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Innovation in Firms: A Microeconomic Perspective

Chapter 1

Innovation Indicators

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1.1. Introduction[1]

Knowledge, research and innovation are of crucial importance for the competitiveness of the modern economy, as well as for high standards of living and welfare. In order to describe and better understand the role of knowledge and its effects, it is vital to have sound statistical information on which to base policy design and evaluation. Indicators to measure research and development (R&D) efforts were first developed and harmonised in the 1960s but it was not until the 1970s and 1980s that researchers started focusing on the development of more complex analytical models and measurement tools to study innovation. In order to understand how innovation occurs and to devise appropriate innovation policies more needed to be known about the process of innovation at the level of individual firms. This led to various experimental surveys in the early 1980s (*e.g.* in the United States, Scandinavia, Italy). Innovation surveys were then developed to increase knowledge about innovation in firms beyond what can be found in other science and technology (S&T) statistics such as surveys of R&D, patent data or bibliometric indicators. The original purpose of these surveys was to obtain data on innovation outputs and on a range of innovation inputs and activities that were not based on formal R&D. This includes collecting information on the types of innovations, the reasons for innovating (or not), the impacts of innovation, collaboration and linkages among firms or public research organisations, and flows of knowledge.

To harmonise and ensure the quality of innovation surveys, the *Oslo Manual* was originally developed by the OECD in 1992. It provides a harmonised framework – including concepts and tools – for undertaking comparable large-scale surveys of this type. While earlier editions of the *Manual* emphasised technological product and process (TPP) innovation, the latest (third) edition (OECD/Eurostat, 2005) extends the scope of these surveys to marketing and organisational innovations and puts new emphasis on the role of linkages (including collaboration) in innovation.

Innovation surveys based on the *Oslo Manual* were introduced in many OECD countries from the early 1990s (the first Community Innovation Survey [CIS] took place in 1993). In recognition that innovation also takes place in developing countries and that their socio-economic structures may affect their innovation activities, an appendix was added in the third edition of the *Manual* with some guidance on how to frame innovation surveys in such

countries. Innovation surveys based on the *Oslo Manual* are now conducted in Australia, Canada, all EU countries (where the sixth round of the CIS takes place in 2008), Japan, Korea, Mexico, New Zealand, Norway, Switzerland, Turkey, as well as in Russia, South Africa and most Latin American countries.[2]

1.2. Rationale and methodology

In comparison to R&D-based indicators, indicators derived from innovation surveys have visibly had a lesser impact in the policy-making community (Arundel, 2007). R&D indicators are still the most widely used indicators of innovative activity. There may be a number of reasons for this. First, R&D subsidies play a central role in national S&T policies and therefore call attention to R&D-based indicators. Second, R&D data have been considered more reliable, particularly than early innovation survey data. Third, innovation indicators are less widely accepted and utilised than those relating to R&D and policy makers may therefore find them less useful. Finally, policy makers may not be fully aware of the innovation data available or its potential uses.

The policy use of innovation survey data may also have been hampered by a lack of internationally comparable indicators based on innovation surveys. This has been a serious drawback given strong policy interest in international benchmarking and in the use of indicators as measures of national capabilities. The first high-profile use of internationally comparable innovation survey indicators was the inclusion in 2000 of several indicators from the European CIS in the *European Innovation Scoreboard*.[3] However, there is still no regular publication of detailed and combined results from EU and non-EU innovation surveys.[4]

A second factor that may have reduced policy uptake of innovation survey indicators has been under-exploitation of innovation survey data. Many potentially useful indicators of direct relevance to policy have not been developed. With the exception of the widely used indicator of the percentage of innovative firms, almost all publicly available indicators from innovation surveys are simple indicators of the frequency of responses to a single question, such as the percentage of enterprises that applied for one or more patents, or the percentage of firms by size class that sourced knowledge from universities. Although these indicators can be very useful, they fail to incorporate important factors linked to innovation outcomes. The effect of such factors on outcomes is best addressed through multivariate analysis, but simple cross-tabulations of indicators can often provide an easily understandable picture of the distribution of multiple factors across countries in a way that is highly relevant to policy.

The purpose of this part of the project was two-fold: first, to produce tabulations of internationally comparable innovation indicators for both EU

and non-EU countries;[5] and second, to develop new indicators that provide greater insight into innovation processes and help to better address policy needs. A number of the composite indicators build on work in the NIND (Policy Relevant Nordic Innovation Indicators) project, financed by the Nordic Innovation Centre (NICe) (Bloch *et al*., 2007; Åkerblom *et al*., 2008).

Although cross-country comparability of innovation surveys based on the *Oslo Manual* is generally good and improving, certain methodological differences may affect comparisons of CIS and non-CIS countries, such as sectoral coverage, size thresholds, length of reference periods, sampling methods and unit of analysis. Differences in survey response rates can potentially also have an influence on international comparisons. Another example is the filtering of innovators/non-innovators, *i.e*. whether firms identified as non-innovators early in the questionnaire are asked to answer subsequent questions (for example, in Canada, only innovators are asked to answer questions on collaboration, but for the CIS, firms that had some innovation activity but did not introduce a product/process innovation could reply). A more detailed description of the methods used in the participating countries is included in Annex A.

For present purposes, it was decided to use the "core" CIS 4 coverage in terms of sectors and firm size thresholds as a benchmark in order to allow for comparability (so countries using industrial classifications other than NACE (Rev. 1.1) performed concordances to map as closely as possible to the CIS 4 list of industries). Unless otherwise noted, the following definitions were used (see also Annex A):

- Sectors covered
  - ❖ Manufacturing: NACE D (divisions 15 to 37).
  - ❖ Services: Core G to K services which include NACE Sections I (Transport, storage and communication), and J (Financial intermediation) and NACE divisions 51 (Wholesale trade and commission trade, except of motor vehicles and motorcycles), 72 (Computer and related activities), and 74.2-74.3 (Other business services).
  - ❖ For Canada and Korea, the data refer to the manufacturing sector only. For Brazil, the data refer to manufacturing and mining only.
  - ❖ Total economy: Manufacturing + Services + NACE sections C (Mining and quarrying) and E (Electricity, gas and water supply).
- Size classes
  - ❖ SMEs: firms with 10-249 employees (5-249 for Australia).
  - ❖ Large firms: 250+ employees.

An additional dimension that is briefly addressed in this chapter is the use of different methods of weighting innovation survey results in order to

make them representative for the full population of firms. There is increasing interest in examining alternative methods of weighting innovation data. The main issue is that with standard weighting methods (based on the number of firms), each firm is counted equally, regardless of its size. This may be useful and appropriate for a number of objectives, in particular those focused on firms' behaviour. However, for overall economic impact, standard weights may be a less accurate measure. For example, the economic impact of a product innovation in a large firm will be much larger, other things being equal, than the impact of one in a small firm. This may also be relevant for international comparisons as the distribution of firms according to size varies across countries, in particular as regards firms with over 1 000 employees. This suggests the value of examining alternative measures that take account of firm size, and the most commonly proposed of these is weighting by the number of employees in each firm. In order to gain a more complete picture, all composite indicators presented here were compiled using weights based both on number of enterprises and on number of employees.

1.3. Simple indicators

As part of the project, a list of key indicators of innovation performance and other policy-relevant innovative activities was chosen. Indicators of innovation performance are based on the four types of innovations defined in the latest *Oslo Manual*, and on measures of novelty and diffusion. These concepts are described in Box 1.1.

Table 1.1 gives a list of the main simple innovation indicators which were tabulated (see Tables in Annex 1.A1).

The first five indicators concern product and process innovations, degree of novelty and whether innovations were developed partly or fully in-house (*i.e.* by the firm itself or together with others). Product and process innovations are often considered **technological** innovation, since firms that have product and/or process innovations have implemented new technology (either developed in-house or adopted) into their business. This measure encompasses the implementation of existing (new to the firm) and new technologies, thus capturing both creative innovation and diffusion.

In order to provide additional relevant information on technological innovations, the indicators also focus on individual elements of product and process innovations. Product innovations represent the final commercialisation of innovation activities on the firm's markets, and thus are of policy interest as a separate indicator. Process innovations involve improvements in firms' internal processes, through either the adoption of new technologies or in-house development. In-house process innovations are related to the concept of "user innovations" which has attracted substantial

Box 1.1. **Defining innovation**

The latest (third) edition of the *Oslo Manual* (OECD/Eurostat, 2005) defines innovation as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. This implicitly identifies the following four types:

- *Product* innovation: the introduction of a good or service that is new or significantly improved with respect to its characteristics or intended uses. This includes significant improvements in technical specifications, components and materials, incorporated software, user friendliness or other functional characteristics.
- *Process* innovation: the implementation of a new or significantly improved production or delivery method. This includes significant changes in techniques, equipment and/or software.
- *Marketing* innovation: the implementation of a new marketing method involving significant changes in product design or packaging, product placement, product promotion or pricing.
- *Organisational* innovation: the implementation of a new organisational method in the firm's business practices, workplace organisation or external relations.

The first two types are traditionally more closely related to technological innovation (also referred to as TPP innovation). Firms are considered innovative if they have implemented an innovation during the period under review (the observation period is usually two to three years).

Measuring novelty and the diffusion of innovations

By definition, all innovation must contain a degree of novelty. The *Oslo Manual* distinguishes three relevant concepts: new to the firm, new to the market and new to the world. The first concept covers the diffusion of an existing innovation to a firm (the innovation may have already been implemented by other firms, but is new to the firm). Firms that first develop innovations (new to market or new to world) can be considered as drivers of the process of innovation. Many new ideas and knowledge originate from these firms, but the economic impact of the innovations will depend on their adoption by other firms. Information on the degree of novelty can be used to identify the developers and adopters of innovations, to examine patterns of diffusion and to identify market leaders and followers.

In addition, innovation surveys often collect information on the developer of an innovation, *i.e.* whether the innovation is developed mainly by the firm itself, together with others, or mainly by others. This is different from questions on the degree of novelty as enterprises may develop innovations that have already been implemented by others. It therefore indicates how innovative enterprises are, but not necessarily how novel their innovations are.

Table 1.1. **Simple innovation indicators**

Technological innovation	
1.	Share of firms that introduced a product innovation
2.	Share of firms that introduced a process innovation
3.	Share of firms that introduced either a product or a process innovation ("innovative firms")
4.	Share of firms that developed in-house technological innovations (product or process)
5.	Share of firms that introduced a new-to-market product innovation
Non-technological innovation	
6.	Share of firms that introduced a marketing innovation
7.	Share of firms that introduced an organisational innovation
8.	Share of firms that introduced a non-technological innovation (marketing or organisational)
Inputs	
9.	Total expenditures on innovation [as a % of total turnover]
10.	Expenditure on innovation by type of expenditure (machinery acquisition, external knowledge, R&D, etc.) [as a % of total expenditure on innovation]
11.	Share of firms that performed R&D
12.	Share of firms that performed R&D on a continuous basis
Outputs	
13.	Share of turnover from product innovations [as a % of turnover]
14.	Share of turnover from new-to-market product innovations [as a % of turnover]
Key policy-relevant characteristics	
15.	Share of firms that were active on international markets (outside the home country)
16.	Share of firms that co-operated with foreign partners on innovation
17.	Share of firms that co-operated on innovation activities
18.	Share of firms that co-operated with universities/higher education or government research institutes
19.	Share of firms that received public financial support for innovation
20.	Share of firms that applied for one or more patents (to protect innovations)

interest recently and has been argued to be a major source of new knowledge creation (von Hippel, 2005; Nordic Council of Ministers, 2006).

The final two indicators deal with the distinction between creative activities and diffusion. In-house innovation captures actual development activities which, even for existing technologies, involve more learning and competence building than simple adoption of technologies. New-to-market product innovation isolates inventive activity, *i.e.* the development of products that do not yet exist on the firm's market.

The next group of indicators measures **non-technological** innovation, or the implementation of marketing and organisational innovations. Policy papers increasingly argue for a broad-based approach to innovation policy (European Commission, 2006; OECD, 2005) and a number of analyses have shown the positive role of organisational innovation in productivity growth (Brynjolfsson and Hitt, 2000; Murphy, 2002).

The third group concerns measures of innovation **inputs**. These includes R&D expenditures, but also broader measures of firms' acquisition of embodied and disembodied technology. The distribution of innovation expenditures also provides information on types of innovation activities, the share of expenditures devoted to creative activities, and the outward orientation of investment in innovation (*i.e.* external acquisitions rather than in-house R&D). Also included are the shares of firms with intramural R&D and of those that conduct R&D on a continuous basis. Both these indicators provide measures of the prevalence of firms involved in creative innovation activities, with R&D playing a more central role among those that conduct R&D on a continuous basis.

Quantitative innovation **output** indicators measure the impact and scope of innovation activity. The two indicators presented here measure the output of product innovations in terms of share of turnover: the first measures the share due to any product innovation, and the second the share due to product innovations that are new to the market.

The final group is composed of indicators that focus on aspects of relevance for **policy**. Internationalisation – activity on foreign markets and efforts to access international knowledge – is vital for maintaining competitiveness and is a central policy issue. The two indicators included here are the share of firms active on foreign markets and the share of firms that have collaborated with foreign partners on innovation.

The literature on innovation systems has long highlighted the importance for innovation of external sources of knowledge. Interaction with other enterprises or public research institutions can be valuable throughout the innovation process, from early development to product launch. The more recent concept of *open innovation* emphasises the role of external knowledge in successful innovation (Chesbrough, 2003). This makes co-operation on innovation an important policy objective, and many funding programmes make engaging in collaboration a condition of funding. Shares of firms with any type of collaboration on innovation provide an overall measure of active co-operation.

