from Eurostat, CIS3 Survey, 2004.

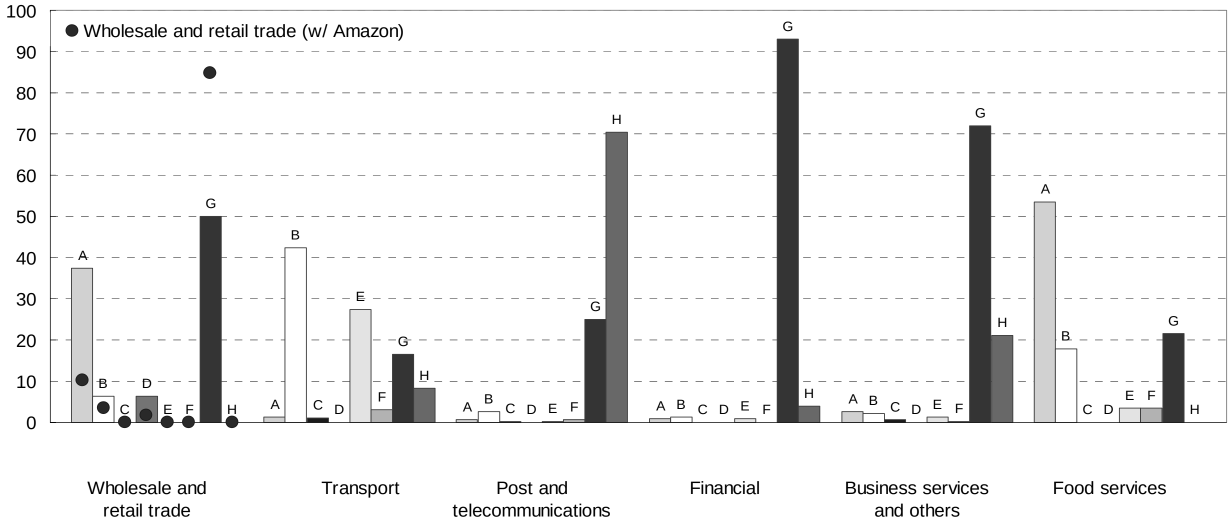
ICT and software account for a large share of service-sector patenting

Despite the wide range of specific industry sectors in which service-sector firms operate, a large share of their patents appear to relate to ICT and software inventions, reflecting the importance of ICT-enabled innovation in services. Among the service sector firms examined, a large number are in IPC class G which covers (in subclass G06), inventions for computing, calculating and counting, including software-related inventions (see Figure 30). Most of the service companies examined file in patent category G06F17, which covers digital computing or data processing equipment or methods, specially adapted for specific functions. More than 90% of the patents filed by the eight financial services firms examined belong to the class G, as do more than 70% of the patents filed by the nine business services firms examined — even though the list of examined business service companies contains only one pure software producer (SAP). Even when Amazon.com is excluded from the analysis, more than half of all wholesale and retail patents are in class G (the figure exceeds 80% when Amazon.com is included).

Beyond software-related patents, the analysis indicates that service-sector firms also patent in particular fields that are closely related to their areas of business. For example, post companies in the sample file patents most often in IPC class B65, which covers inventions related to conveying, packing, storing, and handling thin or filamentary material. Food service companies examined often patent in category A47 for furniture, domestic articles or appliances, coffee mills, spice mills and suction cleaners in general. More than 40% of the patents filed by the transport companies studied are in category B for performing operations and transporting. Most of them cover inventions related to machine tools, vehicles, railways and ships or other water borne vessels. Telecommunication companies examined file a huge number of patents in the H04 category for electric communication techniques, which is also to be expected in light of their main activities.

Figure 30. Classification of patents by select service firms

as a % of total patents by select firms grouped by main sector of activities



Note: Patents are classified according to the primary patent classification based on the International Patent Classification (IPC). A – Human necessities (including cooking equipment); B – Performing operations, transporting; C – Chemistry, metallurgy; D – Textiles, paper; E – Fixed constructions; F – Mechanical engineering, lighting, heating, weapons, blasting; G – Physics (including computing); H – Electricity (including electronic communications)

Source: OECD Patent Database, September 2004.

The geographic coverage of service-sector patents follows patterns of industrial globalisation. US companies included in the sample filed more than 60% of their patents to the USPTO; European and Japanese companies studied filed 79% and 90% of their patents in EPO and JPO, respectively. This reflects the limited geographic coverage of the offerings of many service-sector firms. For example, East Japan Railway Company operates almost exclusively in Japan; major telecommunications service providers also tend to have limited geographic coverage. However, as service-sector firms globalise, their patenting also become more international. A number of international financial firms (*e.g.* CitiGroup and Merrill Lynch) hold patents in several countries, as do larger business services firms. NTT DoCoMo, the largest mobile communication provider in Japan, filed a large number of patents at EPO, especially after 1999. The company launched its services throughout Europe in 2002 in Germany, followed by the Netherlands, Belgium, France, Spain, Italy and Greece.

