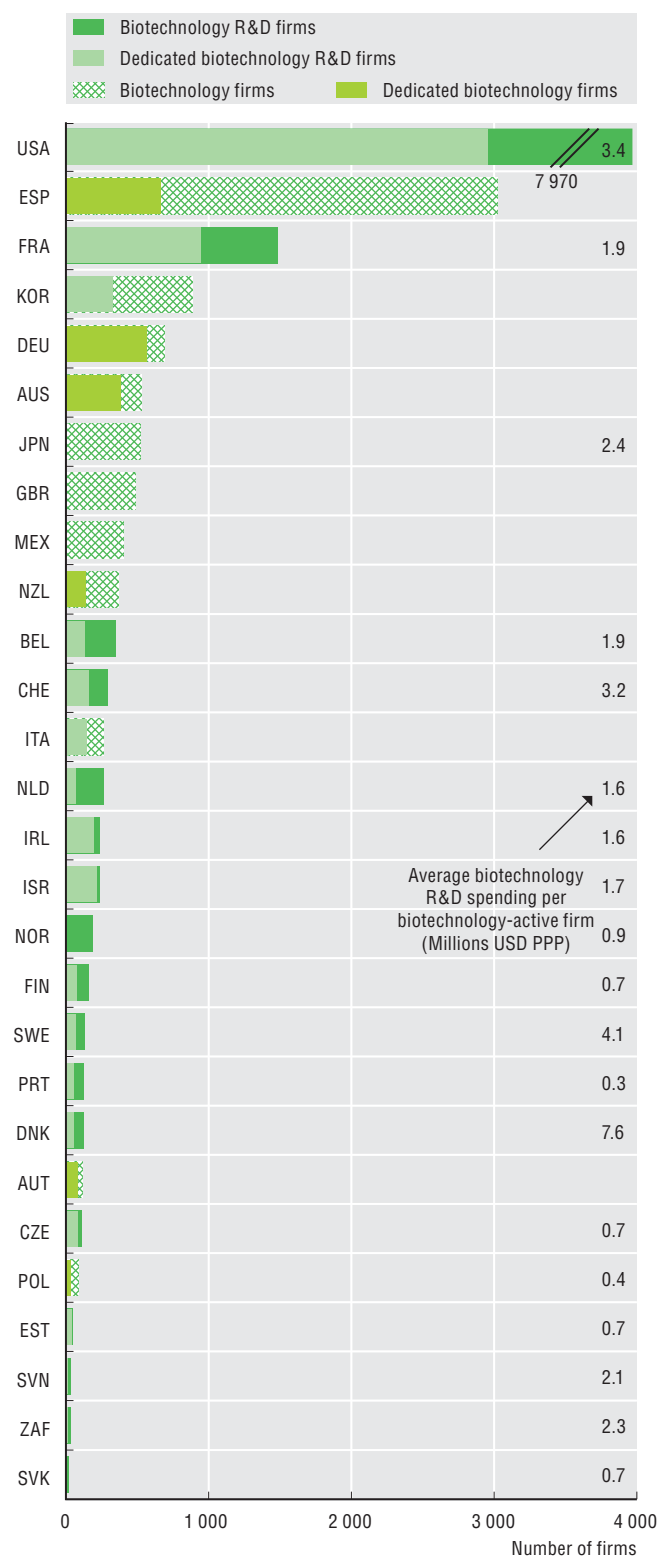


## 4. TARGETING NEW GROWTH AREAS

### 4. Biotechnology R&D

Number of firms active in biotechnology, 2011



Source: OECD, Key Biotechnology Indicators, <http://oe.cd/kbi>, June 2013. See chapter notes.

StatLink <http://dx.doi.org/10.1787/888932892024>

Biotechnology comprises a number of related technologies with a wide range of current and potential applications in many sectors and is of significant interest to policy makers.

Number of biotechnology firms is the most widely available indicator but it is not the best measure of a country's activity in biotechnology, owing to large differences in firm size and R&D intensity. The United States has 7 970 biotechnology R&D firms, followed by Spain with 3 025 biotechnology firms, and France with 1 481 biotechnology R&D firms.

