

Chapter III. Access to and use of information technologies

The contribution of the information economy to economic growth and performance also depends on the way new information technologies are used by individuals and businesses. Greater use of ICT in the production process may, for example, help raise the overall efficiency of the use of capital and labour, e.g. by reducing inventories and transaction costs. For technologies based on networks, such as the Internet, the more people who are connected, the greater the potential benefits of the network owing to spillover effects. Statistics on the diffusion of new information technologies are therefore important for helping to evaluate the extent to which their use has an impact on overall economic performance. Also, the growing interest of policy makers in issues such as universal access, the digital divide, consumer trust and privacy protection has raised demand for indicators on access to and use of ICT.

Access is a prerequisite to the use of the technology. The first indicators in this chapter compare developments in telecommunication networks. Others focus more specifically on the size and growth of Internet infrastructure. The 1990s have witnessed extremely dynamic expansion in telecommunication networks, although differences among OECD countries remain and depend partly on the relative pricing structure and the level of competition for a particular access technology.

For international comparisons of ICT usage statistics, important issues are still to be addressed (see Boxes 3.4 and 3.5), but national statistical offices have made tremendous progress in providing high-quality and timely indicators of ICT use. This chapter presents the latest international comparisons based on official surveys of ICT diffusion in households, among individuals and in businesses that were recently developed by national statistical offices under the aegis of the OECD (see Box 3.4 and Annex 2).

To help to explain differences in the intensity of use of new technologies across countries, this chapter also relies on indicators of barriers to the use of information technology. Answers on perceived barriers and on their evaluation are inevitably qualitative in nature and need to be used with caution in international comparisons (see Box 3.6). Nevertheless, they can be of great interest to policy makers. For example, indicators of barriers can help for monitoring issues of digital divide, point to potential bottlenecks related to the technology or lack of appropriate skills and help address concerns about security and logistics.

Telecommunication networks

- The extremely dynamic pace of network expansion makes some traditional indicators of ICT network size less useful for policy analysis. For example, penetration rates of standard access lines measure single connections whereas some technologies now provide multiple communication channels.
- Telecommunication networks continue to expand rapidly. At the end of 1999, OECD countries had more than one network access channel for every two inhabitants, and several had more than one access channel per inhabitant. In terms of standard access lines, Sweden has long enjoyed the highest penetration rate in the OECD area, and it remains the OECD country with the highest PSTN (public switched telephone network) in terms of fixed network penetration. However, other networks, such as wireless or high-speed networks, also need to be taken into consideration in terms of access to communications.
- The Nordic countries maintain a clear lead over the rest of the OECD area when the connectivity provided by wireless networks is taken into account. The leading countries are Norway, Sweden, Iceland and Finland. All had more than 120 telecommunication access paths per 100 inhabitants by the end of 1999.
- Differences in the development of individual access paths in OECD countries will depend on the development of the network, the relative pricing structure and the level of competition for a particular access technology. Countries with low penetration rates for standard access lines (Czech Republic, Hungary, Poland, Mexico, Turkey and to a lesser extent Ireland) have continued to expand their network in the 1990s. In countries with unmetered telecommunications pricing (e.g. Australia, Canada, the United States), a second residential line has generally been used to keep a line free for telephony, but this is changing as broadband connections increase.
- In countries with metered telecommunication charges, it is sometimes as economical to install an ISDN connection as to have two standard access lines. Access to mobile communications, typically higher in the Nordic countries, has spread rapidly to other countries, especially to those ones where operators have actively marketed prepaid cards.
- With increased demand for higher speed Internet access, new access channels are emerging and ISDN lines are being rapidly overtaken by digital subscriber lines (DSL) or cable modems. By the end of 2000, there were 22 countries with commercial high-speed digital subscriber line services – up from just seven in 1999. High-speed Internet access via cable modems was available in 21 OECD countries. This is beginning to change the access landscape. For example, although Korea has had a low penetration rate for some Internet access indicators, its broadband penetration rate increased from 0.6 per 100 inhabitants at the end of 1999 to 13.8 in June 2001. Three other countries - Canada (6.2), Sweden (4.1) and the United States (3.2) – had more than three broadband subscribers per 100 inhabitants by June 2001. The Netherlands, Austria, Belgium and Denmark had all exceeded two subscribers per 100 inhabitants. The trend towards greater infrastructure competition in local markets will encourage the shift towards higher speed access technologies.

Box 3.1. Measuring the telecommunication network

In the past, the penetration rate for standard access lines provided a reasonable indication of the extent to which basic connections were available to users. In the new environment, use of standard access lines would present a distorted view of network development. Indeed, in more than half of OECD countries, the number of standard access lines has begun to decrease in recent years as the take-up of ISDN (Integrated services digital network) has increased.

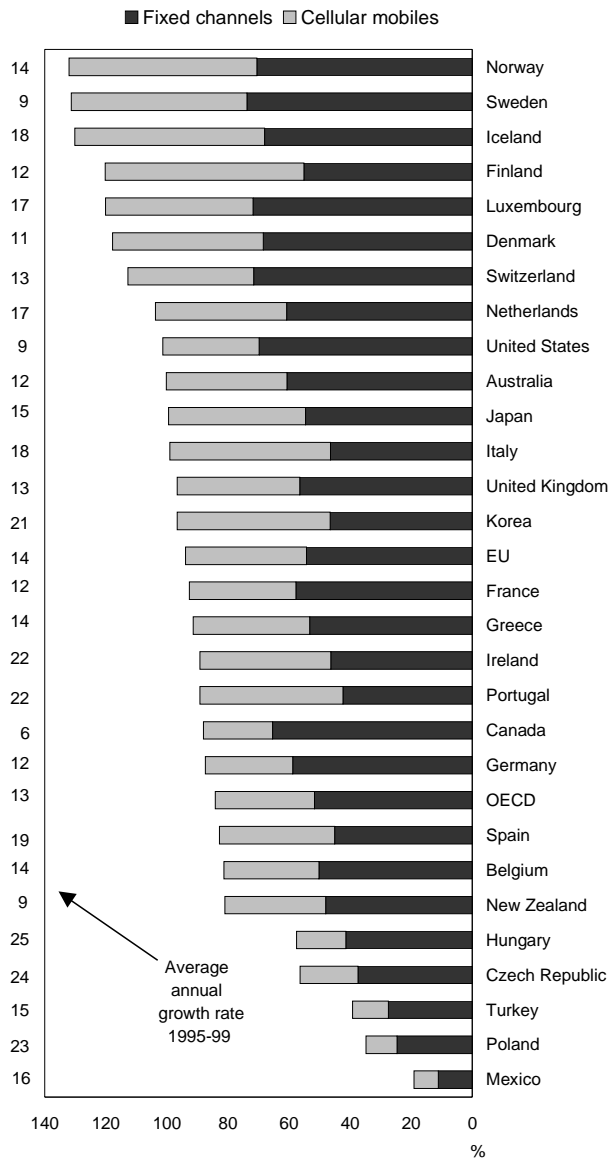
A different methodology than the one traditionally used for the penetration rate of standard access lines is used to measure the penetration of telecommunication channels. Particularly problematic is the measurement of ISDN connections. Telecommunication carriers generally report data for ISDN connections in two ways. One is to report the number of basic and primary ISDN connections. A basic ISDN connection can provide two channels and a primary connection can provide 30. Alternatively, some telecommunication carriers report the total number of ISDN channels by multiplying the number of basic and primary connections by the number of channels they can provide.

For a true appreciation of the overall telecommunication penetration rates across the OECD area, it is also increasingly necessary to take into account the development of mobile communication networks and of "broadband" Internet access. The two leading technologies currently used to provide high speed Internet access are cable modems and Digital Subscriber Line (DSL).

For further information, see OECD, *Communications Outlook 2001*, Paris, 2001.

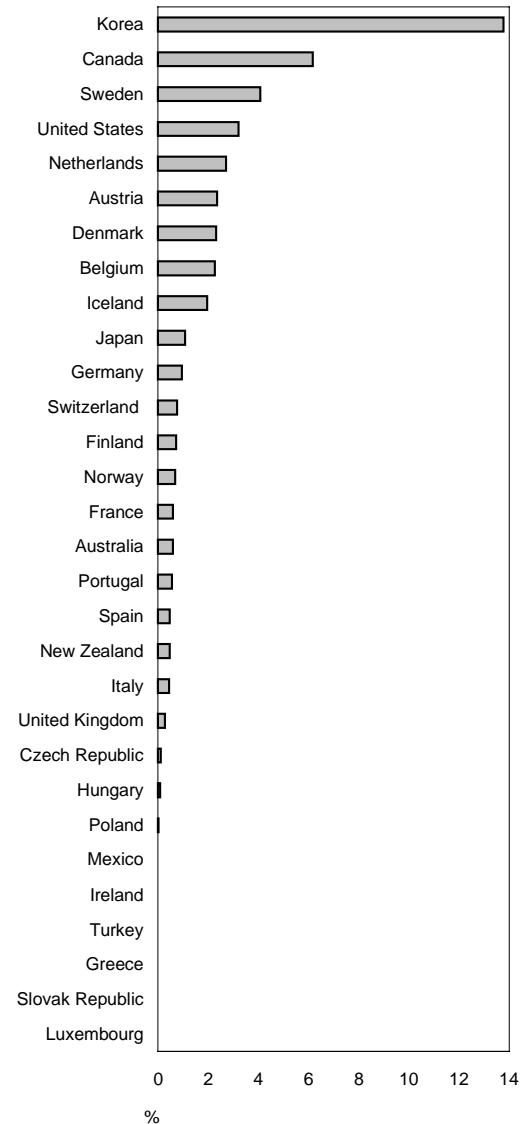
Telecommunication networks

Access paths¹ per 100 inhabitants, 1999²



Broadband penetration rates in OECD countries, June 2001

Number of DSL¹, cable modem lines and other broadband² per 100 inhabitants



1. Telecommunication access paths include the total of fixed access channels (standard telecommunication lines and ISDN connections) and cellular mobile subscribers.

2. The latest data available for publication (1999) do not reflect major developments in network infrastructure, especially in the wireless segment. More recent data (2001) will be published in the biennial *Communications Outlook* (forthcoming 2003).
Source: OECD, *Communications Outlook 2001*, May 2001.

1. Digital Subscriber Lines.

2. The other technologies that were deployed in 2001 to provide broadband services are fixed wireless broadband, direct satellite broadband and various forms of "fibre to the residence".

Source: S. Paltridge, *The Development of Broadband Access in OECD Countries*, OECD, Paris, October 2001.