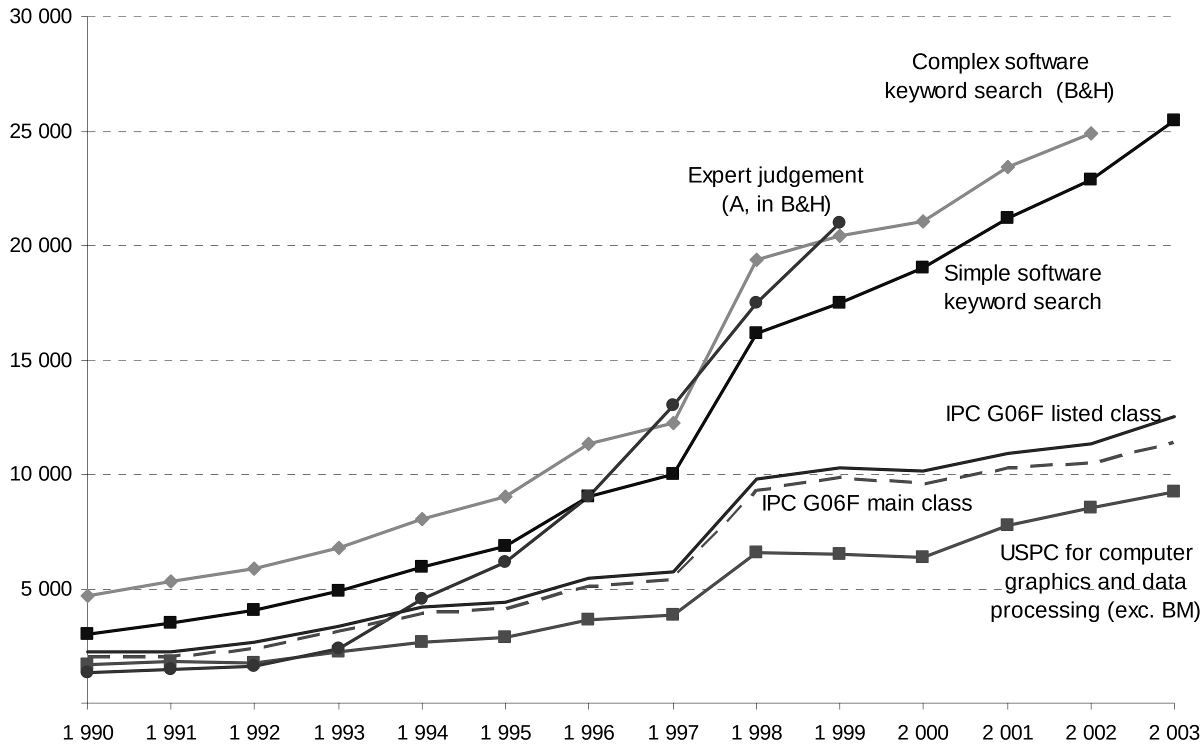
Software patents

As noted, software-related patents account for a sizeable share of the patents held by service-sector firms. There does not exist a single, generally accepted approach to count software-related patents, and various measures offer estimates ranging from 10 000 to 25 000 US-issued software-related patents in 2003 (see Figure 31).[8] A recent study estimates that USPTO granted over 20 000 software patents each

8. Six different estimates of software-related patents are based on the following methodologies: *(i)* complex software keyword search; *(ii)* simple software keyword search; *(iii)* expert judgement; *(iv)* count of patents in computer graphics and data processing US patent classes (excluding USPC-705, specific to business methods); *(v)* count of patents with main IPC class being electric digital data processing (IPC class G06F); and *(vi)* count of patents with one of its IPC classes being electric digital data processing. The first three methodologies seem to be relatively consistent among them, whereas others offer much lower patent counts.

year during the 1990s, accounting for over 15% of all patents granted in the 1990s (Hunt and Bessen, 2003). Lower estimates tend to result from attempts to count patents with specific patent classes related to software. Higher estimates result from keyword searches and other approaches (*e.g.* expert judgement) that look for software-related patents across patent classes. [9] The latter approach reflects the pervasiveness of software across technology fields and industry sectors and highlights that questions related to the patentability of software-related inventions have implications far beyond the software industry itself.

Figure 31. USPTO grants of software-related patents, grant years 1990-2003



Note: The definition of each series set out in the figure is as follows: *(i)* Complex software keyword search: USPTO database search for patents using the word *software* in their specification OR using the words *computer* AND *program* in their specification, AND utility patents excluding reissues, AND NOT using the words *semiconductor* OR *chip* OR *circuit* OR *circuitry* OR *bus* in their title, AND NOT using the words *antigen* OR *antigenic* OR *chromatography* in their specification; *(ii)* Simple software keyword search: USPTO database search for patents using the word software in their specification; (*iii)* Expert judgment: Greg Aharonian expert estimates of software patent counts, as included in Hunt and Bessen (2003); *(iv)* USPC for computer graphics and data processing (excluding business methods: USPTO (2001) count of patents in all classes related to computer graphics and data processing, excluding USPC 705, which is specific to business methods (taking into account original classifications only, to avoid double counting). USPC classes included in the counting are 345, 700, 701, 702, 703, 704, 706, 707, 716 and 717; *v)* IPC G06F Listed Class: USPTO patents having IPC Class G06 as one of its related patent classes; and vi) IPC G06F Main Class: USPTO patents having IPC Class G06 as its main patent class.

Source: OECD based on data from Hunt and Bessen (2003), “An Empirical Look at Software Patents”, Federal Reserve Bank of Philadelphia, Working Paper No 03-17/R; USPTO (2004), *Patents Counts by Class by Year: January 1997-December 2003*, Arlington, Va.; OECD Patents Database, November 2004.

9 In jurisdictions where the patentability of software is not settled, patent counts based on software keyword searches may provide much lower estimates as applicants may try to avoid the use of easily identifiable keywords in their applications.

The patentability of software inventions is a highly contentious topic. At present, patentability requirements differ across countries and regions (see Table 1). In the United States software-related inventions can be patentable if they produce a tangible benefit; in Europe and Japan, however, their utility has to be explicitly claimed with reference to hardware. In Japan, technical nature has to be asserted for an *invention* as a whole; in Europe the invention is not patentable if the *inventive step* does not make a technical contribution to the state of the art (judging by EPO practice and the current proposal for an EU directive on the patentability of computer-implemented inventions, currently under discussion). Opponents of software patentability stress that the software industry has experienced rapid growth in the past in the absence of patent protection.[10] The open source community advocates open access to the knowledge embedded in software inventions to enable follow-on innovation. As argued by representatives of the software industry, pressure from users to make source code available, and the success of open source software, have imposed new challenges to software developers who now need stronger protection means, such as patents (Huppertz, 2004). Few empirical studies have investigated the impact of patents on software innovation and little evidence in either direction has been found to date. As such, it cannot be said whether or not strengthening patent protection for software will enhance or impede innovation in the software sector. What can be said is that changes regarding patentability of software will have implications beyond the software-producing sector itself, including a number of service-sector companies.