Data on business enterprise expenditures on research and development (BERD) for biotechnology provide a direct measure of research effort. The United States devotes almost 10% of total US BERD to biotechnology (USD 27 374 million PPP) and accounts for about 66% of total biotechnology BERD expenditures in the 28 countries for which data are available.

On average, biotechnology accounted for 5.9% of total BERD in 2011. Denmark spends the most on biotechnology R&D as a percentage of BERD (19.4%) followed by Ireland (17.2%) and Switzerland (12.6%).

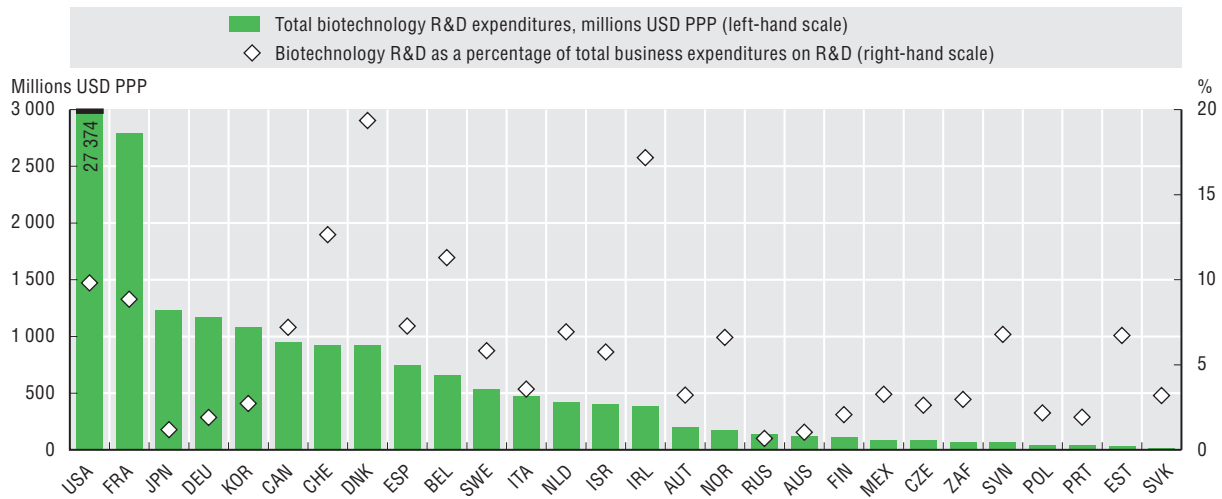
The government and higher education sectors play a key role in supporting biotechnology R&D. Data on biotechnology R&D expenditures in the government and higher education sectors are available for 18 countries. In 11 countries the amount spent by the two sectors exceeds that of the business sector. Reflecting this strong public support, the highest levels are found in Germany (USD 5 972 million PPP), followed by Korea (USD 2 468 million PPP) and Spain (USD 1 346 million PPP). The biotechnology share of total R&D expenditures is highest in Germany, at 21.2%, followed by Korea (19.8%) and Spain (14.3%).

#### Definitions

The OECD defines *biotechnology* as the application of science and technology to living organisms, as well as parts, products and models thereof, to alter living or non-living materials for the production of knowledge, goods and services.

This definition is deliberately broad, covering modern biotechnology but also many traditional or borderline activities. For this reason, the OECD recommends that it should always be accompanied by a list-based definition based on seven categories that serves as an interpretative guideline. The categories are: DNA/RNA, Proteins and other molecules, Cell and tissue culture and engineering, Process biotechnology techniques, Gene and RNA vectors, Bioinformatics, and Nanobiotechnology. In addition, respondents are usually given write-in option for new biotechnologies that do not fit any of the categories. A firm that reports activity in one or more of the categories is defined as a biotechnology firm.