Co-operation with public research is of particular policy interest as governments strive to improve the return to public research through transfer of knowledge to the business sector. The indicators therefore include the shares of firms that receive public support for their innovation activities.

Finally, intellectual property rights are a widely discussed policy issue. The last indicator shows the share of firms that have applied for a patent.

Simple indicators: main results

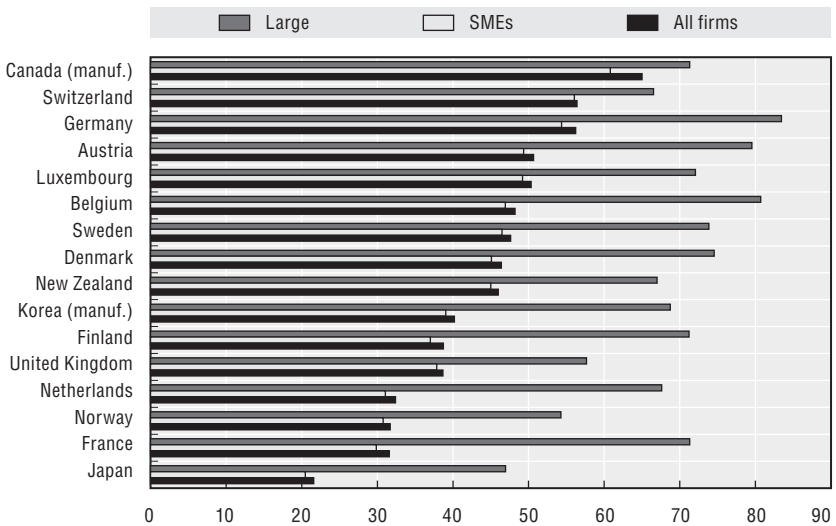
This section summarises some of the main results from the analysis of the simple indicators which have included in detail in Annex 1.A1. Despite

efforts to harmonise the methodology and definitions used to calculate these indicators, cross-country comparisons should be undertaken with caution given that there are differences in both response rates and in the methods used by countries to adjust for non-responses (both at the unit level, and for item non-response).[6]

Figure 1.1 shows the share of firms in each country with a product or process innovation. It ranges from over half of all firms in Austria, Germany, Luxembourg and Switzerland (as well as for manufacturing firms in Canada) to less than a third in France, Japan and Norway. Firm size is an important factor: differences among countries are much less pronounced when the focus is only on large firms (250 employees or more).

Figure 1.1. **Firms having introduced a product or process innovation, 2002-04**[1]

As a percentage of all firms



1. For New Zealand: 2004-05; for Japan: 1999-2001; for Switzerland: 2003-05.

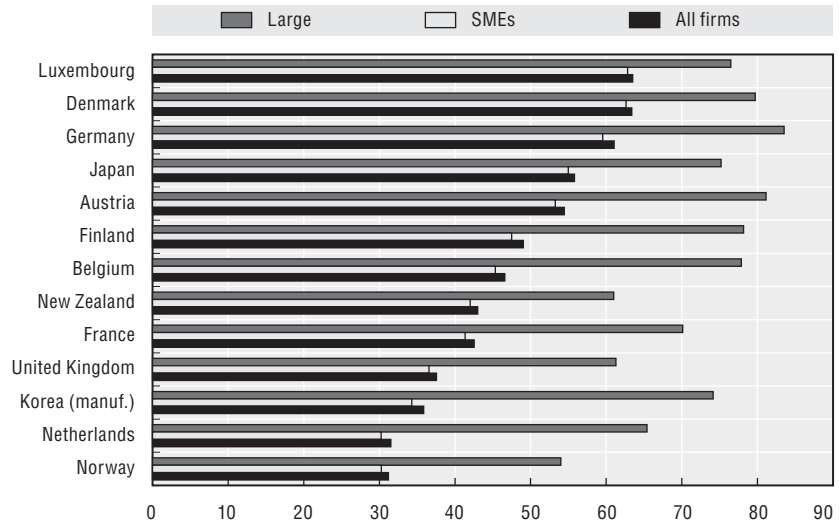
Source: OECD Innovation Microdata Project, 2008.

StatLink http://dx.doi.org/10.1787/545303250144

Figure 1.2 shows the share of firms that introduced a marketing or organisational innovation. There is again wide variation with shares ranging from around 60% of all firms in Denmark, Germany and Luxembourg to around one-third in the Netherlands and Norway. The shares are relatively similar for both service and manufacturing industries (unlike product/process innovations which are more prevalent in manufacturing firms than in services).

Figure 1.2. **Firms that introduced a marketing or organisational innovation, 2002-04**[1]

As a percentage of all firms



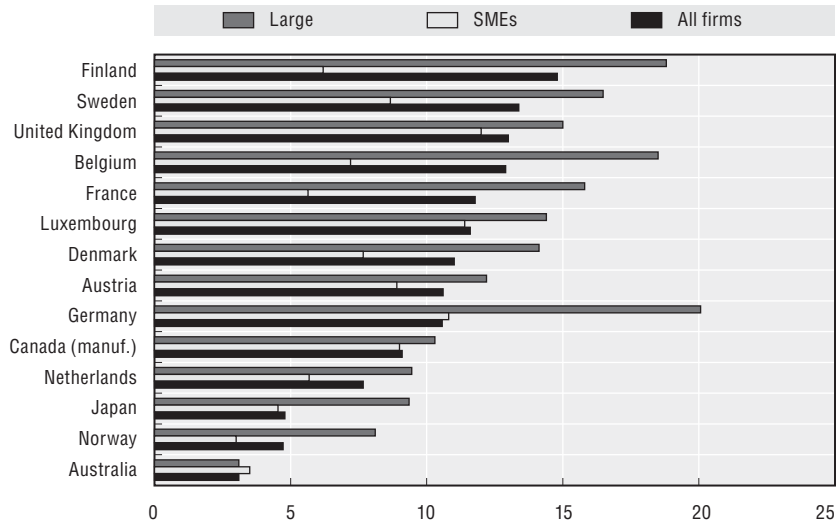
1. For New Zealand: 2004-05; for Japan: 1999-2001.

Source: OECD Innovation Microdata Project, 2008.

StatLink http://dx.doi.org/10.1787/545330160000

Figure 1.3. **Share of turnover from product innovations, 2002-04**[1, 2]

As a percentage of total turnover



1. For Australia: 2004-05; for Japan: 1999-2001.
2. Refers to all firms (not just product innovators).

Source: OECD Innovation Microdata Project, 2008.

StatLink http://dx.doi.org/10.1787/545333484521

Figure 1.3 shows the share of turnover from product innovations. Although the share is modest in most countries (less than 15%), it is around 20% for large firms in Belgium, Finland and Germany.

1.4. Composite indicators

The simple indicators presented above provide a range of useful information on innovation activities and performance across sectors and countries and have often been used as general indicators of innovativeness. For example, the share of enterprises having implemented a product or process innovation is very widely cited. However, as Arundel and Hollanders (2005) argue, these broad indicators fail to fully reveal the wide variation in innovative enterprises, give an incomplete picture of how innovative enterprises are in a sector or country, and may in some cases be misleading in international comparisons. This is because enterprises can innovate many ways. For example, some may be at the cutting edge for their market, developing products and technologies that are truly novel. Others may adopt new technologies developed by others rather than invest in development themselves. Some enterprises' innovation activities may be focused on new organisational practices or marketing methods.

The ability to classify and distinguish different types of innovative enterprises may be of great value for innovation policy design and for further analysis. A clear and detailed view of enterprise innovation can help to identify policy needs and to target innovation policies properly. For example, there is policy interest in identifying the enterprises that actively create new knowledge and in promoting their development. At the same time, to fully capitalise on this knowledge creation, a large share of enterprises must also adopt and implement this new knowledge in their own goods and services.

This section uses **composite** indicators (defined here as indicators that combine answers to several questions) based on firm-level data to examine a number of policy relevant factors as a way to better capture the diversity of innovative firms. Four composite indicators were developed and are presented below:

1. *Output-based innovation modes* which classify innovative firms according to the novelty of their innovations and whether innovation was conducted in house or mainly by others.
2. *Innovation status* classifies firms according to the inventiveness of their innovation activities and whether they engage in collaboration.
3. *Technological and non-technological innovation* examines the combination of product-process innovation with organisational and marketing innovations.
4. *Dual innovators* identifies firms that are active in both goods and service innovation.

Output-based innovation modes

The point of departure here is the classification developed by Arundel and Hollanders (2005), which builds on Tether (2001) and Arundel (2003). Arundel and Hollanders use a variety of CIS innovation variables to characterise four types of innovating enterprises, or "innovation modes". Their classification is based on two main criteria: the level of novelty of enterprises' innovations and the degree of creative in-house activity. The four innovation modes are: strategic innovators, intermittent innovators, technology modifiers and technology adopters (Arundel and Hollanders, 2005).

This indicator has proved useful in increasing our understanding of how firms innovate, but the classification presents difficulties. In particular, the construction of intermittent innovators and technology modifiers is based on various combinations of indicators, which makes it difficult to define them clearly. The classification also relies heavily on inputs, namely R&D (and whether it is continuous or occasional). While R&D is indeed an indicator of creativity, it may in some cases be more appropriate to focus more on output indicators when measuring innovativeness.

An alternative is to base the classification on innovation outputs, implicitly using them as criteria for both novelty and creativity. The emphasis on novelty follows Arundel and Hollanders' classification, but with greater emphasis on output measures, and in particular whether product innovations are new to the market or only new to the enterprise. The "market" is the enterprise's own competitive environment. Hence, a product innovation that is new to the market for an enterprise that operates on international markets may be considered more novel than a product innovation that is new only to the domestic market. On the other hand, a product innovation that is new to domestic markets may or may not be more novel than an innovation that already exists on international markets.

The following classification (Box 1.2) is based on innovative novelty and in-house development and, as for Arundel and Hollanders' innovation modes, it is only based on product and process innovation. Like theirs, this classification is mutually exclusive: enterprises are placed in the highest category for which they meet the criteria. Marketing and organisational innovation, and its combination with product/process innovation, is examined later in this chapter.

Figure 1.4 classifies product/process innovators in all firms according to the five output-based modes. As it shows, there is wide variation in the shares of product/process innovative firms and in the degree of novelty and international orientation.

Canada and Germany have the largest share of product/process innovators,[7] although the breakdown by types of innovation differs widely. In

Box 1.2. **Output-based innovation modes**

New-to-market international innovators

These enterprises have introduced a product innovation that is new to international markets and have developed new products or processes in house. Their innovations have the highest degree of novelty; at the same time, in-house development (product or process innovation developed by the enterprise alone or together with others) indicates that these enterprises possess (at least some of) the capability to create novel products.

New-to-market domestic innovators

These enterprises have introduced product innovations that are new on domestic markets, but not necessarily on international markets. These enterprises only operate on domestic markets. As with new-to-market international innovators, innovations are at least partially developed in-house.

International modifiers

These enterprises have some in-house development activities, but product and/or process innovations already exist on international markets (new-to-enterprise product or process innovators). Innovations may or may not be new to domestic markets.

Domestic modifiers

These enterprises only operate on domestic markets. Product and/or process innovations already exist on domestic markets (new-to-enterprise domestic product or process innovators). These enterprises are adopters that are able to adopt and implement the new technologies themselves.

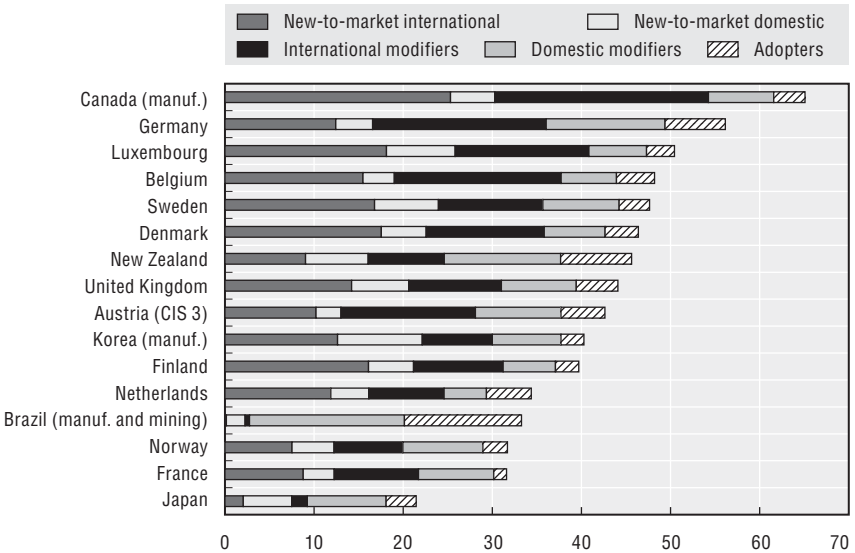
Adopters

These enterprises have not developed product or process innovations in house, but have had them developed by others. This group thus includes all product and process innovators that have had all their product or process innovations developed externally, regardless of novelty.

terms of new-to-market international innovators, Germany's share is lower than that of a number of other countries. Its high share of innovative firms is largely due to innovation based on existing products and technologies on both international and domestic markets. In contrast, Canada has a high share of new-to-market international innovators and a high share of international innovators overall.

After Canada and Germany, the largest shares of innovators are found in Belgium, Luxembourg, and Sweden. Belgium has a particularly high share of innovators that operate on international markets. After Canada, Denmark and Luxembourg have the largest shares of new-to-market international

Figure 1.4. **Output-based modes, all firms**
2002-04[1]



1. For New Zealand: 2004-05; for Japan: 1999-2001; for Brazil: 2003-05; for Austria 1998-2000.
Source: OECD Innovation Microdata Project, 2008.