Internet infrastructure

- The Internet continues to grow at an extremely fast pace. By July 2001, the number of Internet hosts in the OECD area reached 112 million, up from 82 million in July 2000.
- The number of hosts per 1 000 population gives an indication of the relative development of Internet infrastructure in various countries. In July 2001, the OECD average was 101 hosts per 1 000 inhabitants; the EU average was 53 hosts per 1 000 inhabitants. The United States is far ahead of the other OECD countries, with more than 272 hosts per 1 000 inhabitants in July 2001. Other countries with over 150 hosts per 1 000 inhabitants are Finland (183), Canada (183), Iceland (180) and Sweden (177). By way of contrast, Mexico and Turkey had 5 and 4 hosts per 1 000 inhabitants, respectively.
- While the Nordic countries have among the highest penetration rates, between July 2000 and July 2001 Poland was the only country to double its penetration rate. Austria, Germany, Japan, Spain and Sweden all experienced a growth rate exceeding 70%. The unweighted average growth rate in 2001 for OECD countries was 60%. Even among the leading countries, recent growth rates have been uneven. Thus, large gaps between countries remain.
- While the number of Internet hosts gives an indication of the size of the Internet, the number of active Web sites provides information on countries' relative development of Internet content. The United States leads Web site hosting, with 12.6 million Web sites in July 2000. Germany ranks second, hosting 1.8 million Web sites in July 2000. The United Kingdom (1.4 million) was the only other country with more than 1 million Web sites.
- In terms of number of Web sites per capita, there were 17.5 Web sites per 1 000 inhabitants across the OECD region and 12.7 per 1 000 across the European Union in July 2000. The United States had the highest penetration of Web sites in July 2000, with 46.5 per 1 000 inhabitants. Norway (30.4), Canada (24.7), the United Kingdom (24.2), Germany (22) and Denmark (21) were the other countries with more than 20 Web sites per 1 000 inhabitants.

Box 3.2. Measuring the size and growth of the Internet

The number of Internet hosts is one of the most commonly used indicators of Internet growth. It includes any computer system connected to the Internet (via full-time or part-time, direct or dial-up connections), although some systems may not be accessible owing to technologies such as firewalls. Hosts can thus be thought of as an indicator of the minimum size of the public Internet.

Surveys of Internet hosts are undertaken by several entities. Every six months, [Network Wizards](#), on behalf of the [Internet Software Consortium \(ISC\)](#), carries out the longest running host survey. [RIPE](#) conducts monthly surveys of Internet hosts for countries in their region. A third source of statistics is NetSizer's Internet Sizer from [Telcordia Technologies](#) which provides daily updates of the number of Internet hosts based on a random sample of IP addresses throughout the day. Telcordia provides hosts by country as well as by top-level and second-level domains. Hosts by country are computed by redistributing the hosts with three-letter domains (e.g. .com, .net, etc.) to individual countries and then adding them to the hosts by two-letter country domains.

Netcraft surveys Web servers in order to provide information about the software used on computers connected to the Internet. The data can be used to estimate the number of active Web sites under each domain, as well as the number of Web sites in each country by distributing gTLD and ccTLD registrations according to the country allocation of IP address blocks.

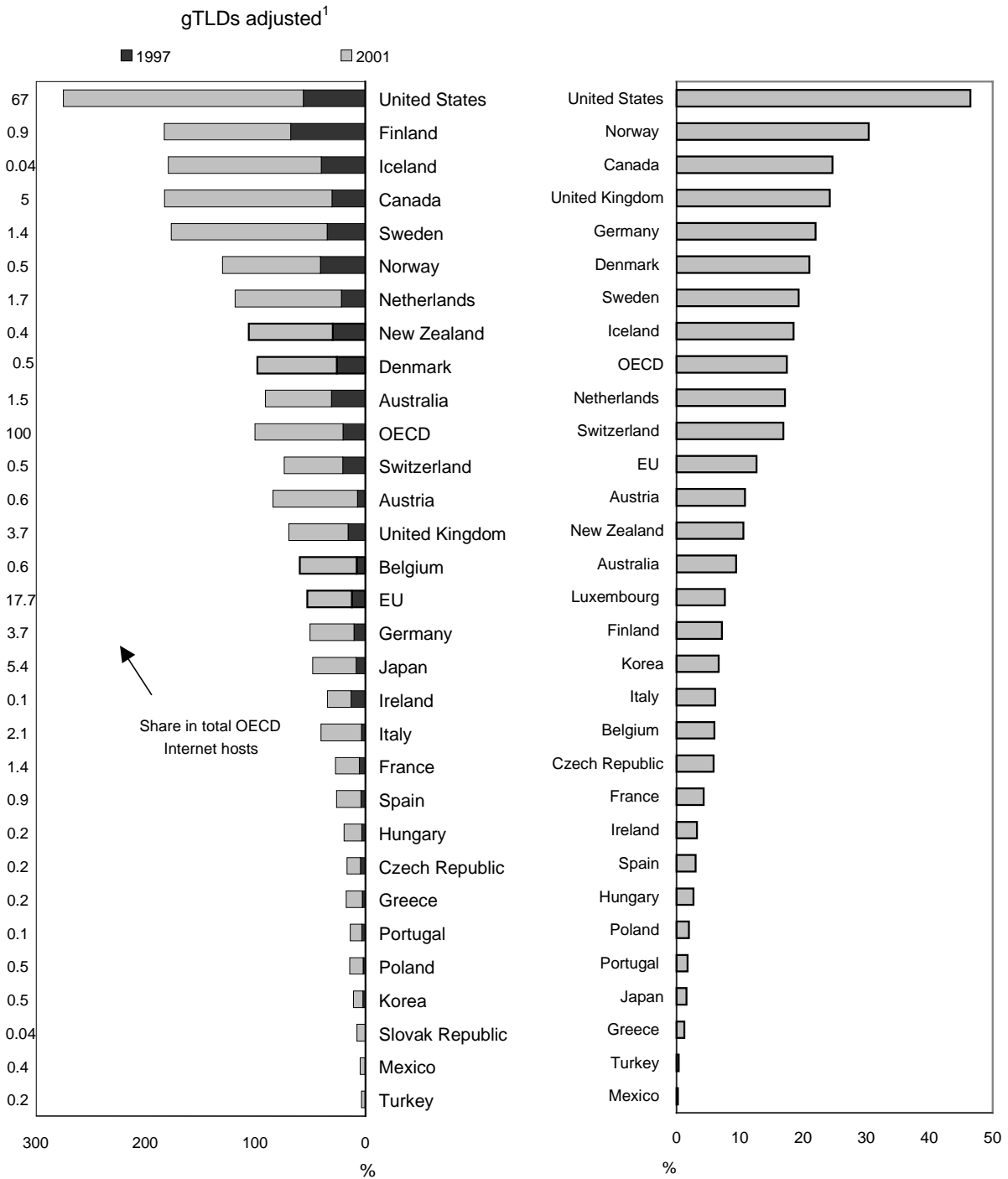
- A host is a domain name that has an IP (Internet Protocol) address "record" associated with it.
- Internet Protocol (IP) addresses are the numbers used to identify computers, or other devices, on a TCP/IP network.
- Servers are computers that host World Wide Web content.
- A top-level domain name (TLD) can either be a country code (for example .be stands for Belgium) or one of the generic top level domains (a so-called gTLD such as .com, .org, .net).

For more information, see OECD, *Communications Outlook 2001*.

Internet infrastructure

Number of Internet hosts per 1 000 inhabitants, July 1997-July 2001

Web sites per 1 000 inhabitants, July 2000



1. Global top-level domains (gTLDs) are distributed to country of location.

Source: OECD, *Information Technology Outlook 2002*; OECD calculations based on Netsizer (www.netsizer.com), July 2002.

Source: OECD, *Communications Outlook 2001*; OECD calculations based on Netcraft (www.netcraft.com), May 2001.

Internet subscribers

- For technologies based on networks, such as the Internet, the more people that are connected, the greater the potential benefits of the network.
- At the end of 1999, there were at least 49.7 million Internet subscribers in the United States, close to 11 million in Japan and in Korea, 9 million in Germany, more than 7.4 million in the United Kingdom and 6.2 million in Canada. Between 1998 and 2000, subscriber numbers grew rapidly, fuelled by “subscription free” Internet service providers (ISPs). Consequently, the data shown simply represent a snapshot. Nevertheless, they give a picture of relative Internet take-up at the end of 1999. A ranking of countries in terms of Internet subscribers per 100 population shows high levels of take-up in Korea, Sweden, Denmark and Canada.
- In itself, the number of subscribers does not indicate the extent to which the Internet is actually accessed and used. As an indicator, average online time per subscriber deserves far more attention in international comparisons. It is particularly important when considering the growth of electronic commerce in different countries.
- An increasing number of ISPs report the amount of on-line time per subscriber on a monthly or quarterly basis. Broadly speaking, in countries where metered telecommunication charges apply, usage generally falls within a band of 5 to 9 hours a month. In 1999, this was the case for the Czech Republic, France, Germany, Portugal, Switzerland, and the United Kingdom. Some exceptions were Sweden and Norway, where average use was up to 12 hours a month. By way of contrast, average use is much higher in countries, such as New Zealand and the United States, with unmetered Internet access.

Box 3.3. Measuring Internet access using information on subscribers

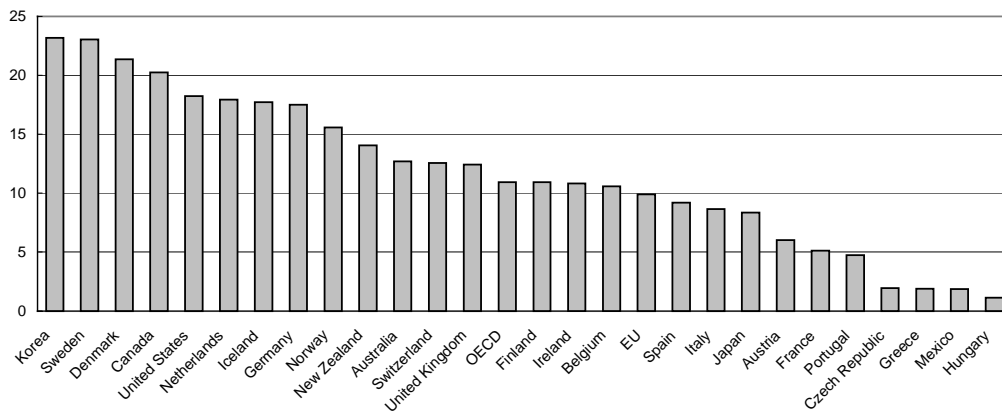
Many public-sector and private-sector organisations report on the number of “users”, “people” or “households” on line. National statistical agencies typically measure Internet access on the basis of surveys of businesses, households or individuals (see boxes 3.4 and 3.5). Statistical offices also collect information on Internet users by surveying ISPs. These surveys are timely and provide a wide range of information, for example on type of subscriber (business, household, government), type of technology used (dial-up, cable, WAP, etc.), and sometimes even the length of connection and volume of data downloaded. One problem relating to such surveys is the dynamism of the ISP industry, which is reflected in high numbers of entries, exits and mergers.