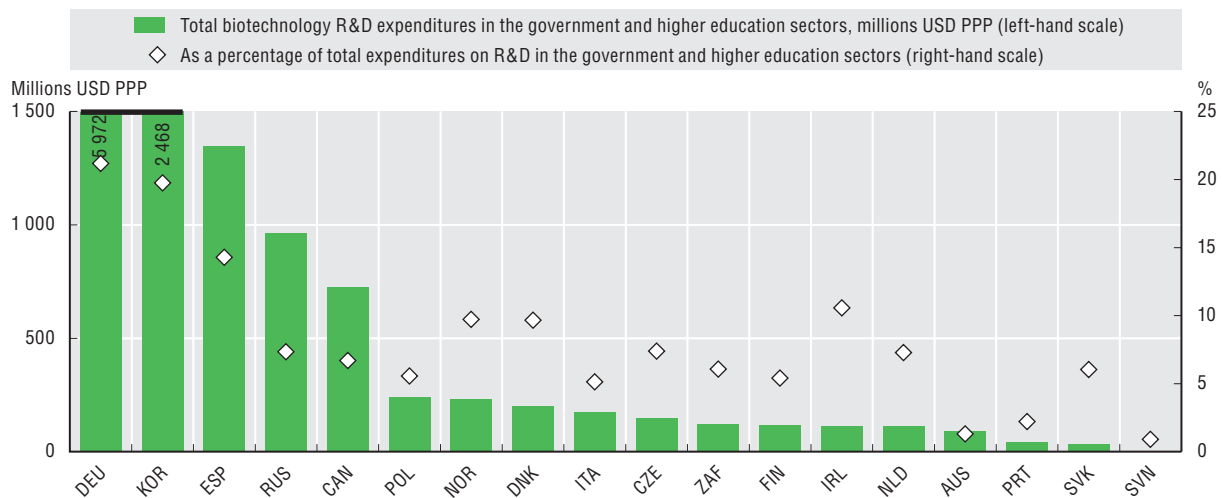
## Biotechnology R&amp;D in the business sector, 2011



Source: OECD, Key Biotechnology Indicators, <http://oe.cd/kbi>, and OECD, Main Science and Technology Indicators Database, [www.oecd.org/sti/msti.htm](http://www.oecd.org/sti/msti.htm), June 2013. See chapter notes.

StatLink <http://dx.doi.org/10.1787/888932892043>

## Biotechnology R&amp;D in the government and higher education sectors, 2011



Source: OECD, Key Biotechnology Indicators, <http://oe.cd/kbi>; and OECD, Main Science and Technology Indicators Database, [www.oecd.org/sti/msti.htm](http://www.oecd.org/sti/msti.htm), June 2013. See chapter notes.

StatLink <http://dx.doi.org/10.1787/888932892062>

## Measurability

Firms' biotechnology activities can be measured by dedicated surveys of these firms, questions on biotechnology added to national R&D surveys of firms and available secondary sources. Data comparability depends on how biotechnology statistics are collected.

There are three types of biotechnology firms:

1. A biotechnology firm engages in biotechnology using at least one biotechnology technique (as defined in the OECD list-based definition) to produce goods or services and/or to perform biotechnology R&D. These firms are captured by biotechnology firm surveys.

Two subgroups of biotechnology firms are largely defined by the method of data collection.

2. A dedicated biotechnology firm devotes at least 75% of its production of goods and services, or R&D, to biotechnology. These firms are captured by biotechnology firm surveys.
3. A biotechnology R&D firm performs biotechnology R&D. Dedicated biotechnology R&D firms, a subset of this group, devote 75% or more of their total R&D to biotechnology. These firms are captured by R&D surveys.

The OECD 2009 guidelines provide a common basis for collecting and reporting biotechnology R&D statistics in the government and higher education sectors.

#### **Cyprus**

The following note is included at the request of Turkey:

“The information in this document with reference to ‘Cyprus’ relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognizes the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the ‘Cyprus issue’.”

The following note is included at the request of all the European Union Member States of the OECD and the European Union:

“The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.”

#### **Israel**

“The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities or third party. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.”