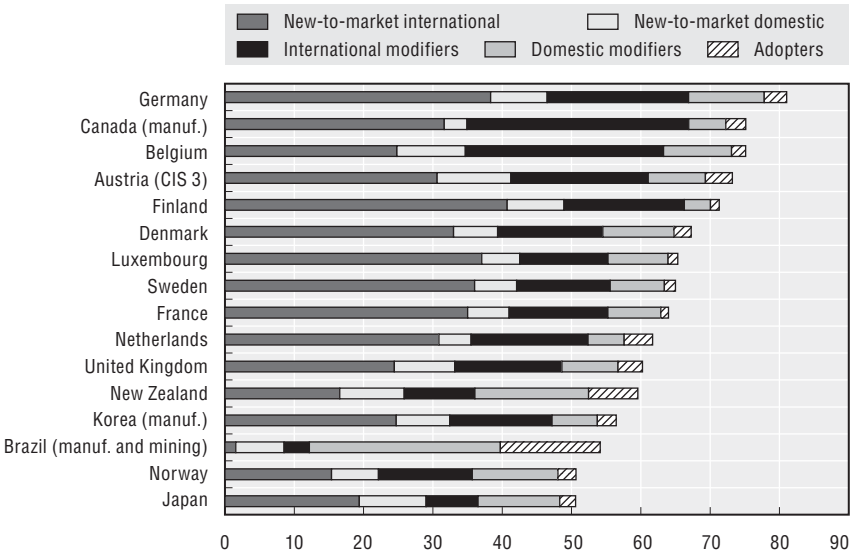
StatLink http://dx.doi.org/10.1787/545437206154

innovators, which represent over a third of their innovative firms. While shares of innovative firms are smaller in the Netherlands, international new-to-market innovators have a relatively high share.

Compared to other countries, Japan has a relatively large share of innovative firms that are new-to-market domestic innovators or domestic modifiers. This reflects in part the size of the Japanese economy and the relatively small share of firms that are active on international markets. New Zealand is much smaller but also has a relatively small share of firms operating on international markets; this is apparent in large shares of domestic new-to-market innovators and modifiers. It also has a relatively large share of adopters. Brazil's profile is markedly different from other countries, with few new-to-market innovators and large shares of domestic modifiers and adopters.

Figure 1.5 shows output-based modes for all firms weighted by employment. This provides a better measure of overall economic impact and takes account of cross-country differences in firm size. The figure, which reflects the shares of employees in product/process innovative firms, shows large increases in innovative shares compared to those in Figure 1.4. As might be expected, almost all of the increase is for firms operating on international

Figure 1.5. **Output-based modes, all firms, employment weights**
2002-04[1]



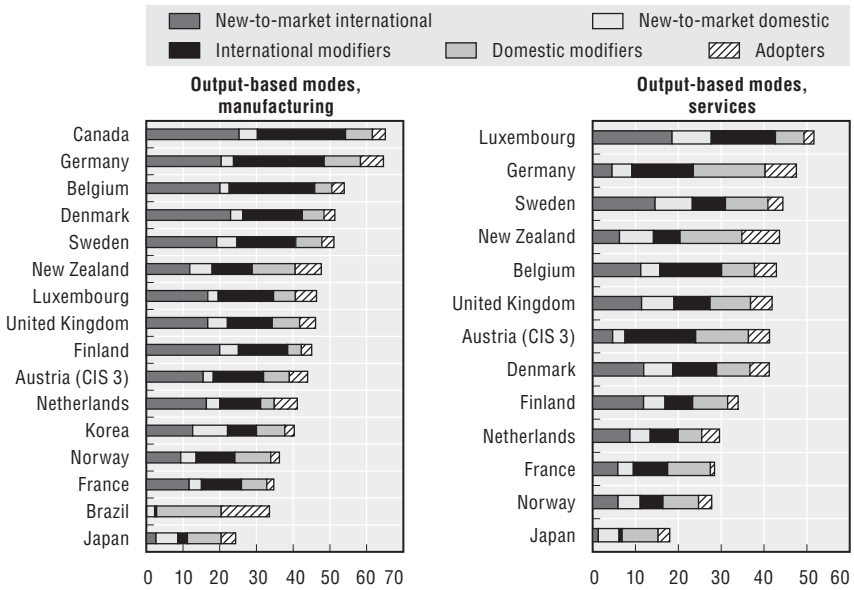
1. For New Zealand: 2004-05; for Japan: 1999-2001; for Brazil: 2003-05.
Source: OECD Innovation Microdata Project, 2008.
StatLink http://dx.doi.org/10.1787/545453266714

markets (both new-to-market international and international modifiers). For most countries the increase is of the order of around 50%. However, the increase is much larger in Brazil, Finland, France, Japan and the Netherlands, with a doubling of innovative shares for France and Japan and it gives Finland the highest share of new-to-market international innovators.

Figures 1.6 and 1.7 highlight sectoral differences by showing output-based modes for both manufacturing (including mining and quarrying) and services. With the exception of Luxembourg, shares of product/process innovative firms are significantly smaller in services, with differences of around 10 percentage points in most countries. Most of this difference concerns new-to-market international innovators, for which shares are much lower in services. This is particularly true for Austria and Germany. For services, shares of new-to-market international innovators are highest in Luxembourg, followed by Sweden.

It is argued that globalisation is an important driver of innovation activities, owing to increased knowledge transfer, international competition which pressures firms to innovate, and the opening up of new markets that increase potential gains from innovations. The output-based innovation modes can be used to examine the role of market orientation. Figure 1.8 shows

Figures 1.6. and 1.7. **Output-based innovation modes**
2002-04[1]



1. For New Zealand: 2004-05; for Japan: 1999-2001; for Brazil: 2003-05.

Source: OECD Innovation Microdata Project, 2008.

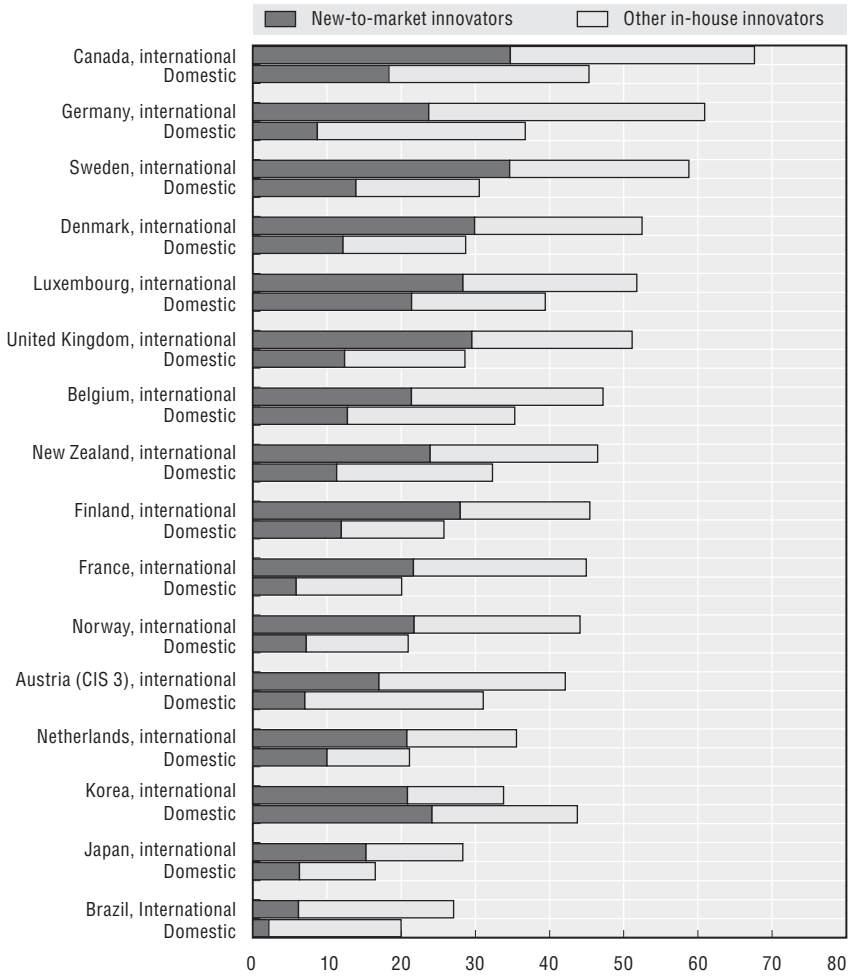
StatLink http://dx.doi.org/10.1787/545461280041

the shares of in-house innovative firms[8] operating only on domestic markets and of those operating internationally. With the exception of Korea, there are substantially higher shares of innovative firms among firms operating internationally than among those operating on domestic markets only. For France and Norway, shares are more than twice as large for firms that operate internationally. Furthermore, most of the difference in shares of innovative firms is for the new-to-market innovators. In most countries, a much larger share of innovators operating internationally have introduced new-to-market innovations than of those operating on domestic markets only. This suggests that exposure to international markets has a strong positive effect on firms' incentives to develop novel products.

Innovation status

Inventive or creative activities and diffusion are two important dimensions of innovation. Arundel and Hollanders (2006), as part of their work on the *European Innovation Trendchart*, develop an indicator to classify innovative enterprises on these two dimensions. Inventive in-house activities (which are denoted here as "formal innovation") are defined here by in-house R&D or a patent application. Diffusion (or "collaboration" in the broad sense)

Figure 1.8. **In-house innovators for domestic and international markets**
2002-04[1]



1. For New Zealand: 2004-05; for Japan: 1999-2001; for Brazil: 2003-05.

Source: OECD Innovation Microdata Project, 2008.

StatLink http://dx.doi.org/10.1787/545547151807

is present if enterprises' innovations were developed with or solely by others or if they engaged in active co-operation on innovations.[9] This indicator also reflects discussions with policy makers in which formal innovation activities and collaboration were mentioned as being relevant to innovation policy.

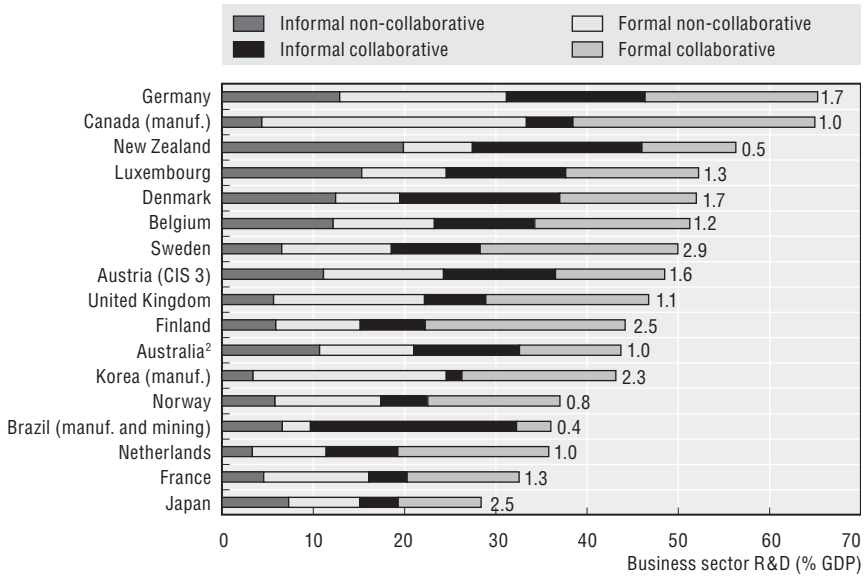
Innovation policy is concerned with promoting both formal innovation activities and collaboration. Formal innovation activities, such as R&D, are important for developing novel products and processes, new competences

and new knowledge that can diffuse to other firms. By combining these two dimensions, four types of firms were identified:

- **Formal collaborative innovators** both carry out in-house creative activities and rely on diffusion in their innovation activities.
- **Formal non-collaborative innovators** carry out creative in-house activities, but do not actively access external knowledge.
- **Informal collaborative innovators** do not carry out creative in-house activities but actively access external knowledge.
- **Informal non-collaborators** do not have inventive in-house activities, nor do they actively access external knowledge.

An increasing amount of attention has been paid to the role of non-R&D innovation (NESTA, 2007; European Commission, 2008). To examine this, Figure 1.9 shows the distribution of firms active in innovation among the four categories and highlights the share engaging in formal and informal innovation and whether or not they collaborate.

Figure 1.9. **Innovation status, all firms**
2002-04[1]



1. For Australia and New Zealand: 2004-05; for Japan: 1999-2001; for Brazil: 2003-05.
2. Figures for Australia include firms with fewer than ten employees, and the reference period for the Australian 2005 Innovation Survey is two years rather than three. These differences can be expected to have a downwards impact on the share of innovation-active firms.

Source: OECD Innovation Microdata Project, 2008.

StatLink http://dx.doi.org/10.1787/545554241041

Korea and Canada (manufacturing only) have the highest share of innovators with formal innovation, followed by Finland, France, the Netherlands, Norway and the United Kingdom which have around 70% with formal innovation. Shares are smaller in the other countries, and under half in Australia, Brazil, Denmark, Luxembourg and New Zealand. If these figures are compared to business-sector R&D intensities (as a share of GDP) for 2005 (OECD, 2007), there are some surprising results. Countries such as France, the Netherlands, Norway and the United Kingdom have relatively low business R&D intensity (less than 1.5% of GDP), but high shares of innovative firms with formal innovation. In contrast, Japan and Sweden have significantly higher R&D intensities, but somewhat lower shares of firms with formal innovation. Similarly, Denmark's R&D intensity is relatively high, yet it has among the lowest shares of innovative firms with formal innovation (42%).

There may be several reasons. First, it appears that Finland, France, Norway and the United Kingdom have fairly large shares of firms that are active in formal innovation, but relatively few of these are highly R&D-intensive. The opposite appears to be true for Denmark.[10] Second, high shares of informal innovators may reflect greater emphasis on non-R&D forms of innovation. Finally, the possibility that some of these differences are due to differences in responses across countries cannot be ruled out.