Table 1. Differences in the patentability of software-related inventions across jurisdictions

United States	Japan	Europe
The patentability of software (mathematical algorithm producing a technical effect in a machine) was first established in 1981 with the US Supreme Court decision Diamond v Diehr, and confirmed and extended since then.	Software inventions are patentable when they are concretely realised by using hardware resources. JPO Examination Guidelines. Japan patent law protects computer programs themselves. 2002 provision of enforcement actions of Japan Patent Law.	Programs for computers are not regarded as inventions and excluded from patentability "as such" in the European Patent Convention (1973), Article 52. The proposed EU directive on the patentability of computer-implemented inventions would limit patentability to inventions making a technical contribution to the state of the art.

Source: Martinez, C. and D. Guellec (2004), "Overview of Recent Changes and Comparison of Patent Regimes in the United States, Japan and Europe", *Patents, Innovation and Economic Performance – OECD Conference Proceedings*, Chapter 7, OECD, Paris.

Business-method patents

Another type of patent of seeming interest to service-sector firms is the business-method patent. Business-method inventions can be defined as broadly as *"new ways for doing business"*. However, in the absence of a more appropriate operational definition, they tend to be narrowly identified with inventions classified under patent class 705 at USPTO: *"data processing: financial, business practice, management or cost/price determination"*. As with software patents, the patentability of business methods has been controversial, in part due to difficulties in evaluating the novelty of a number of computer-mediated business method inventions. In addition, significant differences in patentability of business methods remain across jurisdictions, with the United States having the most permissive rules (see Table 2).[11]

10. Until the 1980s, trade secret protection and contract law were the main means of protection for software, with copyright having been added to the scene since then.

11. Patents for business methods have been granted in the United States since the 1880s, although they were small in number and easily challenged in court. The situation changed in 1998, when the US Court of Appeals for the Federal Circuit explicitly stated in the *State Street Bank* decision that a mathematical algorithm should not be excluded from patentability if it produces a "useful, concrete and tangible" result.

Table 2. Patentability of business methods

United States	Japan	Europe
The patentability of business methods was confirmed by the US Court of Appeals of the Federal Circuit in the State Street Bank 1998 decision**,** stating that a mathematical algorithm is not excluded from patentability if it produces a "useful, concrete and tangible" result.	Business method patents are granted only for business models that have technological aspects. Pure business methods unrelated to software are not granted patent protection.	"Schemes, rules and methods for performing mental acts, playing games or doing business" are not regarded as inventions and excluded from patentability "as such" by the European Patent Convention (1973), Article 52. The proposed EU directive on the patentability of computer-implemented inventions limits patentability to inventions making a technical contribution to the state of the art. A computer-implemented business method, data-processing method or other method in which makes only a non-technical contribution to the state of the art would not constitute a patentable invention.

Source: Martinez, C. and D. Guellec (2004), "Overview of Recent Changes and Comparison of Patent Regimes in the United States, Japan and Europe", *Patents, Innovation and Economic Performance – OECD Conference Proceedings*, Chapter 7, OECD, Paris.

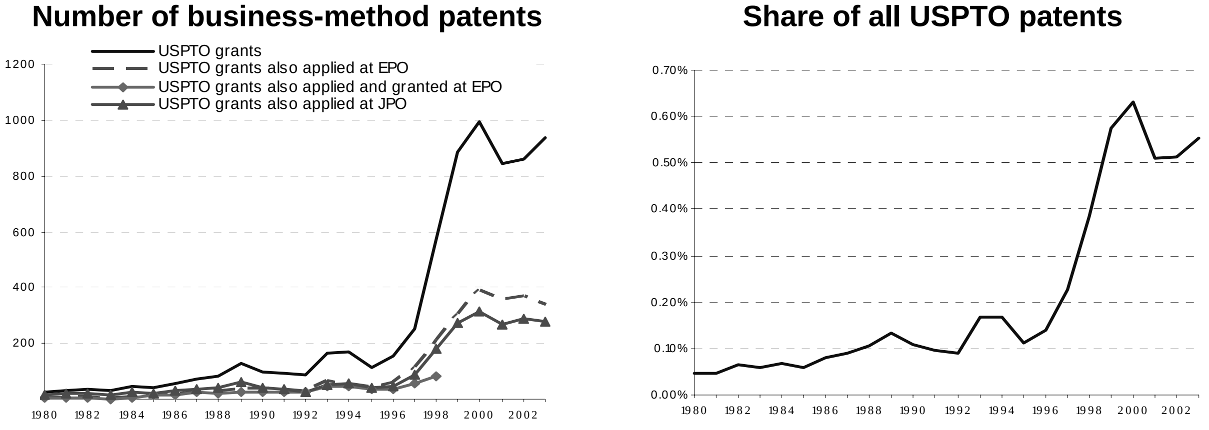
Despite such differences, the number of business-method patents grew rapidly in the late 1990s. Between 1999 and 2003, thousands of business-method patents were granted at USPTO, reaching a peak of 1 000 grants in 2000 (or 0.63% of all USPTO grants in that year) (see Figure 32).[12] Two-thirds of the applicants were based in the United States, which is not surprising given the home effect driving applicants to domestic patent offices. Japan follows as the second country where most USPTO business-method patent holders originate (15%). European countries rank third with almost 7% of the patents, with applicants from France and Germany holding most of them, with about 2% each. Business-method patents also gained in popularity in Japan in the past decade, with the number of business-method patent applications soaring from 4 100 in 1999 to 19 600 in 2000 before declining to 12 000 in 2002 (JPO, 2004).[13] The number of business method patents granted at JPO, however, remained relatively small, at a little over 200 per year, suggesting that many applications did not meet patentability requirements.