“It should be noted that statistical data on Israeli patents and trademarks are supplied by the patent and trademark offices of the relevant countries.”

### 4.1. R&D funding and specialisation

#### **R&D specialisation, top three performing industries, 2011**

For comparability reasons, estimates are only calculated for countries with data available by main economic activity based on ISIC Rev.4 or an analogous classification.

ISIC Rev.4 Divisions as follows: Agriculture, mining, utilities and construction: 01-03, 05-09, 35-39 and 41-43; Chemicals and minerals: 19-23; ICT equipment: 26; Information and communication services: 58-63; Electrical equipment and machinery nec: 27-28; Transport equipment: 29-30; Finance and other business services: 64-66 and 69-82 excluding 72; R&D services: 72; Wholesale, retail and transport services: 45-47, 49-53, 55-56.

For Australia, Denmark, France, Germany, Italy, the Netherlands, Portugal, Spain and the United Kingdom, data refer to 2010.

For Austria, Belgium, Sweden and the United States, data refer to 2009.

For Switzerland, data refer to 2008.

Data are drawn from national sources for Canada and Switzerland.

For Estonia, “Chemicals and minerals” includes a significant investment in new technology in the oil industry (ISIC Rev.4 Division 19) in 2011.

#### **R&D budgets by socio-economic objectives, 2012**

“Other” includes support for research on education and society, exploration and exploitation of space, and budgets not elsewhere classified.

For Chile, EU28, France, Israel, Korea, Mexico, Spain, Sweden and the United Kingdom, data refer to 2011.

For Canada, OECD and Switzerland, data refer to 2010.

For Poland, data refer to 2008.

For Israel, a substantial part of defence R&D is not included in estimates reported to the OECD.

For Japan, military procurement contracts are excluded from defence in government budget appropriations or outlays for R&D (GBAORD).

For Korea, general university funds (GUF) cannot be identified separately from general advancement of knowledge; both categories are reported under non-oriented research.

For Mexico, GUF cannot be identified separately from general advancement of knowledge; both categories are reported under the former heading.

For the United States, GUF is not estimated and is therefore not included in total reported GBAORD. General support for universities is the responsibility of state governments.

**Top two technologies patented by countries, 2009-11**

Data relate to patent applications filed under the Patent Cooperation Treaty (PCT). Patent counts are based on the priority date, the inventor's residence country and fractional counts. Patents are allocated to technology fields using International Patent Classification (IPC) codes, following the classification presented in Schmoch (2008, revised in 2013).

**4.2. Green innovation****R&D budgets for energy and the environment, 2002 and 2012**

Data refer to 2002 and 2012 except for Canada (2010), Chile (2011), EU28 (2011), France (2011), Israel (2011), Italy (2001), Korea (2011), Mexico (2002), the OECD (2010), Poland (2008), the Russian Federation (2001, 2009), Spain (2011), Sweden (2011), Switzerland (2010) and the United Kingdom (2011).

**General notes:****Patents in selected environmental technologies, 1998-2000 and 2008-10 and; Countries' share in selected environmental technologies, 2008-10**

Data relate to patent applications filed under the Patent Cooperation Treaty (PCT). Patent counts are based on the priority date, the inventor's residence and fractional counts. Patents in environment-related technologies are defined using combinations of IPC classes and codes Y02 of the European Classification (ECLA), as detailed in [www.oecd.org/env/consumption-innovation/indicator.htm](http://www.oecd.org/env/consumption-innovation/indicator.htm).

**Additional note:****Patents in selected environmental technologies, 1998-2000 and 2008-10**

Only economies that applied for more than 250 patents in 2008-10 are included. For technology fields based on ECLA codes, data for 2008-10 are underestimated.

**4.3. Health innovation****Government funding of health-related R&D, 2012**

Direct health GBAORD includes government budget appropriations or outlays for R&D primarily committed to the socio-economic objective of protecting and improving human health.