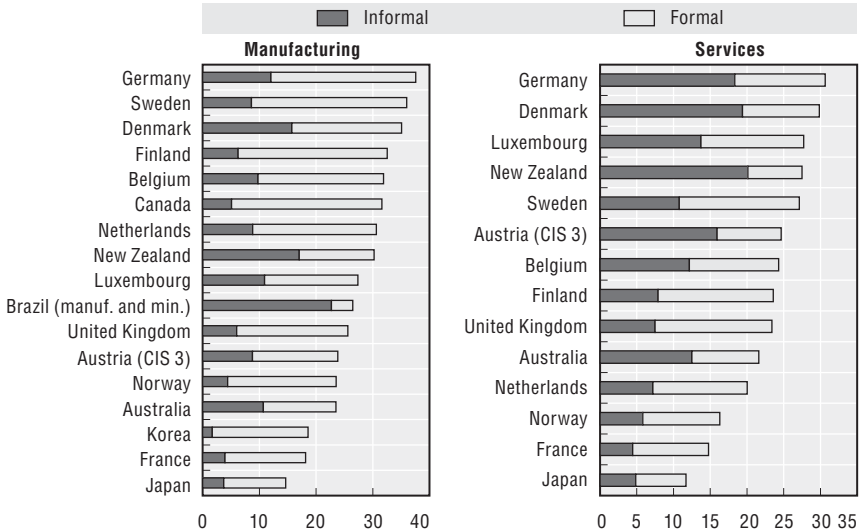
Figures 1.10 and 1.11 focus on collaborating firms (in manufacturing and services), by type of innovation (formal/informal). In manufacturing, Germany has the highest share of such firms, with a large share engaging in formal innovation. Across countries, the great majority of manufacturing firms that collaborate engage in formal innovation. Overall the share of collaborators with informal innovation is much higher in services, with well over half of collaborating firms engaging in informal innovation in Australia, Austria, Denmark, Germany and New Zealand.

Dual innovators

Service innovation, or the development of new services, is not restricted to the services sector. "Traditional" manufacturing enterprises appear to be shifting an increasing share of their activities towards the production of services (Howells, 2004). However, statistical data on this trend and its scope are lacking, and there has been little analysis of innovation processes for developing services in manufacturing enterprises. The development and delivery of services may pose a whole new set of challenges for manufacturing enterprises, in terms of knowledge, organisational practices and distribution channels.

A special feature of the CIS 4 survey as compared to earlier innovation surveys is that it separates product innovations into goods and services. This makes it possible to identify service-innovating enterprises across industrial

Figure 1.10. and 1.11. **Share of firms collaborating on innovation**
2002-04[1]



1. For Australia and New Zealand: 2004-05; for Japan: 1999-2001; for Brazil: 2003-05.

Source: OECD Innovation Microdata Project, 2008.

StatLink http://dx.doi.org/10.1787/545565256172

classes in both the manufacturing and service sectors. It also allows for identifying enterprises that are active innovators in both goods and services, although it does not give information on whether the innovations are integrated or separate.

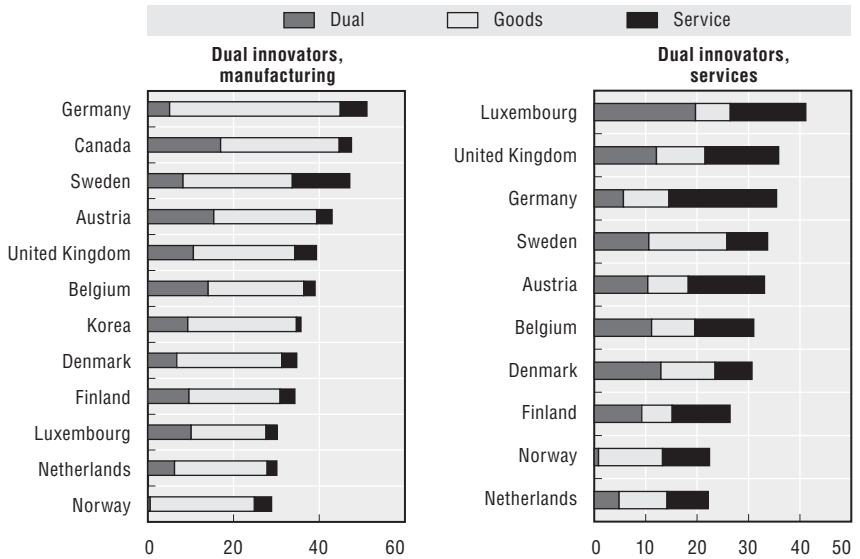
"Dual innovators" refers to enterprises that have implemented both a good and service product innovation. An analysis of dual innovators can help provide a picture of how prevalent service innovation is in manufacturing enterprises (and conversely, the prevalence of goods innovation in the services sector).

Figures 1.12 and 1.13 show the shares of firms that have implemented goods innovations, service innovations or both. As can be seen, significant shares of firms have implemented both goods and service innovations in both manufacturing and services. Within services a large share of product innovators have implemented goods innovations only; this is less apparent in manufacturing (except in Sweden).

Technological and non-technological innovation

The *Oslo Manual* definition of innovation includes four subtypes: product, process, organisational and marketing. An examination of simple combinations of innovation types may be useful for investigating a number of issues, particularly the prevalence of marketing and organisational innovation

Figure 1.12. and 1.13. **Dual innovators**
2002-04



Source: OECD Innovation Microdata Project, 2008.

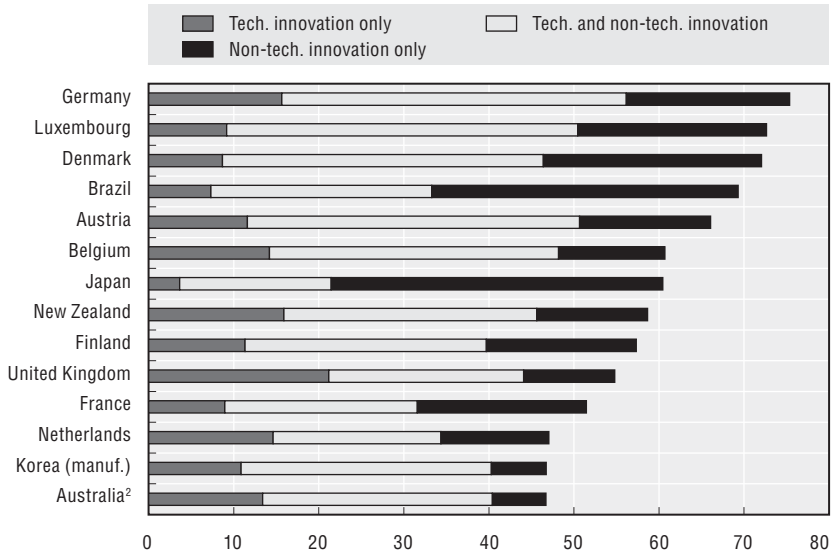
StatLink http://dx.doi.org/10.1787/545605152247

among product and process innovators. Product and process innovations are often considered technological innovations while marketing and organisational are thought of as non-technological. This interpretation is not always correct. For example, many product and process innovations, particularly in services, may not involve technology, while marketing or organisational innovations can include a technological component. Nevertheless, for ease of discussion, this simplification is used to classify enterprises into four groups:

- Technological innovators (product and/or process innovation only).
- Non-technological innovators (marketing and/or organisational innovation only).
- Technological and non-technological innovators.
- No innovations implemented.

Figure 1.14 shows technological and non-technological innovators for all firms. Japan has the largest share of non-technological innovators, followed by Brazil. In terms of overall shares of those with non-technological innovations (*i.e.* non-technological innovators and technological and non-technological innovators), Luxembourg and Denmark have the highest shares. There is a relatively low share of firms with technological innovations only; this

Figure 1.14. **Technological and non-technological innovators, all firms**
2002-04[1]



1. For Australia and New Zealand: 2004-05; for Japan: 1999-2001; for Brazil: 2003-05.
2. Figures for Australia include firms with fewer than ten employees, and the reference period for the Australian 2005 Innovation Survey is two years rather than three. Both these differences can be expected to have a downward impact on the share of innovation-active firms.

Source: OECD Innovation Microdata Project, 2008.

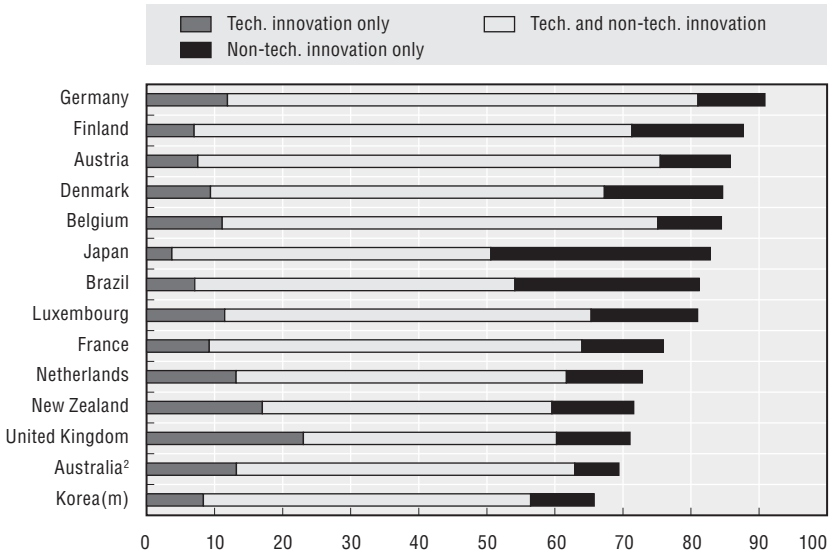
StatLink http://dx.doi.org/10.1787/545638655077

indicates the importance of non-technological innovation, both on its own and combined with technological innovation.

In Figure 1.15, shares are calculated using the number of employees as weights. In general, the impact is less marked than for output-based modes (which are solely based on product/process innovation). Weighting by employees results primarily in an increase in the share of technological and non-technological innovators, a sign that most large firms implement a broad range of innovations, and that shares of innovators with non-technological innovation are more constant across size classes than in the case of product/process innovation. Country comparisons show only a few changes in relative performance, with relative shares increasing for Austria and Finland, and decreasing for Luxembourg.

Figure 1.15. **Technological and non-technological innovators, all firms, employment weighted**

2002-04[1]



1. For Australia and New Zealand: 2004-05; for Japan: 1999-2001; for Brazil: 2003-05.

Source: OECD Innovation Microdata Project, 2008.

StatLink http://dx.doi.org/10.1787/545735812083

1.5. Conclusions

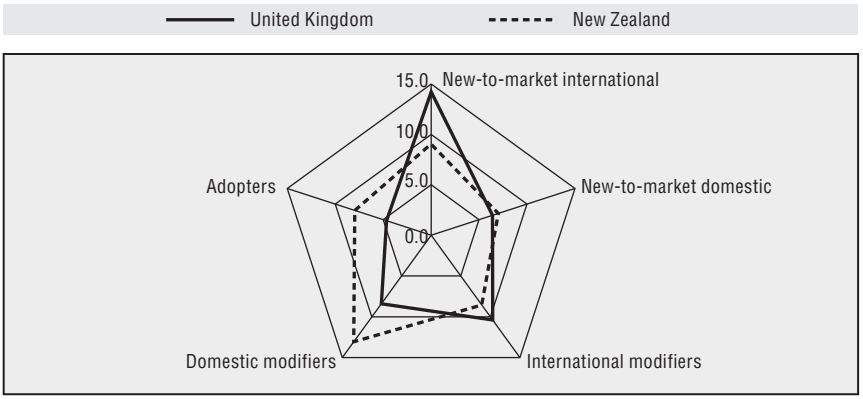
This chapter has presented a number of simple and composite indicators based on data from innovation surveys. It has aimed to address a lack of international comparisons of OECD countries and insufficient exploitation of innovation data for policy purposes. The composite indicators provide a more detailed picture of innovative activities across OECD countries than that provided by a single indicator such as innovation rates (share of product/process innovative firms) and address three broad issues:

- Novelty and creativity: output-based innovation modes.
- Inventiveness and collaboration: innovation status.
- Complementarities in innovation processes: technological and non-technological innovation, as well as dual innovators (firms developing both goods and service innovations, whether in manufacturing or in services).

Such indicators can be used for benchmarking purposes to complement more general indicators such as innovation rates. For example, New Zealand and the United Kingdom with similar overall innovation rates (around 45%) have clearly distinct profiles in terms of innovation modes, with a significantly

Figure 1.16. **Output-based innovation modes in New Zealand (2004-05) and the United Kingdom (2002-04)**

All sectors



Source: OECD Innovation Microdata Project, 2008.

StatLink http://dx.doi.org/10.1787/545745158341

higher share of modifiers and adopters in New Zealand and new-to-market international innovators in the United Kingdom (Figure 1.16).

These indicators only provide a few examples of how data from innovation surveys can be used to identify and examine different modes of innovation. There are a number of possibilities for further analysis. One example is the analysis of open innovation practices (Herstad *et al.*, 2008). In addition, analysis of these indicators could be complemented by econometric analysis of the innovation performance of different types of innovation modes. Finally, other methods can be used to identify innovation modes. One is the use of exploratory analysis (such as factor analysis) to identify the presence of different innovation strategies (see Chapter 2).