This decision opened the door for extensive patenting of business methods in the USPTO (for more information, see www.uspto.gov/web/menu/busmethp/index.html).

12. The number of business-method patents granted by USPTO declined after 2000, possibly due to changes in the application review process, as described later in this section. Only USPTO includes a specific patent field related to business methods in its classification (US class 705), there is no equivalent class in the international patent classification.

13. There may be some differences regarding the definition of business method patents at each patent office: *(i)* USPTO definition refers to patents classified under USPC 705; and *(ii)* JPO defines business-method patents as those classified in the following JPO patent classes G06F15/20@G,N,R; G06F15/20,102; G06F15/21; G06F15/24-G06F15/30; G06F15/42; G06F17/60 since July 2000 (JPO, 2004).

Figure 32. USPTO business method patents, 1980-2003

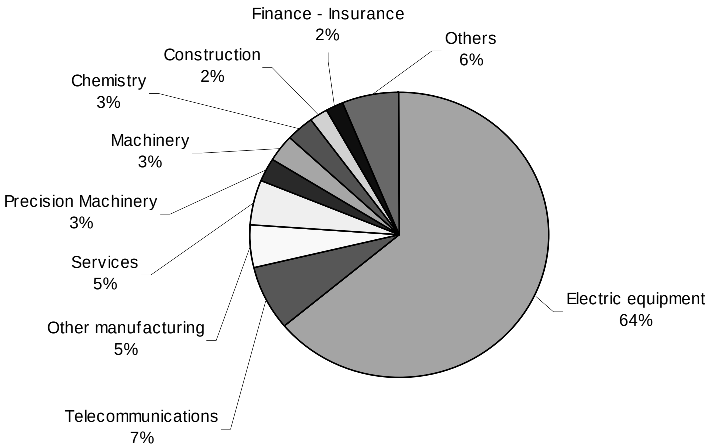


Note: Business-method patents are defined as those classified in USPC 705. Data on EPO grants after 1998 is still partial. The decrease observed in 2000 may be due to changes introduced by USPTO in this field at the time, such as the introduction of a second review for applications classified in USPC 705. Patents are sorted by grant date.

Source: OECD Patent Database, May 2004.

Business method patents are pervasive and applicants can be found in a very broad range of industrial sectors. In Japan, 64% of the business-method patents submitted by the top 100 JPO applicants of business-method patents were held by electric equipment companies, followed by firms in the telecommunications sector with 7%. Firms in services sectors, including finance and insurance, applied for another 7% and firms in machinery sectors for about 6% (see Figure 33). In the United States, the lion's share of the patents granted to the top 100 holders of business-method patents at USPTO is held by companies producing ICT equipment and services (42%), electric equipment (17%) and mail equipment and services (16%). Telecommunications equipment and services account for 9% of the patents, and firms in other service sectors, including financial services, hold about 15% of all business-method patents (see Figure 34).

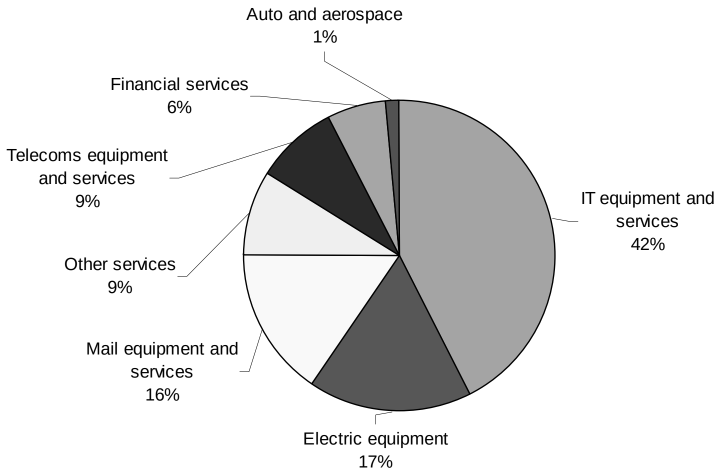
Figure 33. Sectors of activity of top 100 applicants for JPO business-method patents, 2000



Note: Patents sorted by application year.

Source: JPO (2004), "Recent Trends of Business-related Inventions", April, available in Japanese at www.jpo.go.jp.

Figure 34. Sectors of activity of top 100 holders of USPTO business-method patents, January 1976-April 2004



Note: Business-method patents defined as those classified in USPC 705. Conglomerates such as General Electric, Mitsubishi, Siemens and Philips have been classified as electric equipment companies to facilitate comparisons. Patents sorted by grant date.

Source: OECD Patent Database, October 2004.

Two different types of companies holding business-method patents granted by USPTO can be identified within these broad sectors of activity (see Table 3):

- Long-established, R&D-intensive manufacturing firms (especially those in ICT and electric equipment) that have expanded into services related to their manufactured products (*e.g.* IBM, Hitachi, Fujitsu, Matsushita, Hewlett-Packard, Sony, General Electric, Toshiba). These firms hold large patent portfolios, of which business-method patents represent a small share.

- Service-sector firms, including ICT service providers (*e.g.* Electronic Data Systems); Internet-based retailers (*e.g.* Amazon.com, Priceline.com); business consulting firms (*e.g.* Arthur Andersen); and financial services firms (*e.g.* Citigroup). These firms have small patent portfolios overall, of which business-method patents usually represent a two-digit share.

In between these two categories are firms that span medium-technology manufacturing and services, such as those that provide postage and document management services to firms (*e.g.* Pitney Bowes, Francotyp Postalia, Neopost). They have smaller patent portfolios than high-technology, ICT manufacturers, and business methods represent a fairly high share of their patents.

Existing evidence is insufficient to determine the effect of business-method patents on innovation and on the competitive advantage of firms — especially those service-sector firms that make most extensive use of them. What is clear is that business-method patents influence a wide range of firms in many parts of the service sector.