Funds for the general objective of "Advancement of knowledge", comprising non-oriented research funds and general university funds, the estimated R&D content of government block grants to universities, have been included as health-related on the basis of available data attributing a fraction of R&D funds in this category to the field of medical sciences. The "Other" category represents *ad hoc* OECD estimates based on available national sources covering general support for R&D in hospitals and related areas that is excluded from GBAORD estimates.

For Chile, Denmark, Estonia, Finland, Israel, Italy, Korea, Mexico, Slovenia, Spain, Sweden and the United Kingdom, data refer to 2011.

For Canada and Switzerland, data refer to 2010.

For the Russian Federation, data refer to 2009.

For Poland, data refer to 2008.

**General notes:****Health-related patents, 1999-2001 and 2009-11 and; Countries' share in pharmaceutical patents, 2009-11**

Data relate to patent applications filed under the Patent Cooperation Treaty (PCT). Patent counts are based on the priority date, the inventor's residence and fractional counts. Health-related patents are defined using International Patent Classification (IPC) codes, following the classification presented in Schmoch (2008, revised in 2013).

**Additional note:****Health-related patents, 1999-2001 and 2009-11:**

Only economies that applied for more than 250 patents in 2009-11 are included.

## 4. TARGETING NEW GROWTH AREAS

### Notes and References

#### 4.4. Biotechnology R&D

##### General notes:

##### **Number of firms active in biotechnology, 2011 and; Biotechnology R&D in the business sector, 2011**

Biotechnology firms use biotechnology to produce goods or services and/or to perform biotechnology R&D. These firms are captured by biotechnology firm surveys.

Biotechnology R&D firms perform biotechnology R&D. These firms are captured by R&D surveys.

Dedicated biotechnology firms devote at least 75% of their production of goods and services, or R&D, to biotechnology. These firms are captured by biotechnology firm surveys.

Dedicated biotechnology R&D firms devote at least 75% of their total R&D to biotechnology. These firms are captured by R&D surveys.

For Denmark and Slovenia data are preliminary.

For the Russian Federation, a proxy indicator is used: R&D expenditure by priority areas of S&T (Life sciences). These include: Bioengineering; Biocatalysis, biosynthesis and biosensor technologies; Biomedical and veterinary technologies; Genomics and pharmaco-genetics; Living cell technologies.

##### Additional notes:

##### **Number of firms active in biotechnology, 2011**

For Mexico, data include firms with some biotechnology activity over 2010-11. The data are overestimated as they cover two years and therefore exclude firm exit. Data are for firms with 20 or more employees only.

For the Netherlands and Sweden, firms with 10 or more employees only.

For the United Kingdom, an estimated 66% of biotechnology firms (for most of which biotechnology, as defined by the OECD, is the main activity) undertake R&D.

##### **Biotechnology R&D in the business sector, 2011**

For Germany, 2011 business expenditures on R&D (BERD) were used to calculate biotechnology R&D intensity, as 2012 BERD was not available.

For Mexico, with 20 or more employees only. 2010 BERD was used to calculate biotechnology R&D intensity, as 2011 BERD was not available.

For the Netherlands and Sweden, firms with 10 or more employees only.

##### **Biotechnology R&D in the government and higher education sectors, 2011**

Government expenditure on R&D (GOVERD); higher education expenditure on R&D (HERD).

For Italy, the higher education sector is excluded.

For the Netherlands, provisional data; the higher education sector is excluded. Public-sector firms or institutes with 10 or more employees only.

For the Russian Federation, a proxy indicator is used: R&D expenditure by priority areas of S&T (Life sciences). These include: Bioengineering; Biocatalysis, biosynthesis and biosensor technologies; Biomedical and veterinary technologies; Genomics and pharmaco-genetics; Living cell technologies.

For Slovenia, data are provisional.

#### 4.5. Nanotechnology R&D

##### General notes:

##### **Number of firms active in nanotechnology, 2011 and; Nanotechnology R&D in the business sector, 2011**

Nanotechnology firms use nanotechnology to produce goods or services and/or to perform nanotechnology R&D. These firms are captured by nanotechnology firm surveys.