An alternative approach is to compile information on Internet subscribers by country. This information can be obtained from reports of the largest telecommunication carriers on the number of subscribers to their Internet services and their estimates of market share. As these carriers manage connectivity via public switched telecommunication networks, they are often the best placed to know subscriber numbers on an industry-wide basis and market share. Moreover, “subscribers” has a more specific meaning than, for example, “users”. For most carriers, “subscribers” means registered Internet accounts that have been used during the previous three months.

For further information, see OECD, *Communications Outlook 2001*.

Internet subscribers per 100 inhabitants

January 2000



Source: OECD, *Telecommunications Database*, June 2001.

ICT access by households

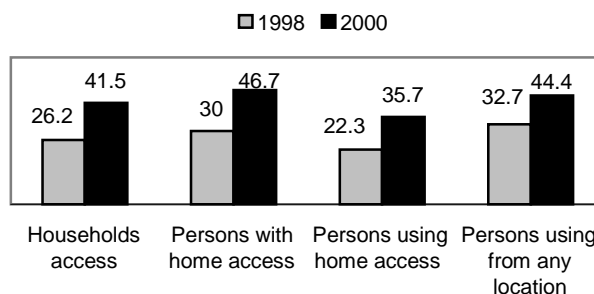
- Recent progress in methodological and statistical work has led to a range of new indicators on access to and use of ICT technologies by households and individuals. This work has also contributed to greater international comparability of the statistics (see Box 3.4).
- Personal computers are still the main device used by households to access the Internet. In most countries for which data are available, more than 40% of all households now have computers.
- While keeping in mind differences in survey methodologies and household structure, there is still a noticeable gap among countries. In Denmark, Switzerland and Sweden over 60% of households have a computer, while in Turkey and Mexico only 11-12% of households have a one. For Turkey, the figures refer only to households in urban areas; the average penetration rate of computers would be even lower if households in rural areas were surveyed. In France, Italy, Spain and Italy, the average penetration rate of computers is 30%.
- The availability of home computers is increasing both in countries with already high penetration rates (an average percent increase of 10% from 2000 to 2001) and those lagging. This is notably in the United Kingdom and Portugal, where computer penetration rates increased by 11 and 12 percentage points, respectively, in 2001.

Box 3.4. The comparability of household- and person-based indicators of Internet access and use and the OECD model questionnaire on ICT use in households/by individuals

Over a very short period of time, national statistical offices have made great progress in providing high-quality, timely indicators of ICT use. From an international perspective, the major drawback of official ICT use statistics is that they are still based on different standards and measure rapidly changing behaviour at different points in time. Most countries use existing surveys, such as labour force, time use, household expenditure or general social surveys. Others rely on special surveys. A first issue for international comparability is to address differences in the timeliness, scope and coverage of indicators.

Another important issue for international comparability is the choice between households or individuals as the survey unit. Household surveys generally provide information on both the household and the individuals in the household. Person-based data typically provide information on the number of individuals with access to a technology, those using the technology, the location from which they use it and the purpose of use. Statistics on ICT use by households may run into problems of international comparability because of structural differences in the composition of households (similarly, differences in countries' industrial structure affect comparability of ICT use statistics in business). On the other hand, statistics on individuals may use different age groups, and age is an important determinant of ICT use. Household- and person-based measures yield different figures in terms of both levels and growth rates. The example below uses US data referring to households and individuals aged three years and more (see *Falling through the Net: Toward Digital Inclusion*, US Department of Commerce, October 2000). Such differences complicate international comparisons and make benchmarking exercises based on a single indicator of Internet access or use quite misleading, since the ranking of countries changes according to the indicator used.

Household- and person-based measures of Internet access and use



The OECD Working Party on Indicators for the Information Society (WPIIS) is currently addressing these issues of international comparability and working on a model survey on ICT use in households/by individuals. The proposal, led by Australia, consists in measuring a core set of indicators which incorporates core country requirements. As in the case of the model questionnaire on the use of ICT and e-commerce in businesses (see Annex 3), additional components of the questionnaire can be added over time as technologies, usage practices and policy interests change.

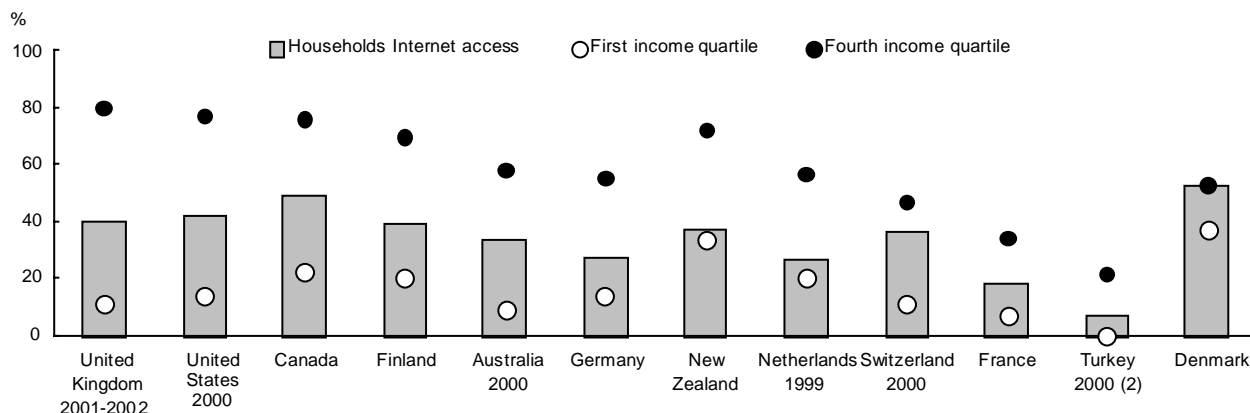
At the moment, five core modules are proposed for inclusion in the model questionnaire: Household access to computers and the Internet; Household barriers to adoption of the Internet; Use of computers and the Internet: location and frequency of use; Purpose and nature of activities on the Internet; Internet-commerce details, with questions on Internet purchases by location, frequency of purchase, type of goods purchased, Internet payments and barriers to purchase online.

Internet access by households

- Internet access in households is soaring everywhere, especially in Portugal where the access rate grew by 125% between 2000 and 2001. Notable also is the increase registered in the United Kingdom, where household Internet penetration increased by 110% in the same period, and in Mexico, albeit from a very small base, from 2.8% in 1999 to 6.2% in 2001. In Japan, following a strong increase in 1999-2000 (74%), the latest data on households Internet access register only a modest increase of 3% between 2000 and 2001.
- Overall households Internet access is highest in Northern Europe and North America, where penetration rates in 2001 ranged between 40% and 60%, and lower in continental and Southern Europe (below 30%).
- The propensity of households to access the Internet once they possess a home computer differs across countries. It is highest in Sweden, the United Kingdom and the United States, where 80-90% of households with a computer have Internet access. Countries with a larger share of home computers have also a greater propensity to have Internet access, but there are some exceptions. In Belgium 45% of households had a computer in 1999, but only about 13% had access to the Internet. In Italy and Ireland in 2000, the share of households with computers was lower (about 30%) and household Internet access rates higher (about 20%).
- Households can access the Internet via different types of services. Indicators of the quality of access, in terms of the speed and capacity of the infrastructure, are of great interest since they point to differences in the potential use of new technologies across countries. So far, data for a very few countries show that most households still use dial-up rather than high-speed access to the Internet. Canada is a notable exception, with over 60% of households using cable modem services to access the Internet.
- Internet penetration in households is strongly affected by household income. Relatively high overall rates of Internet access might hide a relatively uneven distribution of access in households with different income levels. Available data show that the difference between Internet access in households belonging to the lowest and highest income quartiles is highest in the United Kingdom and North America and lowest in Denmark.

Households Internet access by income level,¹ 2001 or latest available year

Households with Internet access as a percentage of all households



1. For the United Kingdom, first and last deciles instead of quartiles, for Germany and New Zealand, first and last income brackets.

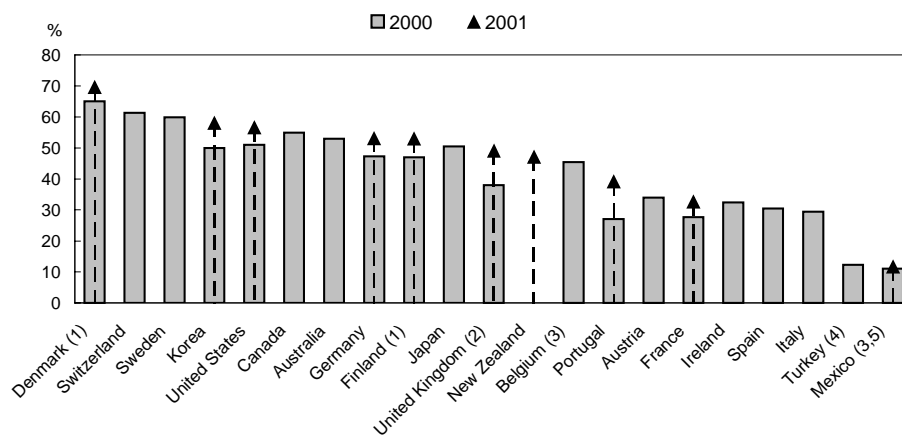
2. Households in urban areas only.

Source: OECD, ICT database, August 2002.