Table 3. Top 25 owners of USPTO business method patents, January 1976-April 2000

Rank	Company	Sector	Country	BM patents	ALL patents	BM share in ALL patents
1	**IBM**	ICT equipment & services	United States	390	36 073	1.08%
2	**Pitney Bowes**	Mail equipment & services	United States	387	2 032	19.05%
3	**Hitachi**	ICT equipment & services	Japan	146	24 642	0.59%
4	**Fujitsu**	ICT equipment & services	Japan	144	14 252	1.01%
5	**NCR**	ICT equipment & services	United States	140	2 520	5.56%
6	**Walker Digital**	Other services	United States	88	227	38.77%
7	**Microsoft**	ICT equipment & services	United States	68	2 992	2.27%
8	**Sharp**	Electric equipment	Japan	66	8 430	0.78%
9	**AT&T**	Telecoms equipment & services	United States	65	7 066	0.92%
10	**Matsushita**	Electric equipment	Japan	64	16 185	0.40%
11	**Citigroup**	Financial services	United States	61	97	62.89%
12	**Hewlett-Packard**	ICT equipment & services	United States	61	12 300	0.50%
13	**Sony**	Electric equipment	Japan	55	16 859	0.33%
14	**Francotyp Postalia**	Mail equipment & services	Germany	47	127	37.01%
15	**Omron**	Electric equipment	Japan	44	1 020	4.31%
16	**General Electric**	Electric equipment	United States	43	23 398	0.18%
17	**Electronic Data Systems**	ICT equipment & services	United States	42	189	22.22%
18	**Toshiba**	ICT equipment & services	Japan	40	18 058	0.22%
19	**Neopost**	Mail equipment & services	France	40	123	32.52%
20	**Lucent**	Telecoms equipment & services	United States	39	6 966	0.56%
21	**Sun Microsystems**	ICT equipment & services	United States	39	3 685	1.06%
22	**Casio**	ICT equipment & services	Japan	36	1 422	2.53%
23	**Mitsubishi**	Electric equipment	Japan	32	19 437	0.16%
24	**Intel**	Electric equipment	United States	31	8 129	0.38%
25	**Xerox**	Electric equipment	United States	31	12 200	0.25%

Note: Firms with 2-digit share of business method patents in their patent portfolio are highlighted in grey. Business method patents defined as those classified in USPC 705. Conglomerates such as General Electric and Mitsubishi have been classified as electric equipment companies to facilitate comparisons.

Source: OECD patent database, October 2004.

Policies to promote innovation in services

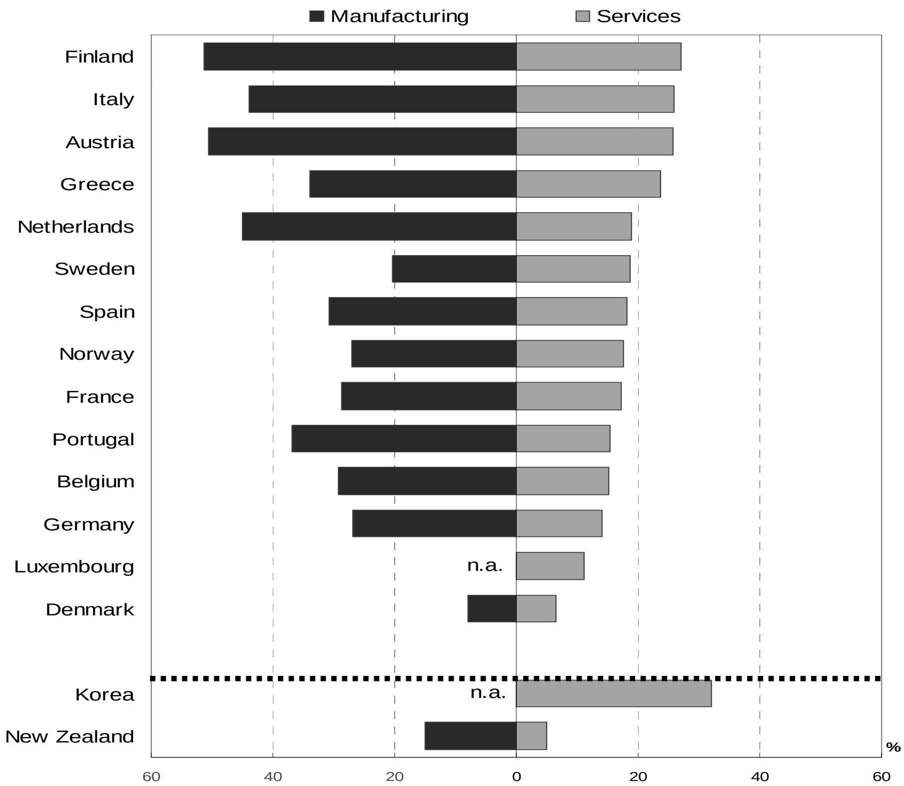
To date, the service sector has not been a major target of innovation policy. In a recent survey by the OECD, most OECD countries claimed not to have specific policies focused on innovation in the service sector.[14] Innovation policy measures in most OECD countries are sector-neutral and address firms in both services and manufacturing; countries do not discriminate between services and manufacturing when considering firms for participation in governments support programmes. This trend is part of a continuing

14. An ongoing OECD project examines the role of knowledge-intensive service activities (KISA) in contributing to innovation in manufacturing and service sector firms. Results are expected to be available by June 2005. More information on the project is available on line under the "Sectoral Case Studies in Innovation" heading at www.oecd.org/sti/innovation.

shift throughout the OECD area away from specific sectoral policies and towards common industry frameworks. Another reason for the limited policy attention to the service sector may be, as claimed by the Netherlands, the difficulty for policy makers to see clear reasons for, or any clear form of, policies for service sectors.