This chapter shows that international comparisons of innovation are indeed possible. However, they are subject to limitations. First, innovation surveys are not fully harmonised in all countries, and even harmonised surveys such as CIS can be subject to differences in interpretation by respondents in different countries. While the *Oslo Manual* and EU efforts to harmonise innovation surveys have made great progress in creating internationally comparable data, national differences still exist. On the other hand, differences exist and are accepted in other type of data and such differences in innovation data should not be over-emphasised. Second, statistical measures of the precision of data estimates would greatly facilitate international comparison, by showing which country differences are in fact statistically significant. While this is feasible, it would be time-consuming and is beyond the scope of the present project. Finally, all indicators here are solely

based on innovation survey data, which greatly restricts the possibilities of analysis. Work to link different data sources, in particular internationally co-ordinated efforts, would be very beneficial. Examples might include linking innovation data to R&D data, structural business statistics, and patent data, among many other possibilities.

Notes

1. This introduction draws in part on an early contribution to this project by Anthony Arundel.
2. The United States is a notable exception, as no official innovation survey based on the *Oslo Manual* framework exists at this time.
3. See European Commission (2008) for the most recent edition.
4. Some editions of the OECD's *Science, Technology and Industry Scoreboard* have included a limited number of such indicators (see for example OECD, 2007).
5. We wish to thank the countries that participated in this part of the project: Australia, Austria, Belgium, Brazil, Canada, Denmark, Finland, France, Germany, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Sweden, Switzerland and the United Kingdom.
6. Annex A includes some information by country on overall response rates and the methods used by countries to adjust their data (such as non-respondent surveys, or imputation), but this report does not include detailed measures of the statistical precision of each estimate (such as coefficients of variation), which would be needed to assess whether country differences are statistically significant. This is an area to be further explored in follow-up work.
7. Note that results for Canada are for manufacturing only, which tends to have a higher share of innovative firms than within services. Considering the manufacturing sector on its own, shares of product-process innovators are about equal for Canada and Germany. See Figure 1.6 below.
8. Using output-based innovation modes, it is not possible to divide adopters according to market orientation.
9. This is broader that the notion of "co-operation" as measured in the simple indicators, which only measures enterprises engaged in active co-operation and excludes enterprises with innovations developed with or solely by others (see Tables S.17 to S.19).
10. Analysis in the NIND (Policy Relevant Nordic Innovation Indicators) project lends some support to this, by showing that Denmark's relatively high R&D intensity is predominantly due to activities in the pharmaceuticals sector, with much lower R&D patterns, similar to Norway's, in all other sectors (Nilsson and Pettersson, 2008).

References

Åkerblom, M. *et al.* (2008), "Policy Relevant Nordic Innovation Indicators – Final Report".

Arundel, A. (2003), "The Knowledge Economy, Innovation Diffusion, and the CIS", Proceedings of the 21st CEIES Seminar, *Innovation Statistics – More than R&D Indicators*

(Athens, 10-11 April 2003), Eurostat, General Statistics, European Commission, Luxembourg.

Arundel, A. (2007), "Innovation survey indicators: What Impact on Innovation Policy", *in* OECD (2007), *Science, Technology and Innovation Indicators in a Changing World – Responding to Policy Needs*, proceedings of the *OECD Blue Sky II Forum*, Ottawa 25-27 September, OECD.

Arundel, A. and H. Hollanders (2005), "EXIS: An Exploratory Approach to Innovation Scoreboards", Brussels, European Commission, DG Enterprise.

Arundel, A. and H. Hollanders (2006), *2006 European Innovation Scoreboard Methodology Report: Searching the Forest for the Trees – "Missing" Indicators of Innovation, Brussels*, European Commission, DG Enterprise.

Bloch, C. *et al.* (2007), "Development and Analysis of Innovation Indicators in the Nordic Countries Based on CIS Surveys", NIND project report.

Brynjolfsson, E. and L.M. Hitt (2000), "Beyond Computation: Information Technology, Organisational Transformation and Business Performance", *Journal of Economic Perspectives*, 14, 23-48.

Chesbrough, H. (2003), "Open Innovation: The New Imperative for Creating and Profiting from Technology", Harvard University Press, Cambridge, MA.

European Commission (2006), "Putting Knowledge into Practice: A Broad-based Innovation Strategy for the EU", COM (2006) 502.

European Commission (2008), *European Innovation Scoreboard 2007 – Comparative Analysis of Innovation Performance*, PRO INNO Europe/INNO-Metrics, February.

Herstad, S. *et al.* (2008), "Open Innovation and Globalisation: Theory, Evidence and Policy Implications", Vision Era-Net project report.

von Hippel, E. (2005) *Democratising Innovation*, MIT Press, Cambridge, MA.

Howells, J. (2004), "Innovation, Consumption and Services: Encapsulation and the Combinatorial Role of Services", *The Service Industries Journal, No.* 24, 19-36.

Murphy, M. (2002), "Organisational Change and Firm Performance", STI Working Paper 2002/14, OECD.

National Endowment for Science, Technology and the Arts (NESTA) (2007), *Hidden Innovation – How Innovation Happens in Six "Low Innovation" Sectors,* June.

Nilsson, R. and I. Pettersson (2008), *Comparison of Research and Development in the Nordic Countries*, Report for the NIND project – Policy Relevant Nordic Innovation Indicators.

Nordic Council of Ministers (2006), *Understanding User-driven Innovation*, TemaNord, 2006:522.

OECD (2005), *Governance of Innovation Systems – Synthesis Report*, Vol. 1, OECD, Paris.

OECD (2007), *OECD Science, Technology and Industry Scoreboard 2007 – Innovation and Performance in the Global Economy*, OECD, Paris.

OECD/Eurostat (2005), *Oslo Manual* – Proposed Guidelines for Collecting and Interpreting Innovation Data, 3rd edition, OECD, Paris.

Tether, B.S. (2001), "Identifying Innovation, Innovators and Innovative Behaviours: A Critical Assessment of the Community Innovation Survey (CIS)", CRIC Discussion Paper No. 48, CRIC, University of Manchester and UMIST, Manchester.

ANNEX 1.A1

Statistical Tables

Section A: Simple indicators (S-tables)

Table S.1. **Firms having introduced a product innovation**
As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia[1]	24.0	23.7	32.5	26.8	18.6
Austria	37.8	36.5	67.9	43.4	33.1
Belgium	35.0	33.8	65.3	39.1	31.5
Canada (manuf.)[2]	n.a.	44.4	52.4	47.6	n.a.
Denmark	32.8	31.5	59.5	34.6	30.7
Finland	29.7	28.1	58.5	34.7	26.2
France	19.4	17.8	57.3	23.3	15.8
Germany	43.3	41.3	71.9	52.2	35.8
Japan	17.3	16.3	40.6	19.8	14.6
Korea (manuf.)	n.a.	34.7	60.8	35.7	n.a.
Luxembourg	38.6	37.1	66.2	31.3	40.7
Netherlands	24.0	23.0	51.8	29.2	20.2
New Zealand[3]	35.0	34.0	52.0	37.0	33.0
Norway	25.4	24.6	44.2	28.9	22.4
Sweden	37.1	36.1	57.9	37.9	36.5
Switzerland	47.6	47.2	60.7	59.3	40.8
United Kingdom	32.7	32.1	49.0	35.8	30.8

1. Two-year reference period and includes firms with fewer than ten employees for manufacturing/services groupings.
2. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547410003558

Table S.2. **Firms having introduced a process innovation**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia[1]	28.7	28.1	46.0	27.3	20.7
Austria	40.4	39.1	70.5	44.5	36.5
Belgium	36.2	35.0	66.9	42.4	30.7
Canada (manuf.)[2]	n.a.	46.3	60.2	50.0	n.a.
Denmark	32.8	31.4	62.6	39.5	26.3
Finland	27.8	26.2	59.5	30.7	25.3
France	25.3	23.8	59.4	27.4	23.2
Germany	36.2	34.3	64.1	40.8	31.9
Japan	11.7	10.9	29.2	12.7	10.5
Korea (manuf.)	n.a.	21.3	50.7	22.5	n.a.
Luxembourg	35.9	34.6	60.3	32.6	36.9
Netherlands	22.4	21.1	55.7	29.0	17.3
New Zealand[3]	28.0	27.0	48.0	29.0	27.0
Norway	19.1	18.2	40.7	22.2	16.5
Sweden	31.9	30.7	60.2	37.1	27.2
Switzerland	36.5	35.8	54.3	46.3	30.6
United Kingdom	20.1	19.4	38.2	23.6	17.7

1. Two-year reference period and includes firms with fewer than ten employees for manufacturing/services groupings.
2. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547434140531

Table S.3. **Firms having introduced either a product or a process innovation**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria	50.6	49.4	79.5	55.4	46.4
Belgium	48.2	46.9	80.7	54.0	43.2
Canada (manuf.)[1]	n.a.	60.8	71.3	65.0	n.a.
Denmark	46.4	45.1	74.5	51.3	41.2
Finland	38.7	37.0	71.2	44.8	33.5
France	31.6	29.9	71.3	35.0	28.4
Germany	56.2	54.4	83.4	65.9	47.9
Japan	21.6	20.5	46.9	24.4	18.5
Korea (manuf.)	n.a.	39.0	68.7	40.2	n.a.
Luxembourg	50.3	49.2	72.1	47.2	51.2
Netherlands	32.4	31.1	67.6	39.5	27.0
New Zealand[2]	46.0	45.0	67.0	48.0	44.0
Norway	31.7	30.8	54.3	36.3	27.8
Sweden	47.6	46.5	73.8	51.3	44.4
Switzerland	56.4	56.1	66.5	67.2	50.0
United Kingdom	38.7	37.9	57.6	41.9	36.5

1. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547460738027

Table S.4. **Firms having developed an in-house technological innovation (product or process)**
As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria	32.9	31.7	59.9	38.4	28.2
Belgium	36.7	35.4	67.4	41.8	32.1
Canada (manuf.)[1]	n.a.	45.5	53.2	48.6	n.a.
Denmark	42.7	41.3	72.3	48.3	36.7
Finland	25.9	24.5	52.0	31.2	21.8
France	30.2	23.8	59.4	27.4	23.2
Germany	36.0	40.1	64.7	46.2	27.3
Japan	18.1	17.0	43.4	20.5	15.5
Korea (manuf.)	n.a.	12.4	32.0	13.1	n.a.
Luxembourg	37.6	36.2	64.7	36.5	37.9
Netherlands	27.5	26.2	61.3	33.4	23.0
New Zealand[2]	38.0	37.0	58.0	41.0	35.0
Norway	29.0	28.1	51.3	33.9	24.8
Sweden	44.2	43.0	71.8	48.0	40.9
Switzerland	30.9	30.5	41.4	39.3	26.1
United Kingdom	34.0	33.2	53.9	37.9	31.3

1. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547473780152

Table S.5. **Firms having introduced a new-to-market product innovation**
As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia[1]	11.8	11.4	21.8	15.0	8.1
Austria	25.4	24.2	53.0	28.6	22.7
Belgium	20.9	19.9	43.9	23.8	18.2
Canada (manuf.)[2]	n.a.	28.8	36.3	31.0	n.a
Denmark	24.8	23.9	45.0	26.8	22.4
Finland	21.5	20.2	44.1	26.1	18.2
France	12.6	11.3	42.0	15.6	9.7
Germany	17.5	16.2	37.3	25.5	10.5
Japan	11.5	10.9	25.9	13.6	9.3
Korea (manuf.)	n.a.	20.4	41.1	21.2	n.a.
Luxembourg	27.0	25.7	51.5	21.2	28.7
Netherlands	16.2	15.4	37.6	20.6	12.8
New Zealand[3]	21.0	20.0	34.0	22.0	19.0
Norway	12.9	12.5	22.7	13.8	12.2
Sweden	26.2	25.4	43.9	25.9	26.5
Switzerland	19.9	19.8	24.0	24.9	17.1
United Kingdom	19.3	18.8	31.3	21.1	18.2

1. Two-year reference period and includes firms with fewer than ten employees for manufacturing/services groupings.
2. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547475224860

Table S.6. **Firms having introduced a marketing innovation**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria	27.3	26.5	45.1	26.6	27.9
Belgium	24.3	23.3	49.4	24.3	24.2
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	20.9	20.5	30.0	18.1	24.1
Finland[1]	24.0	23.1	41.7	27.3	21.9
France	18.3	17.4	40.4	15.2	21.6
Germany	25.2	23.9	43.5	28.1	23.1
Japan	8.3	8.1	13.9	7.7	9.1
Korea (manuf.)	n.a.	21.6	39.2	22.3	n.a.
Luxembourg	30.2	29.8	38.2	22.5	32.5
Netherlands	13.2	12.6	31.7	12.6	13.7
New Zealand[2]	28.0	27.0	38.0	25.0	30.0
Norway	15.8	15.2	28.6	16.6	15.1
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.
Switzerland	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	23.6	23.0	36.4	22.1	24.7

1. Refers to changes in marketing methods or strategy, and aesthetic changes of products.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547488470636

Table S.7. **Firms having introduced an organisational innovation**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia[1]	30.7	30.2	43.5	27.8	24.1
Austria	49.4	48.1	77.4	46.1	51.8
Belgium	39.4	38.1	70.3	39.9	38.8
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	57.9	57.1	76.2	55.3	61.0
Finland[2]	44.3	42.7	73.1	45.9	43.2
France	37.0	35.9	61.2	35.5	38.4
Germany	54.8	53.2	78.2	56.0	53.8
Japan	55.6	54.8	74.9	57.3	53.7
Korea (manuf.)	n.a	28.6	69.0	30.1	n.a.
Luxembourg	59.1	58.4	72.1	51.8	61.2
Netherlands	27.1	25.9	59.8	28.2	26.2
New Zealand[3]	32.0	31.0	52.0	30.0	34.0
Norway	24.1	23.2	46.3	23.9	24.3
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.
Switzerland	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	31.2	30.2	54.8	30.1	32.0