Internet access by households

Households with access to a home computer, 2000 and 2001

Percentage of all households



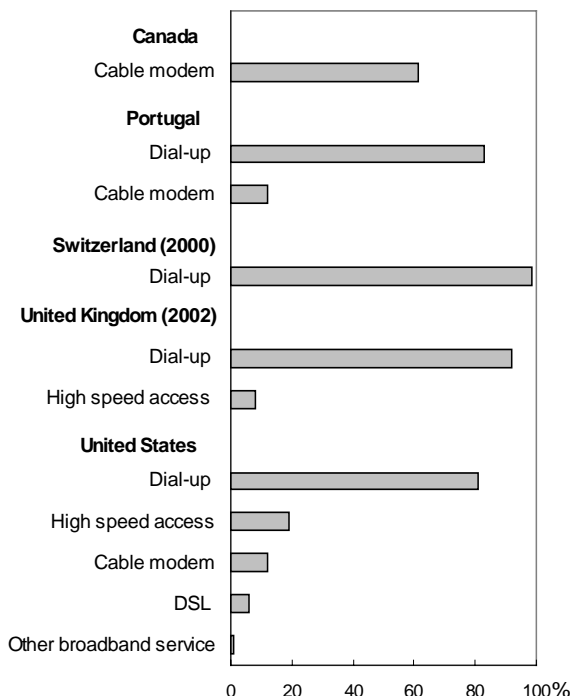
Households with access to the Internet, ⁶ 2000 and 2001

Percentage of all households



Household access by type of service, 2001

Percentage of households with Internet access



1. Beginning of 2002.

2. March 2001-April 2002 (financial year) instead of 2001.

3. 1999 instead of 2000.

4. Households in urban areas only.

5. For 1999, households in urban areas with more than 15 000 inhabitants only.

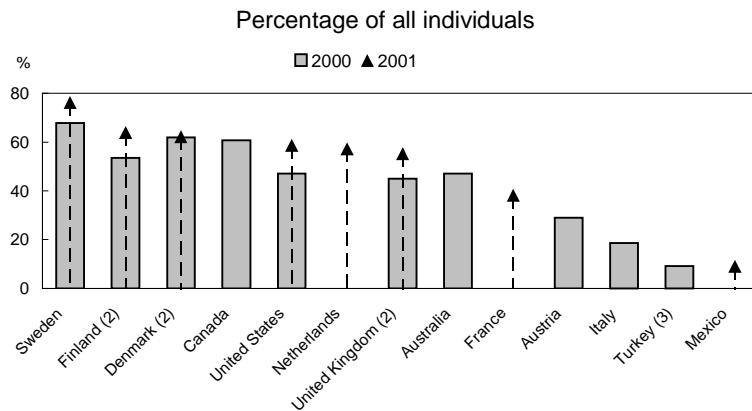
6. Internet access via any device except for Denmark, the Netherlands, Ireland, Austria, France and Turkey where Internet access is via a home computer.

Source: OECD, ICT database, August 2002.

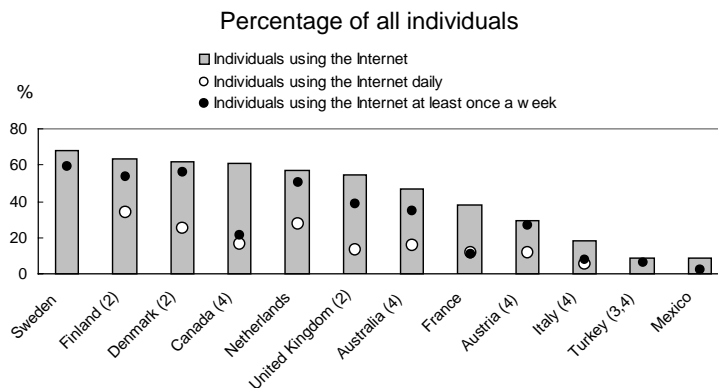
Use of the Internet by individuals

- The share of adults using the Internet from any location is also increasing rapidly, and more than sixty percent of the adult population now use the Internet in Sweden (76%), Finland (64%), Denmark (62%), and Canada (61%). Denmark aside, the share of Internet users is highest in those countries with a relatively lower average Internet price basket over the 1995-2000 period.
- The frequency with which individuals use the Internet varies considerably across countries, with almost 90% of users being frequent users (at least once a week) in the Nordic countries, the Netherlands and Austria. The share of frequent users drops to one fourth to one third in the case of Mexico, France and Canada. Overall, less than fifty percent of users are daily users.
- Individuals using the Internet do so mainly for communication purposes (receiving and sending e-mails) or to find information about goods and prices. But even in countries where over 70% of individuals search for prices online, only 20 to 40 percent purchase over the Internet.
- In most cases downloading digitised goods, such as news, games, music and free software is the most common activity. In Portugal, for example, over 50% of individuals download digitised goods while only 9% purchases over the Internet.
- The Internet is also used to access online services, especially banking services, notably in Finland, where 64% of individuals reported having used the Internet to carry out banking transactions in 2001. Use of the Internet to interact with public authorities is especially common in Denmark and Finland; over 50% of individuals reported using the Internet for that purpose, compared to only 8% in France. Finally, 30% of people in Canada and Portugal report that they carry out on-line job searches.

Individuals¹ using the Internet from any location, 2000 and 2001



Individuals¹ frequently using the Internet, 2001



1. Age cut-off: 16 years and older except for Canada and Finland (15+), Italy (11+), Austria (6+), Mexico and the Netherlands (12+) and Australia and Turkey (18+).

2. Beginning of 2002 instead of 2001.

3. Individuals belonging to households in urban areas.

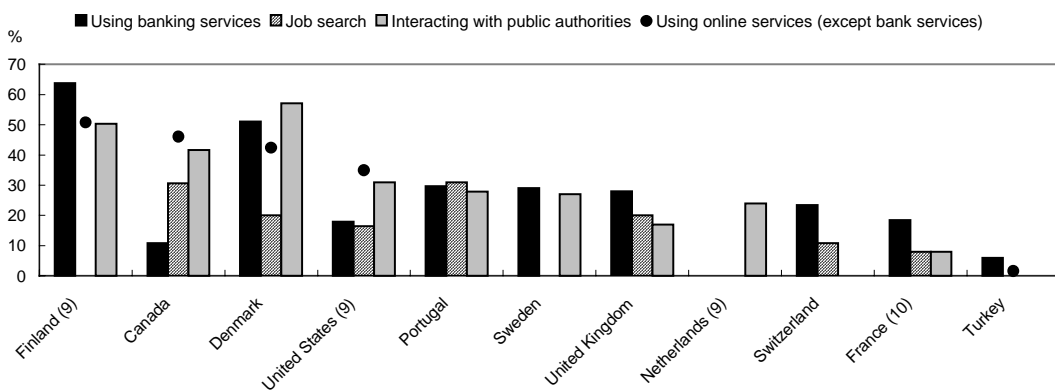
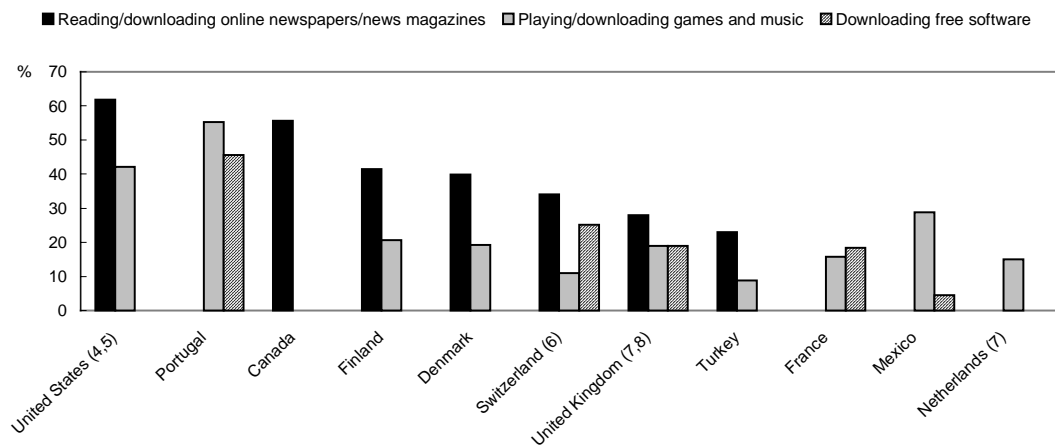
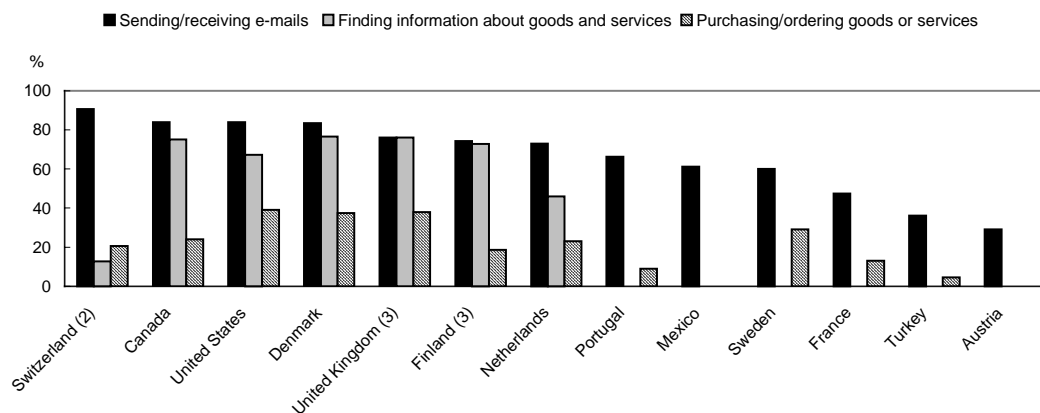
4. 2000 instead of 2001.

Source: OECD, ICT database, August 2002.

Use of the Internet by individuals

Internet use by type of activity, 2001 or latest available year¹

Percentage of individuals using the Internet



1. 2000 for Canada, Sweden and Turkey. 2001 for France, Mexico, Netherlands, Portugal, Switzerland and the United States. Beginning of 2002 for Denmark, Finland and the United Kingdom.

2. Only sending e-mails instead of sending and receiving e-mails.
3. Purchasing/ordering goods or services excludes shares/financial services.

4. Reading/downloading newspapers also includes movies.

Source: OECD, ICT database, August 2002.