Despite the sector-neutral approach to innovation policy, service-sector firms are under-represented in existing innovation programmes. In the OECD survey, few countries reported significant participation by service-sector firms. A recent study in the Netherlands found that only 7% of innovative service firms with fewer than ten employees made use of innovation incentives offered by the Dutch government (Kox, 2002). In most countries, such statistics are not available. In the CIS3 and New Zealand innovation surveys, the share of firms indicating that they had received public funding was considerably lower in the service sector than in manufacturing (Figure 35). In Austria, Finland, Italy and the Netherlands, for example, between 45% and 50% of manufacturing firms reportedly received government financial support, compared to 20% to 30% of service-sector firms. In no country did the share of service-sector firms receiving support exceed that of manufacturing firms. Although public funding as reported in the CIS3 and other innovation surveys may not represent financing only from government innovation programmes, the data suggest that service-sector firms participate less actively than manufacturing firms in public programmes — despite potential benefits. Research in Germany found that service sector participants in innovation policy schemes had an innovation intensity 8 percentage points higher than non-participants (Czarnitzki and Fier, 2002).

Figure 35. Share of innovative firms benefiting from public support programmes in manufacturing and services



Note: Results of CIS3 and the innovation surveys in other countries are not fully comparable (see Box 1). Time period is 2000-2002 for New Zealand, 2001-2002 for Korea; 1998-2000 for all other countries.

Source: OECD, based on data from Eurostat, CIS3 survey 2004 and innovation survey of Korea and New Zealand.

A few countries are nevertheless developing innovation policies that focus on services. In Finland, for example, new strategic guidelines for innovation policy prepared by the Ministry of Trade and Industry recognise the growing importance of services and emphasise the need to support the balanced development of innovation in all sectors. In Ireland, appropriate ways to encourage innovation in the internationally traded service sector are the subject of ongoing work within government. In Norway, two of the projects in the government's Innovation 2010 initiative seek to identify obstacles to innovation in services. Outside the OECD area, countries are also beginning to highlight service-sector innovation in policy making. In 2002, the Chinese State Council circulated a document entitled "Comments on Policies and Measures to Accelerate Development of Service Industry during the 10th Five-Year Period" to raise the nation's service industry to a new level. China will also study the necessity and feasibility of tax policies to encourage innovative activities in services. The Russian government considers measures to stimulate innovation in the service sector under its general framework for innovation infrastructure development.

Beyond these general shifts in focus, some countries have begun to implement policies to encourage innovation in specific service industries; most concentrate on development and use of ICT. Some focus on the establishment and maintenance of an ICT-related business environment, such as developing standards for e-commerce and encouraging public procurement via e-commerce. There is strong support for boosting software industries in some countries. Policy measures for human resource development in the service sector are also aimed at ICT-related sub-sectors, such as educational support to ICT-related human resources and training in ICT-related skills. Some countries focus on encouraging clustering and networking because knowledge acquisition is a major source of innovation in service sectors. Although R&D is not generally a major driver of services innovation, ICT-related sectors which can be seen as more R&D-intensive have attracted government support to encourage R&D. Supporting small and medium-sized enterprises (SMEs) and encouraging entrepreneurship are also targets of government policy measures, most of which focus on IT industries.

Besides ICT-related sectors, a few countries have developed policy measures focusing on the other specific service sectors. For example, Switzerland has organised a federal programme to foster innovation and co-operation in the Swiss tourism sector. CHF 35 million has been prepared by the federal administration for 2003-2007. The programme targets five key factors: new products and distribution channels; improvements of existing services; creation of new organisational structures; education and training; and R&D.

Developing an ICT-related business environment

ICT-related service businesses have received strong support in many countries. For example, Denmark focuses on e-trade and business applications of digital technologies to improve the framework for efficient use of ICT in businesses, thus making use of ICT a lever for increasing innovation, efficiency and productivity. Denmark's strategic goals for ICT in the business sector are digital business and industry, ICT industry and the telecommunications market. Denmark also launched an "Action Plan for E-commerce 2002" which aims to increase user confidence in e-commerce, encourage public institutions to adopt e-commerce-based procurement processes, and motivate private enterprises to integrate e-commerce into their business procedures.

Switzerland has developed standards for online commerce with its Softnet Programme. It has also prepared new legislation concerning electronic signatures, domain names and copyright for online services to guarantee greater legal security on online services. The Norwegian government has taken initiatives related to the establishment of electronic marketplaces and the fostering of more public key infrastructure solutions, both of which are important for the provision of services. Also, work has been initiated with the aim of securing more transparent regulation of the transfer of public data (maps, meteorological data, etc.) for private sector commercial use, in line with EU regulations in the ICT area.

Supporting software industries

Establishing a high-quality software industry is seen as a way to improve the competitiveness of the general economy, in addition to the software industry. In this context, some countries focus on innovation in software industries. For example, Japan has established several policy measures to support individuals and private enterprises aiming to develop high-quality software. A pilot project to promote the development and use of open source software will also be established in Japan.

Iceland's most important programmes for addressing service-sector innovation have been the information and environmental technology programmes. Software companies are the main private sector beneficiaries of these programmes. As part of its Softnet Programme, Switzerland also allocated CHF 30 million to build up a software industry of international standards through co-operation between public research organisations and industry, and fostering networks of competence and training of ICT professionals. Although open source software is already used to some extent in the public administration, evaluation of the advantages and risks of free and open source software for public purposes is ongoing.

Developing human resources

Human resource development has been a major concern in many countries because a skilled professional ICT labour force is essential for more efficient use of ICT in business. Countries have taken a number of steps to improve training and education. For example, the Danish Ministry of Science, Technology and Innovation has implemented measures to make it possible for ICT staff with a short-cycle higher education (such as multimedia designers) to receive credit towards a university education. The Danish government has also allocated DKK 115 million to finance ICT research during 2003-2005, a major portion of which is set aside for increasing the number of PhDs. The Swiss government is creating new degree programmes (and a new type of diploma) for professional training in information technologies.

Japan offers several examples of policy measures to support ICT training. For example, it evaluates the validity of practical training with respect to the ICT Skill Standards and Training Roadmap. The government will also establish standard specifications for both hardware and software to support effective training and education using ICT products in primary and secondary level education.