1. Two-year reference period and includes firms with fewer than ten employees for manufacturing/services groupings.
2. Refers to changes in business strategy, organisational structure and external relations.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547523150501

Table S.8. **Firms having introduced a non-technological innovation (marketing or organisational)**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria	54.5	53.3	81.1	52.6	55.8
Belgium	46.6	45.3	77.9	47.6	45.6
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	63.4	62.6	79.7	60.8	66.5
Finland[1]	49.0	47.5	78.2	52.0	46.8
France	42.5	41.3	70.1	40.8	44.3
Germany	61.1	59.5	83.5	63.7	58.9
Japan	55.8	55.0	75.2	57.8	53.7
Korea (manuf.)	n.a.	34.3	74.1	35.9	n.a.
Luxembourg	63.5	62.8	76.5	56.7	65.5
Netherlands	31.5	30.2	65.4	32.6	30.5
New Zealand[2]	43.0	42.0	61.0	41.0	45.0
Norway	31.2	30.3	54.0	32.1	30.5
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.
Switzerland	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	37.5	36.5	61.3	36.8	38.0

1. See Tables S.6 and S.7 for definitions.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547616324440

Table S.9. **Expenditure on innovation**

As a % of total turnover

	All firms	SMEs	Large	Manufacturing	Services
Australia[1]	2.3	1.5	2.8	3.4	1.9
Austria[2]	1.7	1.5	1.8	2.8	0.9
Belgium	2.0	1.2	2.6	4.3	0.7
Canada (manuf.)[3]	n.a.	6.3	5.8	6.6	n.a.
Denmark	2.7	2.1	3.3	4.2	1.6
Finland	n.a.	n.a.	n.a.	n.a.	n.a.
France	2.2	1.2	2.9	3.6	1.2
Germany	2.9	2.0	3.3	5.2	1.2
Japan	n.a.	n.a.	n.a.	n.a.	n.a.
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	2.6	2.7	2.6	3.3	2.4
Netherlands	1.3	0.8	1.7	2.6	0.4
New Zealand	n.a.	n.a.	n.a.	n.a.	n.a.
Norway	0.7	0.5	1.0	1.2	0.4
Sweden	4.7	4.4	4.9	5.6	3.7
Switzerland	4.8	4.8	5.4	4.9	4.7
United Kingdom	1.4	2.0	1.0	3.8	0.8

1. Includes firms with fewer than ten employees for manufacturing/services groupings.
2. CIS 3 data and quality problems.
3. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.

StatLink http://dx.doi.org/10.1787/547618487352

Table S.10. **Expenditure on innovation by type**
As a % of total innovation expenditure

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria (CIS 3)					
Internal R&D	47.0	35.3	54.4	51.7	38.2
External R&D	6.2	6.6	5.9	5.4	7.6
Machinery	28.5	38.8	22.0	27.9	28.7
External knowledge	6.1	6.0	6.2	2.7	13.6
Other	12.2	13.3	11.5	12.3	11.8
Belgium					
Internal R&D	34.0	39.3	31.5	30.5	48.7
External R&D	12.7	6.2	15.9	13.7	10.0
Machinery, equipment, software	34.3	51.0	26.3	33.8	32.6
Other external knowledge	18.9	3.4	26.3	22.0	8.6
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark					
Internal R&D	55.2	36.8	66.0	59.1	47.7
External R&D	12.2	9.7	13.7	15.5	5.8
Machinery, equipment, software	16.2	31.9	6.9	14.9	18.7
Other external knowledge	5.8	10.1	3.3	2.8	11.6
Other intramural	10.6	11.4	10.1	7.7	16.2
Finland	n.a.	n.a.	n.a.	n.a.	n.a.
France					
Internal R&D	68.4	62.4	70.0	68.8	67.0
External R&D	16.7	10.2	18.4	19.8	8.5
Machinery, equipment, software	12.5	10.2	9.4	9.7	19.9
Other external knowledge	2.4	3.3	2.2	1.6	4.7
Germany					
Internal R&D	43.9	36.8	45.5	47.7	31.4
External R&D	8.0	4.3	8.9	9.0	4.7
Machinery, equipment, software	26.7	35.4	24.9	23.8	35.6
Other external knowledge	3.0	3.2	3.0	2.7	4.1
Other intramural	18.3	20.4	17.8	16.8	24.2
Japan	n.a.	n.a.	n.a.	n.a.	n.a.
Korea (manuf.)					
Internal R&D	n.a.	43.5	45.6	43.7	n.a.
External R&D	n.a.	8.5	6.2	8.3	n.a.
Machinery	n.a.	22.6	18.3	22.3	n.a.
External knowledge	n.a.	3.8	4.8	3.9	n.a.
Other	n.a.	21.6	25.1	21.8	n.a.
Luxembourg					
Internal R&D	47.2	29.4	62.2	74.2	36.9
External R&D	4.5	4.8	4.2	1.3	5.7
Machinery, equipment, software	34.8	46.8	24.7	21.8	39.8
Other external knowledge	13.5	19.1	8.8	2.7	17.6

Table S.10. **Expenditure on innovation by type** *(cont.)*
As a % of total innovation expenditure

	All firms	SMEs	Large	Manufacturing	Services
Netherlands					
Internal R&D	59.7	41.8	67.1	64.8	43.9
External R&D	15.6	11.5	17.2	13.6	18.0
Machinery, equipment, software	22.6	44.1	13.7	19.9	34.5
Other external knowledge	2.2	2.6	2.0	1.7	3.5
New Zealand	n.a.	n.a.	n.a.	n.a.	n.a.
Norway					
Internal R&D	57.7	57.9	57.4	55.1	62.6
External R&D	18.2	16.5	20.0	18.3	17.9
Machinery, equipment, software	11.1	10.5	11.7	14.0	5.5
Other external knowledge	3.7	5.5	1.9	3.0	5.2
Other	9.3	9.6	8.9	9.6	8.7
Sweden					
Internal R&D	50.7	24.0	66.2	64.3	26.9
External R&D	13.2	4.2	18.4	15.8	8.5
Machinery, equipment, software	31.2	61.6	13.6	17.5	55.1
Other external knowledge	4.9	10.2	1.8	2.3	9.5
Switzerland	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom					
Intramural R&D	25.6	19.9	30.8	30.4	19.8
Extramural R&D	6.2	4.1	8.1	6.5	6.0
Machinery, equipment, software	39.0	47.4	31.3	39.7	37.5
Other external knowledge	3.6	3.3	3.9	3.6	3.7
Training	4.6	5.1	4.1	3.8	5.4
Design	4.6	4.0	5.1	6.1	2.9
Marketing	16.5	16.3	16.7	10.0	24.7

StatLink http://dx.doi.org/10.1787/547624025640

Table S.11. **Share of turnover from product innovations**

As a % of total turnover[1]

	All firms	SMEs	Large	Manufacturing	Services
Australia[2]	3.1	3.5	3.1	3.7	2.5
Austria	10.6	8.9	12.2	15.7	7.4
Belgium	12.9	7.2	18.5	17.8	10.4
Canada (manuf.)[3]	n.a.	9.0	10.3	9.1	n.a.
Denmark	11.0	7.7	14.1	17.7	6.0
Finland	14.8	6.2	18.8	21.6	6.2
France	11.8	5.6	15.8	17.1	7.6
Japan	4.8	4.5	9.4	4.8	4.8
Luxembourg	11.6	11.4	14.4	7.3	12.8
Netherlands	7.7	5.7	9.5	12.2	5.2
New Zealand	n.a.	n.a.	n.a.	n.a.	n.a.
Norway	4.7	3.0	8.1	6.9	3.5
Sweden	13.4	8.7	16.5	16.6	9.8
Switzerland	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	13.0	12.0	15.0	12.0	13.0

1. Refers to all firms (not only product innovators).
2. Includes firms with fewer than ten employees for manufacturing/services groupings.
3. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.

StatLink http://dx.doi.org/10.1787/547626748420

Table S.12. **Share of turnover from new-to-market product innovations**

As a % of total turnover[1]

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria	5.2	4.2	6.2	7.8	3.6
Belgium	4.8	3.4	6.1	6.3	3.8
Canada (manuf.)[2]	n.a.	4.7	5.3	5.0	n.a.
Denmark	5.2	3.9	6.5	8.5	2.7
Finland	9.7	2.7	13.0	15.3	2.3
France	6.2	2.8	8.3	8.3	4.4
Germany	7.6	2.6	9.4	11.3	5.1
Japan	2.2	2.1	3.2	2.4	2.0
Luxembourg	5.4	5.4	5.6	3.2	6.1
Netherlands	3.6	2.9	4.3	5.8	2.4
New Zealand	n.a.	n.a.	n.a.	n.a.	n.a.
Norway	1.2	0.8	2.0	1.9	0.8
Sweden	8.3	3.5	11.4	11.9	4.2
Switzerland	12.8	12.8	13.2	11.3	14.1
United Kingdom	4.0	4.0	4.0	3.0	4.0

1. Denominator refers to all firms (not only product innovators).
2. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.

StatLink http://dx.doi.org/10.1787/547636012370

Table S.13. **Firms that performed R&D**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria[1]	24.6	21.7	71.1	32.7	16.6
Belgium	27.3	25.8	65.8	35.2	20.3
Canada (manuf.)[2]	n.a.	49.3	62.6	53.2	n.a.
Denmark	20.8	19.1	58.3	27.7	13.8
Finland	30.0	28.0	67.1	37.9	22.8
France	22.9	21.2	61.2	27.7	18.3
Germany	35.1	33.0	65.8	47.3	24.3
Japan	21.8	20.7	47.9	27.9	15.0
Korea (manuf.)	n.a.	40.9	56.9	42.0	n.a.
Luxembourg	23.5	21.4	63.2	27.4	22.4
Netherlands	22.3	21.1	55.1	29.6	16.8
New Zealand[3]	14.0	13.0	34.0	19.0	9.0
Norway	25.1	24.1	50.4	32.4	18.8
Sweden	33.7	32.4	62.5	40.7	29.5
Switzerland	31.6	31.0	51.4	47.9	22.1
United Kingdom	33.2	32.4	53.5	40.2	28.3

1. CIS 3 data.
2. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.
3. One-year reference period (2005).

StatLink http://dx.doi.org/10.1787/547640220762

Table S.14. **Firms that performed continuous R&D**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria[1]	15.0	12.3	58.4	20.5	9.9
Belgium	18.3	16.9	52.7	22.7	14.2
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	10.8	9.3	43.4	14.5	7.0
Finland	17.5	15.2	60.2	22.7	12.9
France	12.0	10.6	46.3	14.6	9.6
Germany	19.1	16.9	52.2	26.7	12.5
Japan	14.2	13.0	42.8	17.9	10.1
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	16.6	14.7	52.9	21.2	15.3
Netherlands	15.9	14.7	48.6	21.6	11.5
New Zealand	n.a.	n.a.	n.a.	n.a.	n.a.
Norway	12.7	11.7	38.3	16.2	9.7
Sweden	17.7	16.3	49.6	20.8	16.2
Switzerland	16.3	15.3	44.5	28.4	9.2
United Kingdom	n.a.	n.a.	n.a.	n.a.	n.a.

1. CIS 3 data.

StatLink http://dx.doi.org/10.1787/547648025882

Table S.15. **Firms that were active on international markets**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria[1]	29.9	28.0	60.9	35.1	25.7
Belgium	67.9	67.5	77.7	77.6	59.6
Canada (manuf.)[2]	n.a.	67.7	84.5	72.9	n.a.
Denmark	58.7	58.2	70.2	69.0	47.9
Finland	n.a.	n.a.	n.a.	n.a.	n.a.
France	40.6	39.2	72.2	49.0	32.8
Germany	47.5	46.3	65.9	56.0	40.6
Japan	9.3	8.3	32.6	12.0	6.5
Korea (manuf.)	n.a.	37.9	73.5	39.3	n.a.
Luxembourg	80.5	79.9	91.2	78.2	81.1
Netherlands	55.4	54.8	70.3	58.7	53.0
New Zealand[3]	38.0	37.0	59.0	49.0	28.0
Norway	33.2	32.6	48.1	39.3	28.1
Sweden	48.2	47.1	74.3	57.3	43.1
Switzerland	28.7	28.1	45.2	48.5	17.1
United Kingdom	40.2	39.3	62.3	48.6	34.4

1. CIS 3 data.
2. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547656405850

Table S.16. **Firms that received public financial support for innovation**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia[1]	4.3	4.0	6.9	7.0	1.9
Austria	17.8	16.6	43.0	24.5	12.0
Belgium	11.7	11.0	27.3	16.9	6.9
Canada (manuf.)[2]	n.a.	36.6	59.2	40.4	n.a.
Denmark	7.8	7.3	18.6	12.6	2.9
Finland	15.2	13.6	43.9	23.0	7.6
France	9.0	8.2	27.8	13.1	5.0
Germany	9.2	8.1	25.2	13.2	5.4
Japan	5.9	5.6	12.7	7.8	3.7
Korea (manuf.)	n.a.	30.9	59.6	32.0	n.a.
Luxembourg	13.0	11.5	41.2	22.8	10.2
Netherlands	12.5	11.5	37.9	20.5	6.4
New Zealand	n.a.	n.a.	n.a.	n.a.	n.a.
Norway	16.3	15.8	27.4	22.7	10.8
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.
Switzerland	4.1	3.9	10.1	5.7	3.2
United Kingdom	9.9	9.7	13.7	12.8	7.8

1. Two-year reference period and includes firms with fewer than ten employees for manufacturing/services groupings.
2. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.