5. Playing games only instead of downloading games and music.

6. All downloaded software instead of free software only.

7. Downloading music only instead of games and music.

8. Downloading other software instead of free software.

9. Obtaining information from public authorities' Web sites only instead of interacting with public authorities.

10. Downloading official forms only instead of interacting with public authorities.

Internet access and use by businesses

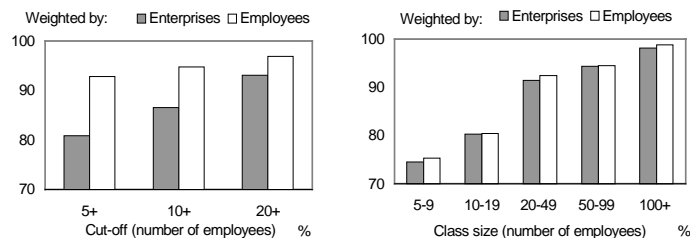
- International comparisons of ICT access and use by businesses suggest interesting patterns but should be interpreted with caution (see Box 3.5).
- Internet penetration in businesses with ten or more employees continues to increase and has reached well above 80% in several OECD countries. In 2001, penetration rates were particularly high in the Nordic countries, with 93% in Denmark. In Asian-Pacific countries, they stood at 91% in Japan, 86% in Australia and 84% in New Zealand.
- Businesses can develop their own Web sites or rely on sites managed by third parties. A Web site, if it is not simply used as a "window", can reflect the firm's level of sophistication in the use of the technology. The propensity to develop Web sites is quite high in Northern Europe (between 65% and 80%), and about 50% in Australia, New Zealand and Canada, but it is only about 7-8 percent in Italy and Spain.
- Available survey data on Internet access by type of service show that high-speed Internet access is spreading in the business sector, with about 30% of businesses in Denmark and Canada using broadband connections. Countries' averages may hide differences between larger and smaller firms, with smaller firms lagging behind in broadband access. In Italy, for example, while over 60% of large enterprises have broadband Internet access, the percentage falls respectively to 30% and 10% in the case of medium-sized and smaller firms.

Box 3.5. Measuring ICT access and use by businesses: OECD efforts to improve international comparability

Technology diffusion varies with business size and industry, so that indicators based on the overall "number" (proportion) of businesses using a technology can give rise to misleading international comparisons. "Number of businesses" is extremely sensitive to the sample used in a survey. In countries surveying all businesses (no cut-off), like Australia, the smallest firms' results dominate. Using cut-offs, e.g. of five or more employees (Denmark, Finland) or of ten or more employees (Sweden, the United Kingdom), shifts the weight to different size groups. One possibility is to compare overall "numbers" weighted by firm size with the weights expressed in terms of turnover or employment. The figures below use Danish data to show the sensitivity of indicators of "proportion of businesses using the Internet" and of "percentage of employment in businesses using the Internet" to different cut-offs and size groups.

Indicators of Internet access weighted by "number of enterprises" and by "employment in enterprises"

Sensitivity to survey cut-off and enterprise size groups, an example based on Danish data



Source: Statistics Denmark, calculations based on *Use of ICT in Danish Enterprises 2000*.

Internet access weighted by employment should not be interpreted as the share of employees with access to the Internet, since this would assume that in each enterprise all workers, or the same proportion of workers, have access to the Internet. In Canada, for example, 63.4% of private sector businesses (weighted by revenue) had access to the Internet in 2000, but only 39% of employees. In Denmark and Finland, 80% and 84%, respectively, of businesses with five or more employees had access to the Internet in 2000, but only 40% and 44%, respectively, of employees used personal computers and had access to the Internet.

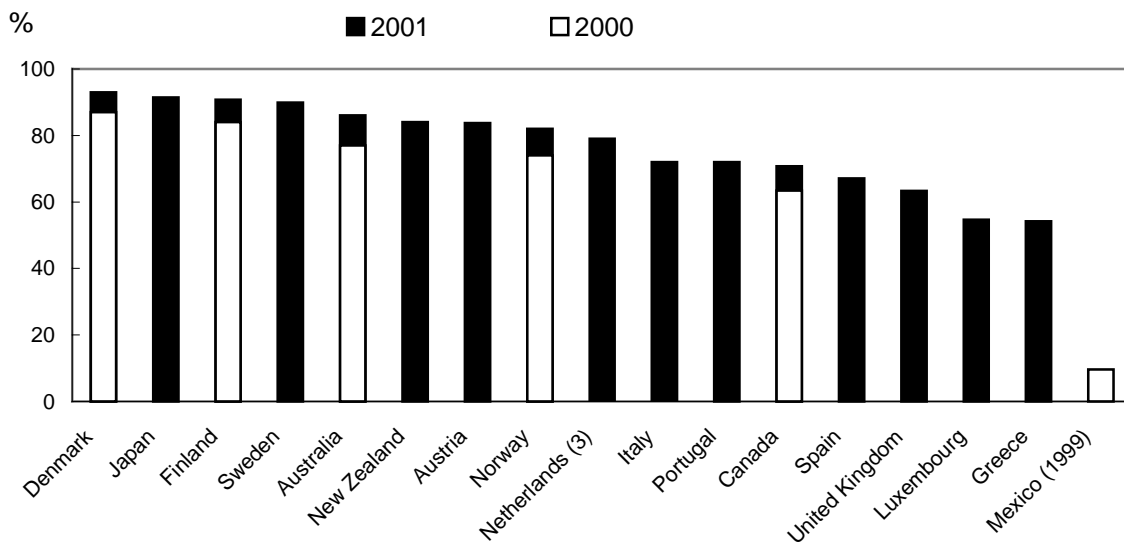
It should also be borne in mind that international comparisons of ICT usage indicators are affected by differences in the sectoral coverage of surveys. While figures for Canada and Australia cover the whole private sector, Danish and Finnish surveys cover selected sectors; for example they exclude finance and insurance.

International comparisons are made more difficult by the lack of harmonisation in the definitions of indicators. The OECD has worked with the Voorburg Group and Eurostat to develop a model survey of the use of ICT in the business enterprise sector. The model survey, approved by the OECD in 2001, is intended to provide guidance for measurement of indicators of ICT, Internet use and electronic commerce. It is composed of separate, self-contained modules to ensure flexibility and adaptability to a rapidly changing environment. See Annex 3.

Internet access and use by businesses

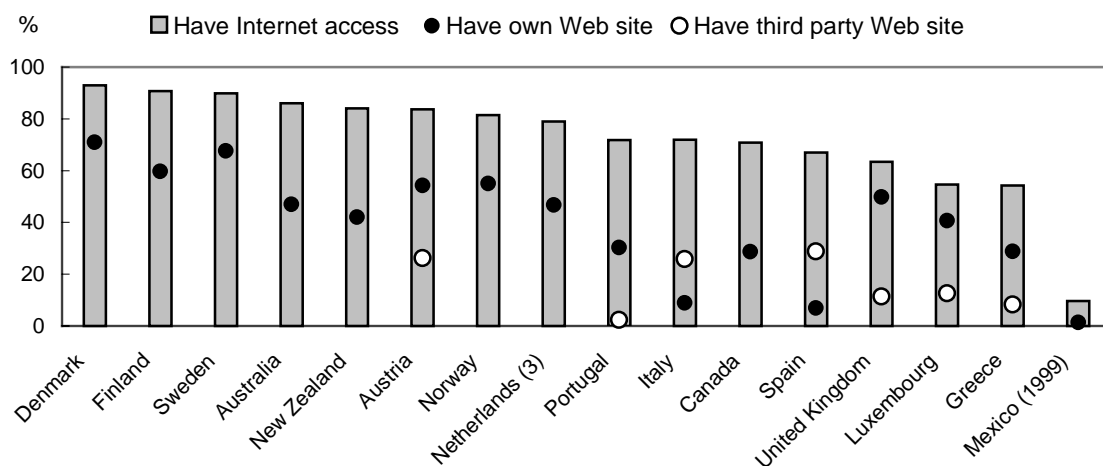
Businesses with Internet access, 2000-01¹

Percentage of businesses with ten or more employees²



Businesses with home and third-party Web sites, 2001¹ or latest available year

Percentage of businesses with ten or more employees²



1. Beginning 2001.

2. All business for Canada and Mexico. For Mexico it excludes the public and financial sectors.

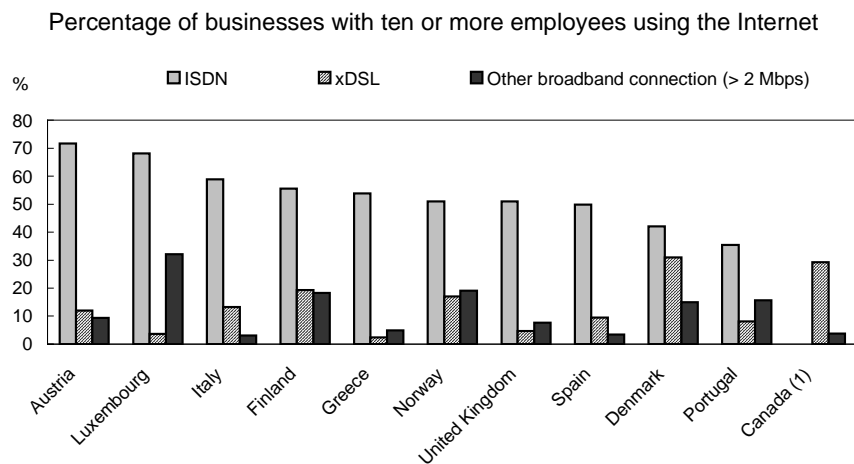
3. Use of the Internet and other computer-mediated networks.

Source: OECD, ICT database and Eurostat, E-Commerce Pilot Survey 2001, August 2002.

Internet access and use by enterprise size and industry

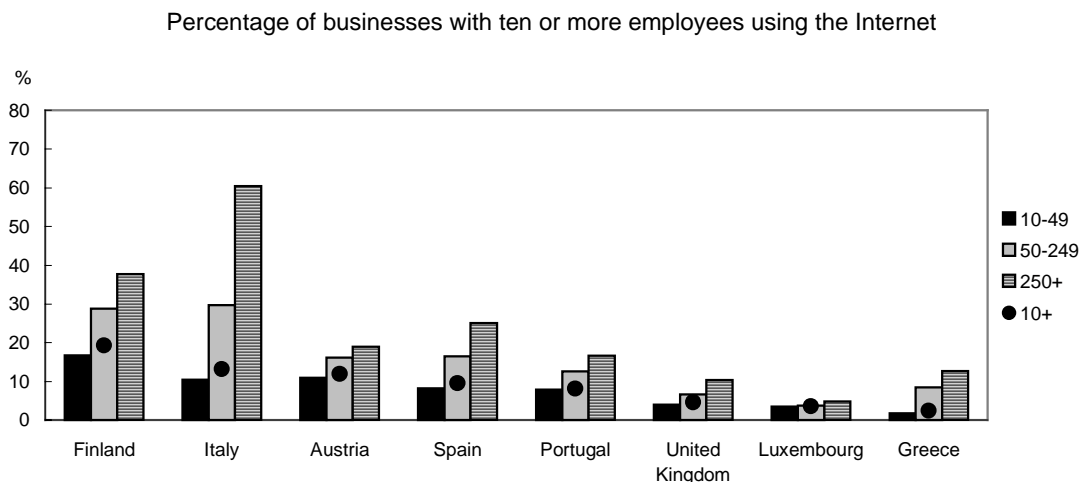
- In general, Internet access is highest in larger enterprises. While country rankings may change according to class size, Denmark generally has the highest penetration rates for any given size class; in that country, 85% of micro enterprises (5-9 employees) have access to the Internet.
- Differences in Internet access in the 17 countries for which data are available are greater for smaller enterprises. The Nordic countries have a more homogeneous distribution across firms of different sizes, while in Spain, for example, 97% and 89% of large and medium-sized enterprises have Internet access, compared to about 60% of small and micro enterprises.
- Internet penetration also varies across sectors. The most intensive business users are generally firms in finance and insurance, business services, and wholesale trade. Retail trade has the lowest Internet access rates. These patterns are consistent across 17 OECD countries. Canada and Japan, where Internet access is slightly higher in manufacturing than in market services, are exceptions.