Since innovation potential in the service sectors heavily depends on its human capital assets, labour costs of the service sectors could be focused on particularly when governments plan fiscal instruments for fostering innovative activities. A recent study suggests a tax deduction for maintaining firm's human capital assets as a possible instrument, although this requires further study with regard to the particularities of such a tax incentive and its compatibility with generic fiscal rules (Kox, 2002).

Clustering and networking

Since suppliers and customers are significant resources for service innovation, clustering and networking can help widen and increase the efficiency of knowledge acquisition for innovation. Several countries encourage clustering and networking to enhance innovation across their economies, but some have implemented specific policy measures for ICT fields. For example, there are over 40 cluster development initiatives currently in progress in New Zealand with total grants of up to NZD 50 000. Some of the clusters focus on the service sectors, including software industries.

Ireland's policy document, "Opportunities for Ireland's High-technology Internationally Traded Services Sector to 2007" (ITS 2007), has as a key element of its strategy the development of a series of regional infrastructure initiatives or technology hubs known as "Web works" to facilitate networking among companies and encourage mutual learning and information sharing (Martin, 2001). Some Web works may evolve in response to existing local clusters of knowledge-intensive companies, while others may develop strong links with third-level colleges to facilitate the spin-off of high-technology campus companies. Each Web works will: concentrate on one technology, be broadly defined, and house companies in one of the four target sectors: informatics, e-business, digital media and health sciences.

Policy measures to strengthen science and industry linkages are observed in some countries' policy practices. For example, New Zealand has a specific policy to foster innovation across the service sector by strengthening linkages with government research laboratories and universities. Another aspect of the Danish government's funding of ICT research is the expectation that it will improve interaction between research institutions and the business sector in the field of ICT research. In the Czech Republic, universities and public research institutes offer several services to the innovation activities of private firms. For example, the Centre for Innovation and Technology Transfer of Palacky University offers contact with its scientific experts, R&D space for enterprises, and consultation for start-ups.

Investing in R&D

Since service innovation relies less on R&D than manufacturing innovation, government R&D support programmes have not been widely used to stimulate service-sector innovation in OECD member countries. Most government-funded R&D is aimed at work that is more closely aligned to the needs of the manufacturing sector, as is evident in the emerging priorities for government R&D programmes in many OECD countries: ICT, biotechnology and nanotechnology (OECD, 2004*a*). This situation does not imply that R&D could not be made more relevant to the service sector or could not improve its productivity. Governments could consider various approaches.

One step would be to establish R&D programmes related to the needs of the more R&D-intensive segments of the service sector, such as computing and telecommunications services. While much of the R&D needed to improve service in these industries derives from advances in the products they procure from related manufacturing industries (*e.g.* computing and communications equipment), service providers face particular problems related to management and reliability of complex systems and networks that are often not addressed by hardware manufacturers. Some countries have already taken steps to target R&D-intensive service sectors, and the software industry in particular, which must also address issues of reliability, security and complexity. Japan provides special financial support to SMEs for software-related R&D and also funds ICT experts to develop original software. Projects to develop next-generation software technology can also receive government subsidies. The US government also invests in software-related R&D. The National Science Foundation, for example, funds university research on software engineering and languages, and the National Information Technology R&D Initiative included 340 million USD for R&D on software design and productivity and on high-confidence software and systems in 2005.

A related approach would be to promote R&D related to the application of ICT to other innovative service industries, such as health-care, financial intermediation, wholesale and retail trade, and education, where much innovation derives from ICT use. A 2000 study by the US National Academies, for example, called for an expansion of ICT-related R&D to more explicitly address the application of ICT to such end-user organisations (CSTB, 2000), such as by funding more multidisciplinary research that would include researchers from the ICT community and other fields such as management, health-care services and education and by creating collaborative research programmes that involve participants from ICT manufacturing and ICT-intensive users. Opportunities may also exist for involving service sector firms more actively in public/private partnerships for innovation that link public sector research organisations with the private sector. Such efforts would need to recognise that end-user organisations tend to have limited internal R&D capabilities, but can benefit from guiding R&D projects to better suit their needs.

Research could also be conducted on non-technical aspects of service-sector innovation, in particular as relates to organisational innovation. Such work would likely derive from research in social sciences and management, in particular as relates to organisational structures, training and management of innovation. It may need to be focused more on individual services industries, which as shown above, differ considerably in their innovation processes. Greater emphasis on technology diffusion, to help spread innovative approaches throughout the highly fragmented service sector, could also enable advances in productivity (Alic, 2001).

Fostering service SMEs and encouraging start-ups in services

Promoting innovation in SMEs is a focus of innovation policy measures, and some countries set their sights on knowledge-intensive service sectors, especially ICT industries. For example, the Danish Action Plan for E-commerce (mentioned above) took a consultancy and training initiative for e-commerce to 60 SMEs. SMEs are also major targets of the Danish E-learning Initiative. Larger enterprises appear already to be on the way to capitalising on their investments in e-leaning for vocational training, but SMEs are less advanced. Therefore, the initiative focuses on how SMEs may gain in competitiveness and develop competencies through the use of e-learning. Japan also supports ICT-related SMEs by providing financial support for R&D.

Fostering entrepreneurship is an important element of stimulating innovation in services. In many cases innovative new services consist of new business models that must be tested out in the market place. New firms serve as a form of experimentation with service-sector innovations. In terms of encouraging entrepreneurship, Ireland can provide useful experience for encouraging the service sector’s participation in government policy programmes. Although all R&D programmes of Enterprise Ireland are aimed both at manufacturing and services, the government has a unit dedicated to encouraging start-ups in the service sector. The unit provides assistance with business planning, feasibility studies, and access to other Enterprise Ireland services such as technical expertise and its overseas office network.