StatLink http://dx.doi.org/10.1787/547673375473

Table S.17. **Firms that co-operated on innovation activities**
As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia[1]	10.6	10.4	15.8	11.2	9.0
Austria	9.1	7.7	40.2	10.8	7.6
Belgium	18.3	16.6	60.9	22.0	14.9
Canada (manuf.)[2]	n.a.	12.4	23.3	14.0	n.a.
Denmark	22.2	20.8	53.9	24.6	20.0
Finland	19.2	17.3	56.1	23.4	14.8
France	12.9	11.6	43.6	14.1	11.7
Germany	10.4	8.6	36.3	14.2	7.0
Japan	7.4	6.5	27.9	8.4	6.2
Korea (manuf.)	n.a.	32.9	49.3	34.0	n.a.
Luxembourg	15.9	14.8	38.2	17.9	15.4
Netherlands	13.2	12.0	47.3	18.4	9.2
New Zealand[3]	17.0	16.0	34.0	18.0	15.0
Norway	12.3	11.3	36.9	15.8	9.3
Sweden	21.4	20.0	53.5	26.0	18.6
Switzerland[4]	9.9	9.4	22.2	16.6	5.9
United Kingdom	15.8	15.3	27.7	14.7	16.7

1. Two-year reference period and includes firms with fewer than ten employees for manufacturing/ services groupings.
2. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.
3. Two-year reference period (2004-05).
4. Refers to collaboration on R&D.

StatLink http://dx.doi.org/10.1787/547736748323

Table S.18. **Firms that co-operated on innovation with higher education or government institutions**
As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria	5.7	4.5	31.9	6.6	4.8
Belgium	8.0	7.0	33.5	10.3	5.9
Canada (manuf.)[1]	n.a.	4.2	11.9	5.0	n.a.
Denmark	8.5	7.4	31.7	9.3	7.7
Finland	14.9	12.8	53.2	19.0	10.5
France	4.0	3.3	21.1	4.9	3.1
Germany	6.0	4.7	23.7	8.9	3.3
Japan	2.4	1.9	15.6	3.3	1.4
Korea (manuf.)	n.a.	16.8	29.8	17.7	n.a.
Luxembourg	6.7	5.6	27.9	10.7	5.6
Netherlands	4.8	4.0	26.1	6.8	3.1
New Zealand[2]	5.0	5.0	20.0	7.0	4.0
Norway	7.4	6.4	31.9	10.3	5.0
Sweden	9.3	8.0	39.4	13.6	5.8
Switzerland[3]	4.4	4.0	16.7	8.7	1.9
United Kingdom	6.3	5.9	14.9	6.8	5.9

1. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.
2. Refers to firms collaborating with universities, polytechnics, Crown Research institutes and other research institutes/institutions. Two-year reference period (2004-05).
3. Refers to collaboration on R&D.

StatLink http://dx.doi.org/10.1787/547741285320

Table S.19. **Firms that co-operated on innovation with foreign partners**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria	5.3	4.2	30.2	6.1	4.7
Belgium	13.5	11.3	51.0	15.7	10.1
Canada (manuf.)[1]	n.a.	8.8	19.5	10.2	n.a.
Denmark	14.8	13.5	44.2	16.5	13.3
Finland	13.3	11.2	51.6	16.9	9.8
France	6.2	5.0	31.9	7.4	5.0
Germany	4.8	2.9	32.4	7.6	2.1
Japan	1.2	0.9	9.9	1.6	0.8
Korea (manuf.)	n.a.	16.1	32.5	17.7	n.a.
Luxembourg	14.6	13.4	38.2	17.9	13.7
Netherlands	7.8	6.7	36.8	11.8	4.9
New Zealand[2]	8.0	8.0	24.0	8.0	8.0
Norway	7.9	7.1	27.4	10.1	6.0
Sweden	11.4	9.9	45.3	14.2	9.5
Switzerland[3]	6.4	6.0	19.1	11.0	3.8
United Kingdom	7.7	7.2	19.7	7.8	7.6

1. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.
2. Two-year reference period (2004-05).
3. Refers to collaboration on R&D.

StatLink http://dx.doi.org/10.1787/547758568344

Table S.20. **Firms that applied for one or more patents to protect their innovations**

As a % of all firms

	All firms	SMEs	Large	Manufacturing	Services
Australia	n.a.	n.a.	n.a.	n.a.	n.a.
Austria[1]	9.0	6.5	49.3	14.3	3.5
Belgium	5.9	5.2	22.5	7.9	4.3
Canada (manuf.)[2]	n.a.	10.7	21.1	12.2	n.a.
Denmark	11.7	10.7	32.1	16.3	7.1
Finland	8.4	6.7	38.6	12.2	5.0
France	9.4	8.1	38.2	12.0	6.8
Germany	14.5	12.5	43.6	24.1	5.9
Japan	8.6	7.4	35.9	11.3	5.5
Korea (manuf.)	n.a.	45.5	58.6	46.4	n.a.
Luxembourg	5.6	4.2	32.4	14.0	3.2
Netherlands	5.4	4.9	19.3	8.9	2.7
New Zealand	n.a.	n.a.	n.a.	n.a.	n.a.
Norway	7.6	6.9	23.9	9.4	6.0
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.
Switzerland	8.0	7.4	25.8	14.8	4.1
United Kingdom	20.6	19.5	45.8	26.3	16.6

1. CIS 3 data.
2. Lower threshold is more than 20 employees and more than CAD 250 000 in revenues.

StatLink http://dx.doi.org/10.1787/547780822111

Section B: Composite indicators (C-tables)

Table C.1. **Output-based innovation modes, all sectors**

	New-to-market international	New-to-market domestic	International modifiers	Domestic modifiers	Adopters
Austria[1]	10.2	2.8	15.1	9.6	4.9
Belgium	15.5	3.5	18.7	6.2	4.3
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	17.6	5.0	13.3	6.8	3.7
Finland	15.5	5.1	9.7	5.9	2.5
France	8.8	3.5	9.5	8.4	1.4
Germany	12.4	4.1	19.5	13.3	6.8
Japan	2.1	5.4	1.8	8.8	3.4
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	18.1	7.7	15.0	6.5	3.1
Netherlands	11.9	4.3	8.4	4.8	5.0
New Zealand[2]	9.1	7.0	8.6	13.1	8.0
Norway	7.5	4.7	7.7	9.0	2.7
Sweden	16.8	7.2	11.7	8.6	3.4
United Kingdom	14.2	6.4	10.4	8.4	4.7

1. CIS 3 data.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547811560768

Table C.2. **Output-based innovation modes, all sectors, employee-weighted**

	New-to-market international	New-to-market domestic	International modifiers	Domestic modifiers	Adopters
Austria[1]	30.6	10.6	19.8	8.3	3.9
Belgium	24.8	9.9	28.6	9.8	2.0
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	33.0	6.4	15.2	10.3	2.5
Finland	40.6	8.2	17.3	3.8	1.3
France	35.0	6.0	14.3	7.6	1.1
Germany	38.3	8.2	20.4	10.9	3.2
Japan	19.4	9.6	7.5	11.8	2.3
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	37.0	5.5	12.7	8.7	1.4
Netherlands	30.9	4.6	16.9	5.2	4.1
New Zealand[2]	16.6	9.3	10.2	16.4	7.1
Norway	15.4	6.8	13.5	12.4	2.6
Sweden	36.0	6.1	13.5	7.8	1.6
United Kingdom	24.4	8.7	15.5	8.1	3.5

1. CIS 3 data.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547841228228

Table C.3. **Output-based innovation modes, manufacturing**

	New-to-market international	New-to-market domestic	International modifiers	Domestic modifiers	Adopters
Austria[1]	15.5	2.7	13.7	7.0	5.0
Belgium	20.1	2.5	23.3	4.6	3.4
Brazil[2]	0.2	2.1	0.5	17.6	13.1
Canada	25.3	5.0	24.0	7.3	3.5
Denmark	23.0	3.3	16.2	5.9	3.0
Finland	19.1	4.9	12.8	3.9	2.8
France	11.7	3.3	10.9	6.9	1.9
Germany	20.4	3.4	24.7	9.9	6.3
Japan	2.7	5.9	2.6	9.2	3.9
Korea	12.6	9.5	7.9	7.7	2.6
Luxembourg	16.7	2.8	15.1	6.0	5.7
Netherlands	16.4	3.6	11.2	3.7	6.3
New Zealand[3]	11.8	6.1	10.9	11.7	7.1
Norway	9.4	4.2	10.6	9.8	2.4
Sweden	19.2	5.5	16.0	7.1	3.3
United Kingdom	16.7	5.4	12.2	7.5	4.3

1. CIS 3 data.
2. Also includes mining.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547850646477

Table C.4. **Output-based innovation modes, manufacturing, employee-weighted**

	New-to-market international	New-to-market domestic	International modifiers	Domestic modifiers	Adopters
Austria[1]	42.8	3.7	22.8	5.6	4.1
Belgium	39.4	1.9	28.7	3.9	1.7
Brazil[2]	1.3	7.0	3.7	28.0	14.4
Canada	31.6	3.3	32.0	5.4	2.9
Denmark	46.7	2.5	18.0	4.1	1.9
Finland	47.9	6.3	20.6	1.5	1.0
France	44.9	2.6	17.3	3.5	1.2
Germany	49.0	1.8	26.2	5.2	2.7
Japan	28.4	5.4	9.6	7.0	2.3
Korea	24.7	7.7	14.8	6.5	2.7
Luxembourg	54.3	1.1	14.2	2.7	1.8
Netherlands	40.2	3.2	17.1	3.3	4.4
New Zealand[3]	25.7	5.8	15.0	7.0	6.8
Norway	23.0	5.8	16.3	11.0	3.1
Sweden	46.1	3.1	16.9	5.0	1.7
United Kingdom	30.9	4.9	18.5	6.0	3.0

1. CIS 3 data.
2. Also includes mining.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/547884333165

Table C.5. **Output-based innovation modes, services**

	New-to-market international	New-to-market domestic	International modifiers	Domestic modifiers	Adopters
Austria[1]	4.7	2.9	16.5	12.3	4.9
Belgium	11.2	4.4	14.5	7.7	5.1
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	11.9	6.8	10.2	7.8	4.6
Finland	11.6	5.4	6.3	7.9	2.3
France	5.9	3.6	8.0	10.0	1.0
Germany	4.5	4.6	14.4	16.8	7.3
Japan	1.3	4.8	0.7	8.4	2.7
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	18.6	9.1	15.0	6.6	2.4
Netherlands	8.7	4.7	6.5	5.5	4.2
New Zealand[2]	6.3	7.9	6.2	14.4	8.8
Norway	5.9	5.2	5.3	8.3	3.1
Sweden	14.6	8.7	7.7	9.9	3.5
United Kingdom	11.4	7.5	8.4	9.4	5.0

1. CIS 3 data.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548007537321

Table C.6. **Output-based innovation modes, services, employee-weighted**

	New-to-market international	New-to-market domestic	International modifiers	Domestic modifiers	Adopters
Austria[1]	11.4	21.6	15.2	12.5	3.6
Belgium	10.0	18.0	28.5	15.8	2.4
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	18.6	10.4	12.2	16.7	3.1
Finland	27.6	11.6	11.6	7.8	1.8
France	23.7	9.8	10.8	12.3	1.0
Germany	19.8	19.3	10.4	20.9	4.1
Japan	3.9	16.9	3.9	20.0	2.3
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	29.0	7.6	12.1	11.5	1.2
Netherlands	22.8	5.9	16.7	6.9	3.8
New Zealand[2]	7.0	13.0	5.2	26.3	7.4
Norway	6.9	7.9	10.4	13.9	2.1
Sweden	23.1	9.8	9.2	11.4	1.5
United Kingdom	17.2	13.1	12.0	10.5	4.2

1. CIS 3 data.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548030086437

Table C.7. **Share of firms with co-operation in innovation by output-based modes, all sectors**

	New-to-market international	New-to-market domestic	International modifiers	Domestic modifiers	Adopters
Austria[1]	26.6	9.4	22.5	17.2	16.6
Belgium	46.4	45.2	33.1	31.7	17.9
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	53.2	54.4	42.8	35.0	23.8
Finland	56.4	43.6	40.1	41.0	17.6
France	51.6	54.3	36.5	26.8	30.6
Germany	29.6	15.8	17.7	10.7	4.9
Japan	41.8	33.9	36.3	24.6	16.6
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	41.5	24.8	28.5	15.2	11.2
Netherlands	50.7	40.3	37.5	31.8	25.3
New Zealand[2]	37.9	28.6	29.8	26.2	20.4
Norway	53.9	44.3	38.5	23.4	24.4
Sweden	54.6	41.1	41.4	29.9	28.7
United Kingdom	43.4	33.7	28.1	21.2	21.2

1. CIS 3 data.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548125280836

Table C.8. **Share of firms with co-operation in innovation by output-based modes, manufacturing**

	New-to-market international	New-to-market domestic	International modifiers	Domestic modifiers	Adopters
Austria[1]	23.3	13.3	25.5	0.5	18.8
Belgium	54.9	38.7	33.5	12.1	24.9
Brazil[2]	22.2	16.3	12.2	4.0	0.9
Canada	29.5	24.1	16.2	13.0	13.0
Denmark	53.2	54.8	45.6	22.6	12.3
Finland	58.7	40.3	41.8	53.9	19.6
France	48.7	57.8	37.9	20.0	28.2
Germany	31.3	15.3	18.0	11.0	3.4
Japan	42.3	30.9	40.1	24.1	13.9
Korea	40.4	40.3	27.7	36.2	44.3
Luxembourg	57.8	37.6	26.9	27.3	100.0
Netherlands	57.0	44.1	43.1	34.1	27.9
New Zealand[3]	40.1	23.4	31.5	27.3	16.8
Norway	57.5	51.4	40.3	26.2	17.9
Sweden	60.8	43.5	44.8	32.8	35.0
United Kingdom	42.5	27.2	28.6	16.7	13.0