Business Internet access by type of service, 2001



1. All businesses. The first bar refers to high-speed ISDN/xDSL lines and the second to T1 lines or greater (1.544 Mbps or more).
 Source: OECD, ICT database and Eurostat E-commerce Pilot Survey 2000, August 2002.

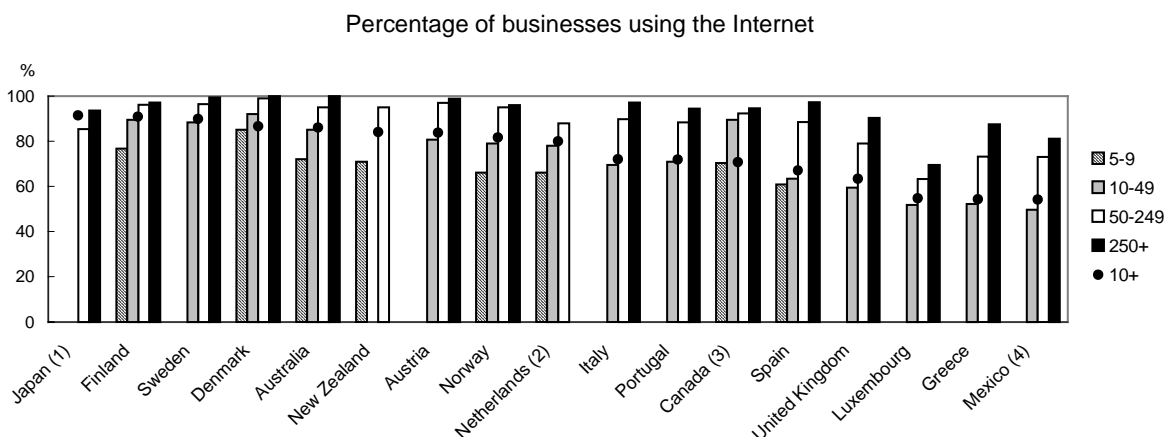
Business use of the Internet via broadband connection (xDSL) by firm size, 2001



Source: OECD, ICT database and Eurostat, E-Commerce Pilot Survey 2001, August 2002.

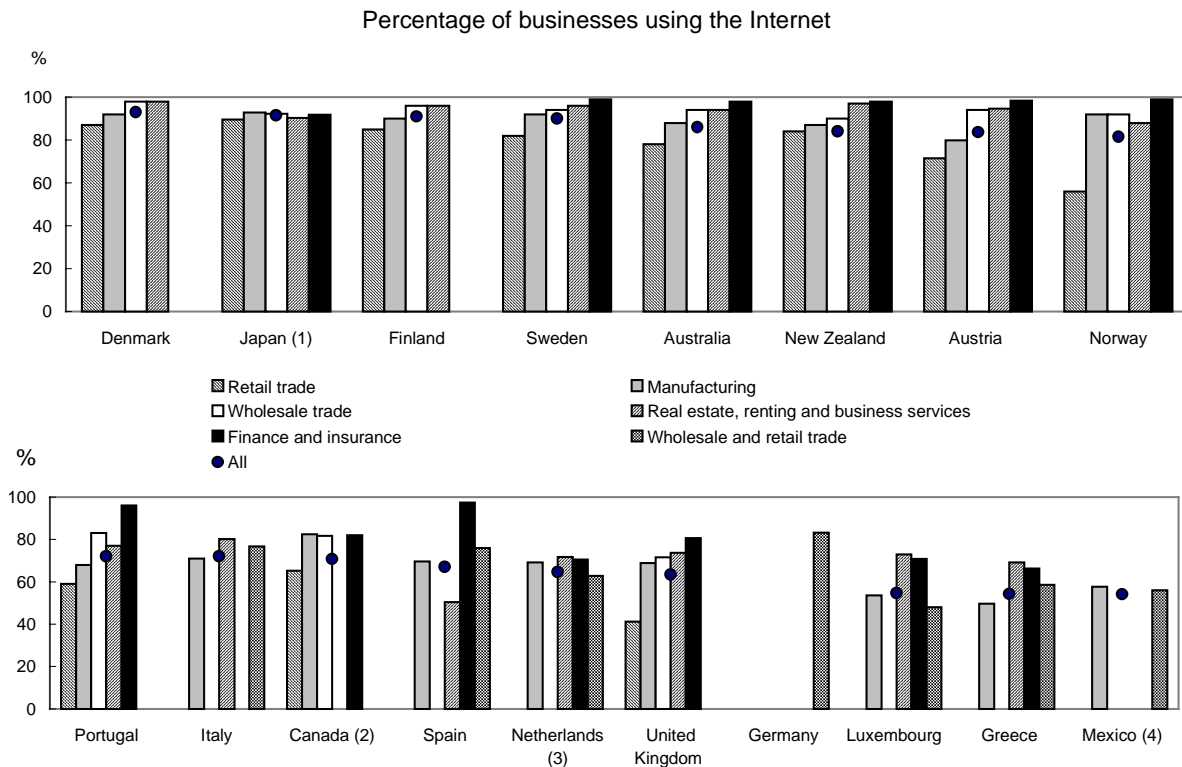
Internet access and use by enterprise size and industry

Internet penetration by size class, 2001 or latest available year



1. Businesses with 50 or more employees; 50-99 employees instead of 50-249 and 100 or more employees instead of 250 or more.
 2. Internet and other computer-mediated networks; 50-199 employees instead of 50-249.
 3. All businesses; 1-9 employees instead of 5-9, 20-49 instead of 10-49, 50-99 instead of 50-249, 100-249 instead of 250 or more.
 4. Businesses with 21 or more employees; 21-100 employees instead of 10-49, 101-250 instead of 50-249, 151-1000 instead of 250 or more.
- Source: OECD, ICT database and Eurostat E-commerce Pilot Survey 2001, August 2002.

Internet penetration by activity, 2001 or latest available year



1. Businesses with 50 or more employees.
 2. All businesses.
 3. Internet and other computer-mediated networks.
 4. Businesses with 21 or more employees, 1999.
- Source: OECD, ICT database and Eurostat E-commerce Pilot Survey 2001, August 2002.

Perceived barriers to Internet access and use in the business sector

- Analysis of barriers to the use of information technology is of interest to policy makers, but international comparisons based on qualitative data need to be interpreted with caution (see Box 3.6).
- Indicators of perceived barriers to the use of the Internet show that lack of network security to be the main obstacle for all European businesses. Analysis by firm size reveals that larger firms tend to rate security issues as very important more than smaller ones. This may be partly due to the fact that “security” is often perceived as a barrier when the technology is actually used (see Box 3.6).
- Perhaps surprisingly, costs of access to and use of the Internet generally receive the lowest ranking in all countries. On average, smaller firms attribute greater importance to costs than larger ones. There are exceptions, however. In Portugal, Luxembourg and Greece, larger firms find costs to be relatively more important. This may be due to the weight of non-user firms, which are likely to be smaller firms in those countries (see Box 3.6).
- Lack of perceived benefits may partly explain differences in Internet diffusion across sectors. Overall, wholesale and retail trade appears to be the sector with least scope for using the Internet, while “lack of perceived benefits” does not seem to be a very important barrier in the financial sector.

Box 3.6. Measuring "perceived" barriers to ICT access and use in business surveys

While information about perceived barriers may not traditionally be collected as part of official statistical surveys, it is important for policy makers. For example, indicators on barriers can help monitoring issues of digital divide, potential bottlenecks related to the technology, lack of appropriate skills, or concerns about security and logistics. Answers on perceived barriers and on their evaluation (e.g. no importance - some importance - much importance) are inevitably qualitative in nature and limit the use of these indicators for purposes of international comparisons. Nevertheless they can be useful for detecting common obstacles to the diffusion of new information technologies and may be used with other types of quantitative indicators to explain differences in the intensity of use of new technologies across countries.