Standards

Standards are also seen as a means of promoting innovation in services. They can do so in two ways. First, the development and promulgation of technical standards can improve compatibility and interoperability among various components that service firms may assemble into systems used to support their activities. In regard to ICT systems, for example, technical standards can allow firms to develop information networks that seamlessly integrate components (*e.g.* networks, computers, software) from different suppliers. Second, standards and quality measures for service offerings can also induce innovation by providing service firms with better metrics for measuring their own performance (and gauging improvements in those services) and allowing consumers to more easily compare offering from different service providers, thereby increasing competition. Such standards could, for example, enable consumers to compare the offerings of various Internet service providers using criteria such as bandwidth, reliability and cost. Consumers could also compare health-care services using criteria such as success rates, costs and recovery times for various procedures.

Development of service-related standards is under way in a number of OECD member countries. The European Committee for Standardization, for example, has developed a work programme for service standards that cover domains related to: maintenance, transport logistics and services, tourism, postal services, facilities management, translation services and funeral services. Standards in several of these areas are currently under development or approval. In Germany, the Ministry of Education and Research has funded a project on Service Standards for Global Markets. A consortium of standard and certification organisations, companies and research organisations will explore the potential for standardisation in services and initiate concrete standardisation activities, with the aim of improving market transparency, lowering transaction costs, improving consumer satisfaction and confidence and enabling deregulation. The Danish Standards Association has explored ways of adapting ISO 9001 standards to various service industries, such as child-care, home services, health-care, dentistry, social services, hospice care, and design.

Intellectual property rights

In services as in manufacturing, intellectual property rights (IPR) regimes have tended to be viewed less as a policy instrument for stimulating innovation than as part of the framework conditions that influence incentives to innovation and diffusion of knowledge. Nevertheless, IPR regimes have been reformed over time, generally to strengthen patent rights and enforcement and to accommodate new types of inventions (*e.g.* genetic, software-related, business methods). Service-sector firms appear to rely less than their manufacturing counterparts on formal IPR protection mechanisms, with the notable exception of copyright, and hence, reforms to IPR regimes may be expected to have less of an impact on service-sector innovation than manufacturing innovation. As the analysis shows, however, software-related and business-method inventions are broadly diffused across industry sectors, including services, and have grown significantly in number over the last decade. Changes to patentability of these two types of inventions could have broad impacts across services industries. Such broad effects will need to be considered in policy formulation. Since patents provide incentives to innovate and contribute to technology diffusion, additional attention is needed for policy makers to ensure that the patent system continues to strike the right balance between the appropriation of the fruits of innovation by patent holders and the diffusion of technology for society as a whole (OECD, 2004*b*).

While few countries focus on service-sector invention in their IPR policies, a few exceptions are beginning to appear. Switzerland, for example, has prepared new legislation concerning copyright for online services in order to guarantee more legal security in Internet-based service activities. Japan is paying more attention to business methods. Just after the boom in business-method patents in Japan, the JPO published guidelines that illustrated JPO’s plan for improving the understanding of business-method patents among potential applicants. Following the guidelines, JPO modified examination criteria in order to provide a more clear-cut definition of patentability, and it organised a series of seminars to explain the new criteria to potential applicants. JPO also created a new examination office to focus on business-method patents examination. The USPTO also instituted a second review for all patents classified under patent class 705 to improve the quality of their examination. In Europe, considerable discussion is under way related to a proposal for a European directive on the patentability of computer-implemented inventions, which would mainly affect software-related inventions, including those related to business methods. The objective is to harmonise national laws in EU countries in this respect. Although no political agreement has been yet reached, it is expected that the directive would limit the patentability of software-related inventions and retain the exclusion on the patentability of business-method inventions.[15]

Conclusion

This overview indicates the growing importance of the service sector in OECD economies. Productivity and employment growth are highly dependent on the success of service industries, and services are strong drivers of recent economic growth in most OECD economies. In spite of the traditional view of service sectors as less dynamic, poorly paid and not innovative, statistical evidence supports the notion that services are increasingly knowledge-based, innovative and drivers of growth. Although service-sector firms are generally less likely to be innovative than manufacturing firms, they are becoming increasingly innovative and knowledge-intensive, and services such as financial intermediation and business services show above-average levels of innovation.

15. Additional information on the proposed EU directive is available on line at http://europa.eu.int/comm/internal_market/en/indprop/comp/index.htm

Enhancing innovation in the service sector will require attention to a number of policy areas, with different emphases than for manufacturing. Service-sector innovation derives less from investments in formal R&D and draws more extensively on acquisition of knowledge from outside sources. Development of human resources is especially important to service firms, given their high reliance on highly skilled and highly educated workers, as well as indications that a lack of highly skilled personnel is a major impediment to service innovation in most OECD economies. The role of newly established firms in innovative activity is greater in services than in manufacturing, so that entrepreneurship is also a key driver of service innovation. Nonetheless, small firms tend to be less innovative than larger firms. IPR protection has also attracted considerable attention, especially as relates to software and business-method patents, which seem to have strong links to innovation in services. Thus, changes in policy regimes governing software-related patents and business-method patents would have an effect on the service-sector firms, regardless of their main activities.

Although the growing importance of services for economic growth and the significant role of innovation in vitalising the service sector have been clearly recognised by OECD economies, policy measures for promoting service-sector innovation are lacking. Many countries do not have innovation policies that target services, and participation of service-sector firms in sector-neutral programmes is low. The few policies targeting service innovation aim primarily at ICT development and use. Clearly, greater attention is needed to raising awareness of public policies and programmes among service-sector firms, but it will also be important to design programmes to be more relevant and useful to the service sector. Since the characteristics of service-sector innovation vary among individual service industries, policy makers will be challenged to establish effective sector-wide policy measures for promoting innovation. However, some findings discussed in this report may suggest policy directions, such as those related to external knowledge acquisition, clustering and networking, IPR protection, human resource development and entrepreneurship. Although empirical policy experience is limited, more attention to service-sector innovation may yield large dividends.

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