1. CIS 3 data.
2. Also includes mining.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548126225275

Table C.9. **Share of firms with co-operation on innovation by output-based modes, services**

	New-to-market international	New-to-market domestic	International modifiers	Domestic modifiers	Adopters
Austria[1]	38.1	5.4	19.9	27.2	14.3
Belgium	32.2	48.8	32.5	42.5	13.8
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	53.3	54.2	38.1	44.8	31.6
Finland	52.5	46.8	36.5	34.1	15.1
France	57.4	51.1	34.7	31.5	35.3
Germany	21.9	16.1	17.0	10.6	6.2
Japan	40.6	38.9	21.0	25.2	22.2
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	37.1	23.6	28.9	11.9	19.4
Netherlands	42.4	38.2	30.9	30.7	22.6
New Zealand[2]	33.9	32.6	26.8	25.2	23.3
Norway	48.9	39.6	35.4	20.6	29.1
Sweden	47.1	39.6	35.0	28.0	23.0
United Kingdom	45.0	38.8	27.4	25.2	29.0

1. CIS 3 data.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548182244383

Table C.10. **Innovation-active firms by type of innovation status,[1] all sectors**

	Informal non-collaborative	Inventive (formal) non-collaborative	Informal collaborative	Inventive (formal) collaborative	No innovation activity
Australia	10.7	10.3	11.6	11.1	56.4
Austria[2]	11.1	13.2	12.3	12.0	51.5
Belgium	12.2	11.1	11.0	17.0	48.8
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	12.5	7.0	17.5	15.0	48.0
Finland	5.8	9.2	7.0	21.2	56.8
France	4.6	11.5	4.2	12.3	67.4
Germany	12.9	18.3	15.2	18.9	34.7
Japan	7.3	7.8	4.2	9.1	71.6
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	15.3	9.3	13.1	14.6	47.8
Netherlands	3.3	8.1	7.9	16.5	64.2
New Zealand[3]	19.9	7.6	18.6	10.3	43.7
Norway	5.8	11.6	5.2	14.5	63.0
Sweden	6.6	12.0	9.7	21.7	50.0
United Kingdom	5.7	16.5	6.7	17.8	53.3

1. Collaborative = engaged in innovation co-operation or product/process innovations developed together with or mainly by others. Formal = engaged in intramural R&D or having applied for a patent.
2. CIS 3 data.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548214230731

Table C.11. **Innovation-active firms by type of innovation status,[1] all sectors, employment-weighted**

	Informal non-collaborative	Inventive (formal) non-collaborative	Informal collaborative	Inventive (formal) collaborative	No innovation activity
Australia	10.2	15.8	11.7	29.4	32.9
Austria[2]	10.8	18.1	10.2	37.5	23.5
Belgium	7.4	8.0	8.9	53.2	22.6
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	8.9	10.7	11.5	40.3	28.6
Finland	2.8	9.5	4.3	58.1	25.3
France	4.5	15.7	4.2	40.7	34.9
Germany	6.6	16.7	8.5	53.9	14.3
Japan	4.2	11.6	2.6	36.0	45.6
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	12.5	15.3	7.8	31.6	32.9
Netherlands	2.8	7.2	11.6	42.3	36.2
New Zealand[3]	14.0	9.9	22.3	21.9	32.0
Norway	5.9	14.0	5.3	31.7	43.1
Sweden	6.0	8.1	7.9	46.3	31.7
United Kingdom	5.2	19.6	6.5	31.9	36.7

1. Collaborative = engaged in innovation co-operation or product/process innovations developed together with or mainly by others. Formal = engaged in intramural R&D or having applied for a patent.
2. CIS 3 data.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548226180126

Table C.12. **Innovation-active firms by type of innovation status,[1] manufacturing**

	Informal non-collaborative	Inventive (formal) non-collaborative	Informal collaborative	Inventive (formal) collaborative	No innovation activity
Australia	10.2	13.0	10.7	12.8	53.2
Austria[2]	10.3	18.5	8.8	15.1	47.4
Belgium	12.3	13.9	9.8	22.2	41.9
Brazil[3]	6.7	3.1	22.7	3.8	63.7
Canada[4]	4.4	29.0	5.1	26.5	35.0
Denmark	12.9	9.8	15.8	19.3	42.3
Finland	6.0	10.7	6.2	26.3	50.7
France	4.0	14.0	4.0	14.2	63.9
Germany	11.7	23.7	12.0	25.5	27.0
Japan	7.7	10.6	3.7	10.9	67.0
Korea	3.4	21.2	1.7	16.9	56.9
Luxembourg	10.2	11.4	10.9	16.4	51.1
Netherlands	3.1	9.6	8.8	21.8	56.7
New Zealand[5]	21.1	9.8	17.0	13.2	38.9
Norway	5.7	14.1	4.4	19.1	56.7
Sweden	5.1	13.2	8.6	27.4	45.7
United Kingdom	5.0	18.4	6.0	19.6	51.0

1. Collaborative = engaged in innovation co-operation or product/process innovations developed together with or mainly by others. Formal = engaged in intramural R&D or having applied for a patent.
2. CIS 3 data.
3. Includes mining.
4. Based on product/process innovative firms only.
5. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548228450822

Table C.13. **Innovation-active firms by type of innovation status,[1] services**

	Informal non-collaborative	Inventive non-collaborative	Informal collaborative	Inventive collaborative	No innovation activity
Australia	11.2	7.0	12.5	9.1	60.3
Austria[2]	12.0	7.5	15.9	8.7	55.8
Belgium	12.0	8.5	12.2	12.2	55.2
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	12.0	4.2	19.4	10.5	54.0
Finland	5.6	7.5	7.9	15.7	63.3
France	5.1	9.1	4.4	10.3	71.0
Germany	14.1	12.9	18.3	12.3	42.4
Japan	6.8	4.4	4.9	6.8	77.1
Korea	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	16.9	8.7	13.7	14.0	46.8
Netherlands	3.5	7.1	7.2	12.8	69.5
New Zealand[3]	18.7	5.4	20.1	7.4	48.5
Norway	5.9	9.5	5.8	10.5	68.3
Sweden	7.9	10.9	10.8	16.4	54.1
United Kingdom	6.4	14.5	7.5	15.9	55.7

1. Collaborative = engaged in innovation co-operation or product/process innovations developed together with or mainly by others. Formal = engaged in intramural R&D or having applied for a patent.
2. CIS 3 data.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548251422720

Table C.14. **Firms with technological and non-technological innovations,[1] all sectors**

	Enterprise weights			Employee weights		
	Technological innovation only	Technological and non-technological innovation	Non-technological innovation only	Technological innovation only	Technological and Non-technological innovation	Non-technological innovation only
Australia	13.4	27.0	6.3	13.2	49.7	6.5
Austria	11.6	39.0	15.4	7.5	68.0	10.3
Belgium	14.2	34.0	12.5	11.1	64.0	9.4
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	8.7	37.7	25.7	9.4	57.9	17.4
Finland	10.9	27.8	18.0	7.0	64.1	16.5
France	9.0	22.6	19.9	9.2	54.8	12.0
Germany	15.6	40.5	19.2	11.9	69.2	9.8
Japan	3.7	17.8	39.0	3.7	46.9	32.3
Korea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	9.2	41.3	22.2	11.5	53.8	15.7
Netherlands	14.6	19.7	12.7	13.2	48.5	11.2
New Zealand[2]	15.9	29.7	13.0	17.0	42.6	12.0
Norway	12.4	19.3	11.9	16.5	34.1	12.6
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	21.2	22.9	10.7	23.1	37.2	10.8

1. Technological innovation = product/process; non-technological innovation = marketing/organisational innovation.
2. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548280740443

Table C.15. **Firms with technological and non-technological innovations,[1] manufacturing**

	Enterprise weights			Employee weights		
	Technological innovation only	Technological and non-technological innovation	Non-technological innovation only	Technological innovation only	Technological and non-technological innovation	Non-technological innovation only
Australia	16.8	27.0	5.4	19.3	38.0	6.7
Austria	15.0	40.2	12.8	11.2	65.1	9.5
Belgium	16.9	37.0	10.8	12.9	62.7	9.8
Brazil[2]	14.4	7.6	22.4	7.0	47.4	27.2
Canada	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	12.3	39.1	21.4	10.7	62.6	12.8
Finland	13.2	30.4	17.4	69.6	7.6	11.8
France	12.2	22.5	18.3	12.3	57.2	9.3
Germany	18.5	46.3	15.2	12.6	72.2	8.0
Japan	3.6	20.8	38.6	3.3	49.4	33.6
Korea	10.9	29.4	6.4	8.4	48.1	9.3
Luxembourg	11.5	34.8	21.8	23.4	50.5	13.7
Netherlands	17.9	23.2	10.7	16.3	51.9	9.3
New Zealand[3]	19.6	28.0	12.8	22.8	37.5	10.6
Norway	15.1	21.2	10.9	18.2	41.0	9.6
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	23.9	22.2	8.8	23.0	40.2	9.9

1. Technological innovation = product/process; non-technological innovation = marketing/organisational innovation.
2. Includes mining.
3. Two-year reference period (2004-05).

StatLink http://dx.doi.org/10.1787/548311543072

Table C.16. **Firms with technological and non-technological innovations,[1] services**

	Enterprise weights			Employee weights		
	Technological innovation only	Technological and non-technological innovation	Non-technological innovation only	Technological innovation only	Technological and non-technological innovation	Non-technological innovation only
Australia	9.3	27.1	7.3	7.8	60.0	6.3
Austria	8.5	37.9	17.8	4.0	70.7	11.2
Belgium	11.7	31.2	14.1	9.3	65.4	8.9
Brazil	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Canada	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Denmark	5.0	36.3	30.2	8.0	53.0	22.2
Finland	25.0	8.5	47.8	54.5	5.9	24.9
France	5.7	22.8	21.5	5.7	52.0	15.1
Germany	12.8	34.8	23.2	10.6	63.9	13.0
Japan	3.7	14.3	39.4	4.5	42.5	29.9
Korea	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Luxembourg	8.5	43.2	22.3	5.9	55.4	16.6
Netherlands	12.3	17.3	14.1	10.5	45.7	12.8
New Zealand[2]	12.2	31.4	13.2	10.8	48.0	13.6
Norway	10.1	17.7	12.8	14.7	26.5	16.0
Sweden	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
United Kingdom	18.2	23.7	12.8	23.1	33.8	11.9

1. Technological innovation = product/process; non-technological innovation = marketing/organisational innovation.
2. Two-year reference period (2004-05).

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Table C.17. **Firms with product-process innovations by type of innovation,[1] all sectors**

	Dual innovators[2]	Goods innovation	Service innovation	Process innovation only
Austria	12.8	15.6	9.5	12.8
Belgium	12.6	15.1	7.2	13.3
Canada	n.a.	n.a.	n.a.	n.a.
Denmark	9.8	17.7	5.3	13.6
Finland	9.2	13.4	7.1	9.1
Germany	5.4	24.3	13.6	12.9
Korea	n.a.	n.a.	n.a.	n.a.
Luxembourg	17.5	9.2	11.9	11.9
Netherlands	5.4	14.4	5.6	8.9
Norway	0.7	17.9	6.8	6.3
Sweden	9.4	20.2	10.6	7.4
United Kingdom	11.3	16.9	9.5	6.4

1. Data not available for other countries.
2. Dual innovators = having both goods and service innovations.

StatLink http://dx.doi.org/10.1787/548345886455

Table C.18. **Firms with product-process innovations by type of innovation,[1] manufacturing**

	Dual innovators[2]	Goods innovation	Service innovation	Process innovation only
Austria	15.4	24.0	3.6	12.3
Belgium	14.1	22.3	2.6	14.9
Canada	17.0	27.7	2.9	17.4
Denmark	6.7	24.6	3.5	16.6
Finland	9.2	20.4	3.3	10.7
Germany	5.1	39.8	6.2	13.7
Korea	9.3	25.3	1.1	4.5
Luxembourg	10.1	17.4	2.6	16.2
Netherlands	6.2	21.6	2.3	11.0
Norway	0.6	24.3	4.0	7.4
Sweden	8.2	25.5	13.4	4.0
United Kingdom	10.6	23.6	5.1	6.8

1. Data not available for other countries.
2. Dual innovators = having both goods and service innovations.

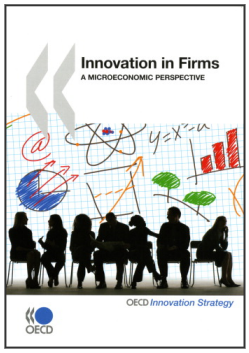
StatLink http://dx.doi.org/10.1787/548377215721

Table C.19. **Firms with product/process innovations by type of innovation,[1] services**

	Dual innovators[2]	Goods innovation	Service innovation	Process innovation only
Austria	10.4	7.9	14.8	13.3
Belgium	11.2	8.4	11.5	11.9
Canada	n.a.	n.a.	n.a.	n.a.
Denmark	13.0	10.5	7.2	10.6
Finland	9.2	6.0	11.1	7.3
Germany	5.7	8.8	21.0	12.1
Korea	n.a.	n.a.	n.a.	n.a.
Luxembourg	19.7	6.8	14.7	10.5
Netherlands	4.8	9.3	8.0	7.5
Norway	0.8	12.5	9.2	5.4
Sweden	10.6	15.2	7.9	10.7
United Kingdom	12.1	9.5	14.3	6.0

1. Data not available for other countries.
2. Dual innovators = having both goods and service innovations.

StatLink http://dx.doi.org/10.1787/548411076335



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