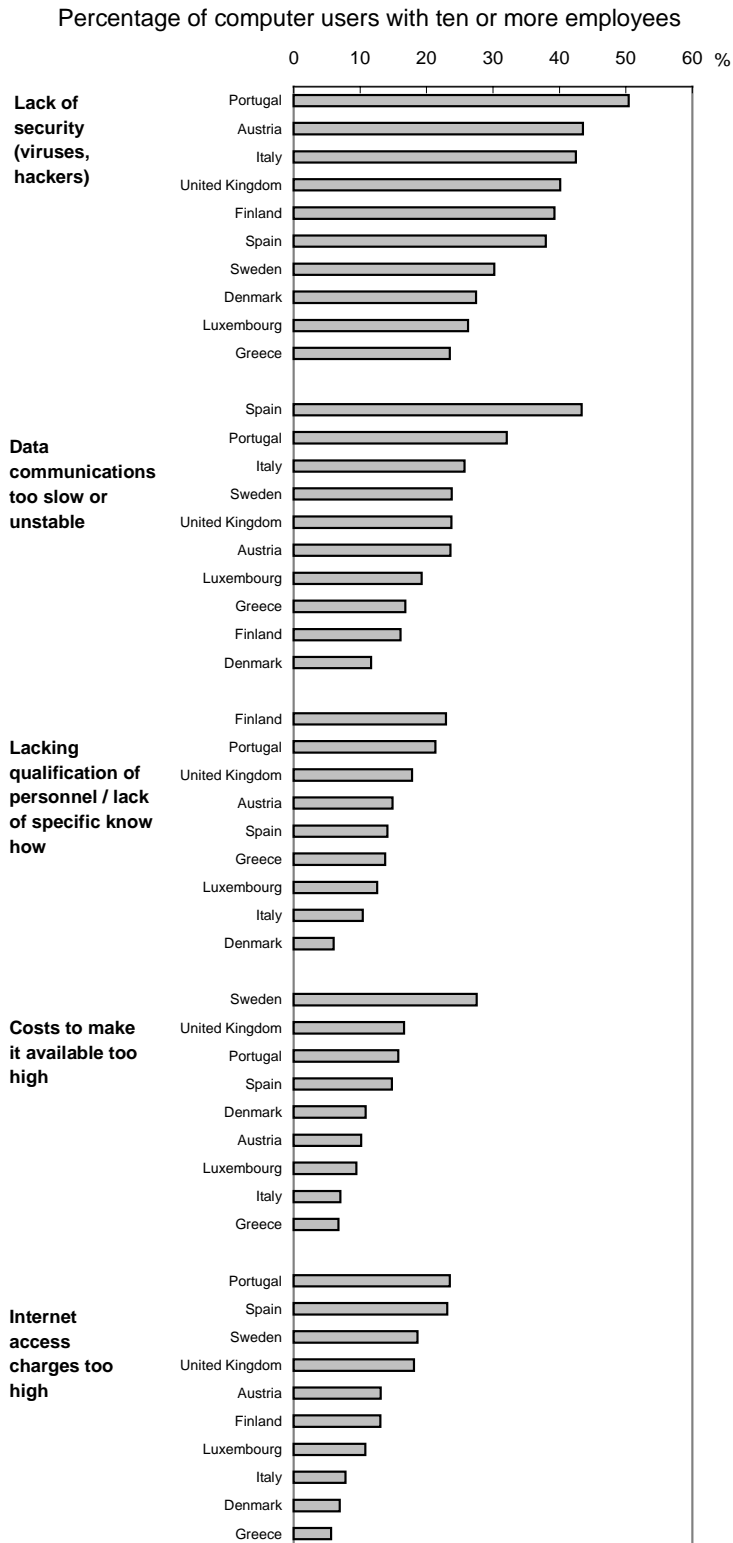
International comparisons based on such qualitative information need to be interpreted with caution. The perception of barriers seems to vary with the type of respondent. Baldwin and Lin (“Impediments to Advanced Technology Adoption for Canadian Manufacturers”, Statistics Canada Working Paper No. 173, 2001) show that in the Canadian manufacturing sector impediments are reported more frequently among technology users than non-users and more frequently among innovating firms than non-innovators. A similar pattern also appears for survey tabulations of barriers by type of respondent (e.g. by Internet and non-Internet users). A given barrier to Internet use may be interpreted as a “perceived” barrier by a non-Internet user and as an “experienced” barrier by an Internet user. One might expect some types of barriers, such as lack of perceived benefits and loss of working time, as being greater barriers among non-users than users. Interestingly, in Norway, the barrier “lack of security” has increased importance over time and it is much higher for Internet users than non-Internet users (see table below), *i.e.* those who have experienced “lack of security” give it greater importance. If this is the case in all countries, international comparisons of barriers may show that “lack of security” is a greater barrier in countries that are intensive users of the Internet (although those are probably the countries that are more equipped with secure systems). However, this may simply be due to the weight of non-users in different countries, rather than to differences in the degree of “security” of the environment.

Perceived barriers by respondent: an example based on Norwegian survey data

Barriers judged to be very important	% of non Internet users that judge this barrier very important			% of Internet users that judge this barrier very important		
	1999	2000	2001	1999	2000	2001
Expense on hardware and programmes	6	6	10	11	11	10
Expense on home pages development and maintenance	12	9	13	13	13	13
Internet access charges too high	5	10	8	6	7	7
Lacking qualification of personnel/lack of specific know-how	3	4	3	2	3	3
Lack of perceived benefits for the company	...	19	7	...	8	6
Lost working time because of irrelevant surfing	15	22	11	9	8	8
Data communication too slow or unstable	4	8	10	8	10	9
Lack of security (viruses, hackers)	14	16	26	28	29	35

Perceived barriers to Internet access and use in the business sector

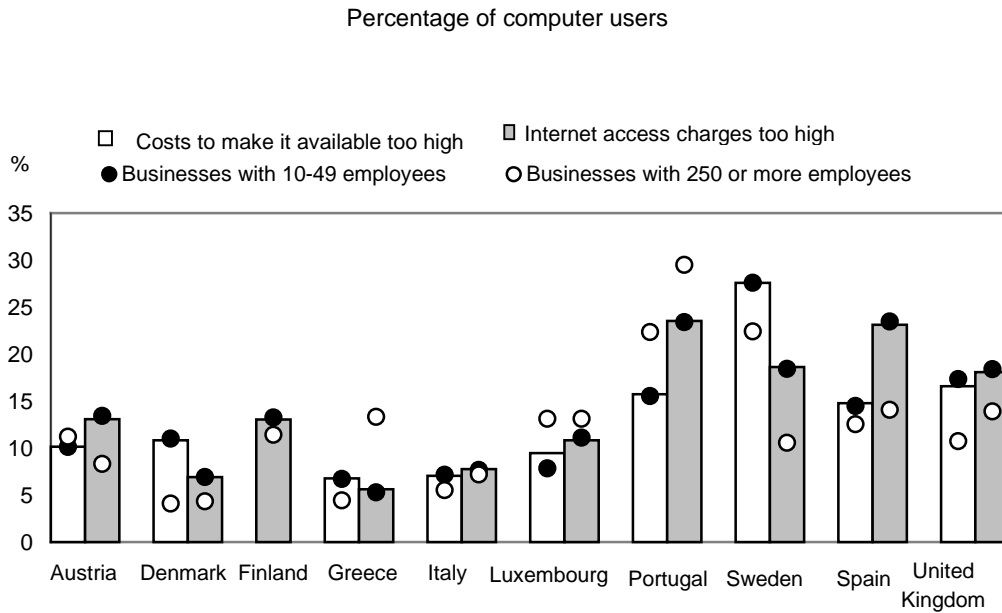
Perceived barriers by businesses, 2000



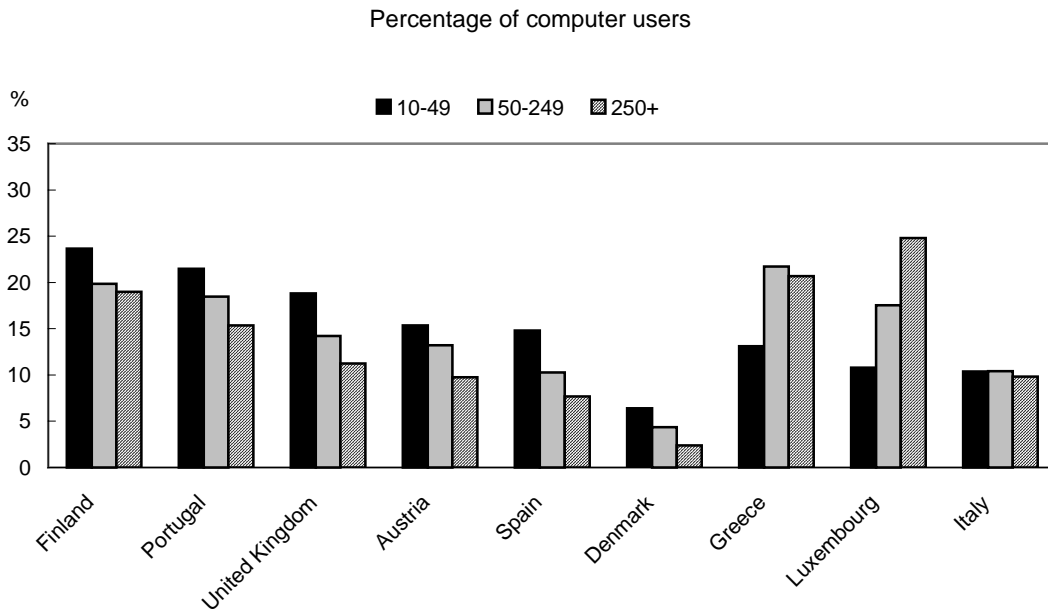
Source: Eurostat E-commerce Pilot Survey, 2001.

Perceived barriers to Internet access and use in the business sector

Perceived cost barriers by businesses by firm size, 2000

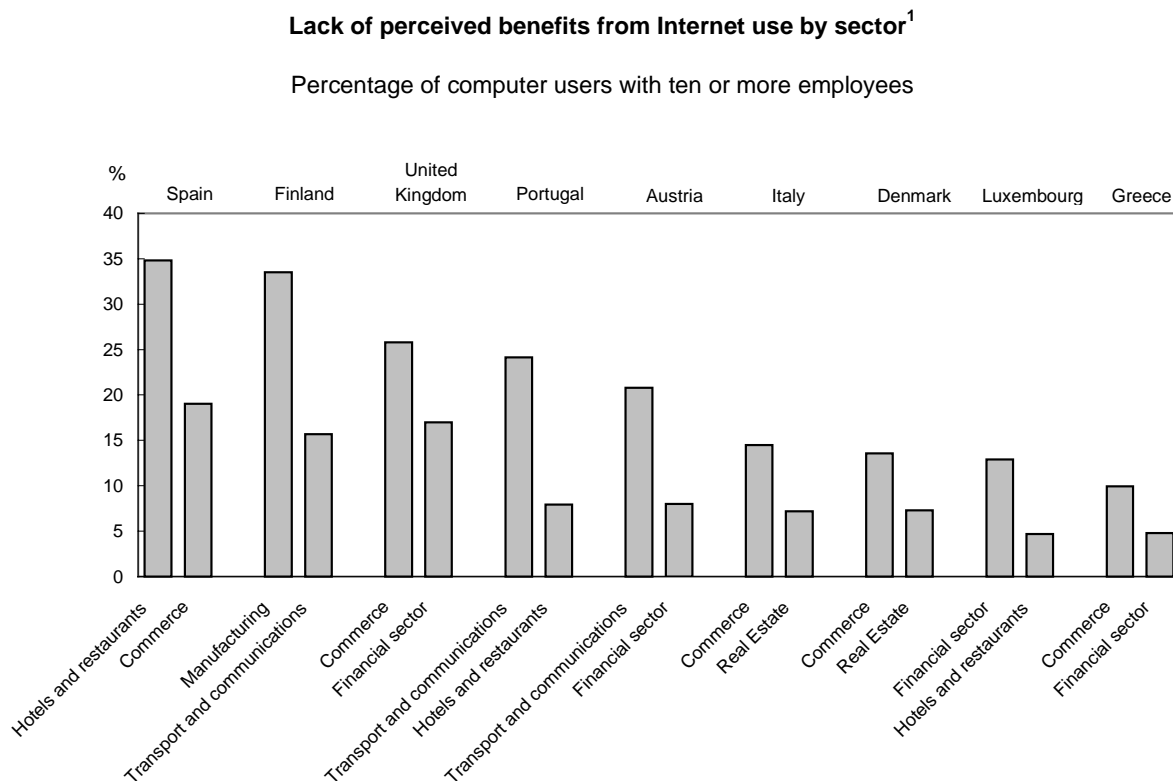
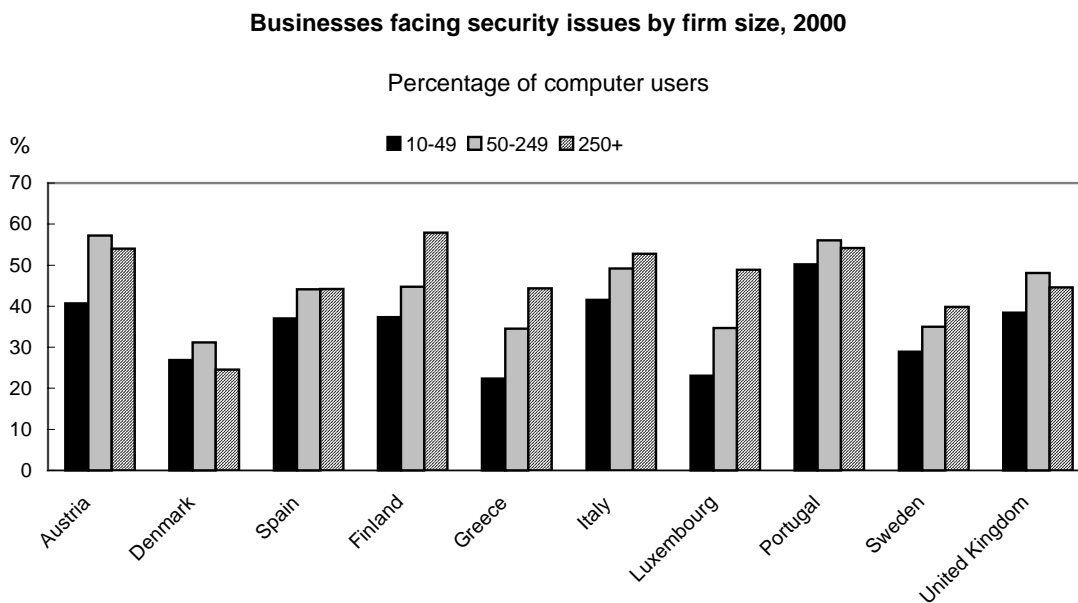


Businesses lacking qualified personnel or know-how to use the Internet by firm size, 2000



Source: Eurostat E-commerce Pilot Survey, 2001.

Perceived barriers to Internet access and use in the business sector



1. The sector in which the largest share of firms considers "lack of perceived benefits" to be a very important barrier (left bar) and the sector in which the smallest share of firms ranks it as important (right bar).
 Source: Eurostat E-commerce Pilot Survey, 2001.

The price of Internet access and use

- For consumers as for businesses, a significant barrier appears to be cost of access.
- Increased competition in the telecommunications industry has been driving down these costs. For example, prices of leased lines, which provide the infrastructure for business-to-business electronic commerce, have fallen significantly in recent years, particularly since 1998, following widespread liberalisation in the communication sector in Europe. However, large price differences remain. The Nordic countries have the lowest charges, at about one-quarter of the OECD average. Elsewhere, the least expensive countries are Switzerland, Luxembourg, Ireland, Germany, and the United States. At the other end of the spectrum, the Czech and Slovak Republics have charges of at least twice the OECD average.
- Another barrier to ICT diffusion is the cost of Internet access for consumers. Prices continue to differ widely and are among the largest for any communication service. Price differences for consumer access reflect the fixed and variable telephone charges set by telecommunications firms, but also the fees charged by the leading Internet service providers (ISPs).
- For 40 hours of Internet access, at peak and off-peak times, differences in Internet access cost for consumers are even more noticeable. At peak times, countries which traditionally have had unmetered local calls – Australia, Canada, Mexico, New Zealand, the United States – are among the least expensive. Turkey, where a call allowance is included in the line rental, is also inexpensive.
- Price differences seem to affect Internet take-up, with prices in the previous year affecting the Internet take-up for the current year. Countries with lower average access prices over the period 1995-2000, such as Canada, Finland and the United States, typically have more Internet hosts than those with high average prices. Other factors also matter. Korea now has low average prices for consumer access but has traditionally had expensive leased line connection for business. This appears to be reflected in a high subscriber penetration but a low host penetration.

Box 3.7. OECD Internet access price baskets

Leased lines (private lines in North America) provide the infrastructure for business-to-business electronic commerce. They give users that need to transport high volumes of traffic lower prices than the public switched telephone network (PSTN) and control over their telecommunication facilities and traffic. The basket of national leased lines includes total charges (excluding taxes) for leased lines that can carry two megabits of information per second.

For consumers and small businesses, the most significant cost for engaging in electronic commerce is the price of local communication access. The OECD basket includes the line rental, public switched telephony network (PSTN) usage charges and the ISP fee. The line rental charge is used to balance the fact that countries that traditionally did not charge for local calls had higher fixed charges, whereas those that did had lower ones. The use of a fixed charge does not imply that customers would need an additional line, as most residential customers use their PSTN line to access Internet services. In addition, some of the prices shown for a defined duration include further amounts of online time. This is the case for countries with unmetered access or packages that include large amounts of online time.

The comparisons use the prices in place as of 15 September 2000 for the largest telecommunication carrier in each country. Changes that had been announced but were not yet available are not included.

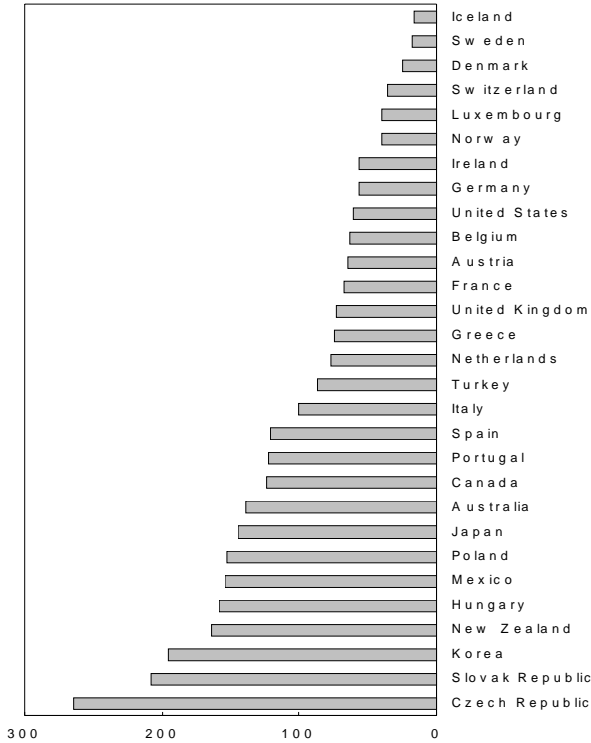
- Fixed charge: the monthly line rental for residential users.
- Usage charge: the price of local telephone calls (or special rates for Internet access) to an ISP for residential users.
- ISP charge: the price of Internet access from the largest telecommunication operator.
- Peak and off-peak times: the price of local calls at 11:00 hours (peak) and at 20:00 hours (off-peak) during weekdays.

For further information, see OECD, *Communications Outlook 2001*, Paris, 2001.

The price of Internet access and use

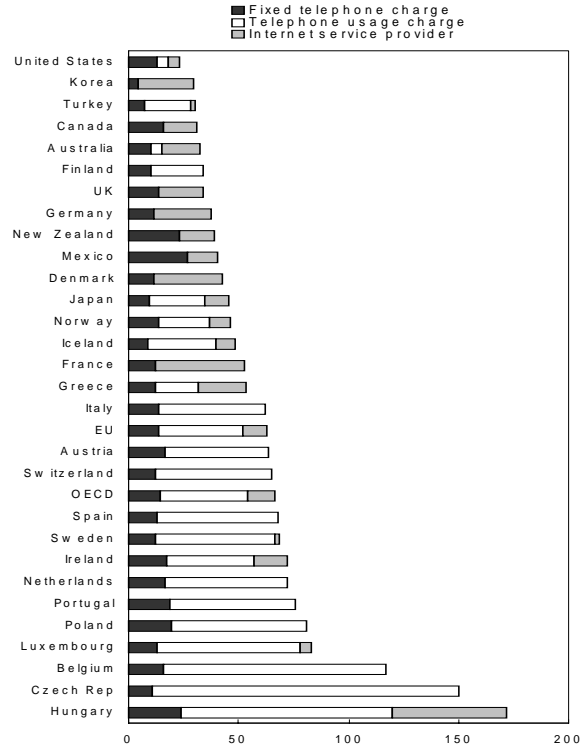
Price of leased lines in the OECD area, May 2002

Charges for a basket of national leased lines of 2 megabits per second, OECD average = 100



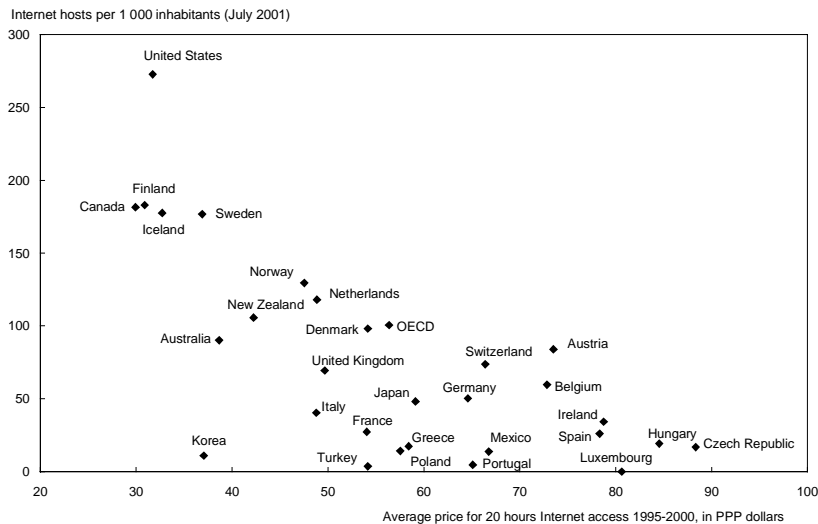
Price of 40 hours of Internet use at peak times, August 2001, in PPP dollars

OECD Internet access basket for 40 hours at peak times using discounted PSTN rates¹



1. In some countries ISP and PSTN usage charges are bundled and included under the ISP charge. Source: OECD, *Telecommunications Database*, June 2002.

Internet access prices and Internet hosts¹



1. Internet access costs include VAT and cover both peak and off-peak. Source: OECD; Telcordia Technologies: www.netsizer.com, May 2001.