Nanotechnology R&D firms perform nanotechnology R&D. These firms are captured by R&D surveys.

Dedicated nanotechnology firms devote at least 75% of their production of goods and services, or R&D, to nanotechnology. These firms are captured by nanotechnology firm surveys.

Dedicated nanotechnology R&D firms devote at least 75% of their total R&D to nanotechnology. These firms are captured by R&D surveys.

For Japan, number of business enterprises with a paid-in capital of JPY 100 million or more.

#### **Additional notes:**

##### **Number of firms active in nanotechnology, 2011**

For Mexico, data include firms with some nanotechnology activity over 2010-11. The data are overestimated as they cover two years and therefore exclude firm exit. Data are for firms with 20 or more employees only.

##### **Nanotechnology R&D in the business sector, 2011**

For Japan and Mexico, 2010 business expenditures on R&D (BERD) were used to calculate nanotechnology R&D intensity, as 2011 BERD was not available.

For the Russian Federation, preliminary estimates based on data gathered in the R&D survey.

##### **Nanotechnology R&D in the government and higher education sectors, 2011**

Government expenditure on R&D (GOVERD); higher education expenditure on R&D (HERD).

For Italy and Korea, the higher education sector is excluded.

For Japan, 2010 GOVERD and 2010 HERD were used to calculate nanotechnology R&D intensity, as 2011 data were not available.

For Korea, 2011 GOVERD and 2011 HERD were used to calculate nanotechnology R&D intensity, as 2012 data were not available.

## **4.6. ICT innovation**

### **R&D expenditure in information industries, 2011**

The “information industries” aggregate comprises ISIC Rev.4 Divisions 26 and 58-63. The terms “ICT equipment”, “Publishing, audiovisual and broadcasting activities”, “Telecommunications” and “IT and other information services” refer to ISIC Rev.4 Divisions 26, 58-60, 61 and 62-63, respectively. “ICT services not allocated” refers to industries within Divisions 58-63 that cannot be separated.

For Australia, Denmark, France, Germany, Italy, the Netherlands, Portugal, Spain and the United Kingdom, data refer to 2010.

For Austria, Belgium, China, Sweden and the United States, data refer to 2009.

For Switzerland data refer to 2008.

Data from national sources for Canada and Switzerland.

### **ICT-related patents, 1999-2001 and 2009-11**

Data relate to patent applications filed under the Patent Cooperation Treaty (PCT). Patent counts are based on the priority date, the inventor’s residence and fractional counts. ICT-related patents are defined using International Patent Classification (IPC) codes, following the classification presented in Schmoch (2008, revised 2013). Only economies that applied for more than 250 patents in 2009-11 are included.

### **Enterprises with broadband connection, by employment size, 2012**

For Australia, data refer to 2010/11 (fiscal year ending 30 June 2011) instead of 2012.

For Canada, medium-sized enterprises have 50-299 employees instead of 50-249 persons employed. Large enterprises have 300 or more employees instead of 250 or more persons employed.

For Japan, all businesses with 100 or more persons employed instead of 10 or more, 100-299 instead of 50-249, and 300 or more instead of 250 or more.

For Mexico, data refer to 2008 instead of 2012 and to businesses with 20 or more persons employed instead of 10 or more.

For Switzerland, data refer to 2011 instead of 2012.

## **4.7. Broadband price and quality**

### **Prices of fixed broadband basket, 33 GB, 15 Mbit/s and above, September 2012**

The OECD basket of fixed broadband services includes total charges for a subscription with a minimum speed of 15 Mbit/s and 33 GB for 60 hours of usage a month. USD purchasing power parities (PPP) are used to facilitate international comparisons.

## 4. TARGETING NEW GROWTH AREAS

### Notes and References

#### Prices of mobile voice calls plus data traffic reference baskets, August 2012

The OECD methodology for measuring prices for communication services is based on consumption patterns or “baskets” of fixed, mobile and leased line communication services prices, collected from multiple operators with the largest market shares in each country. The current presentation of the price benchmarking results for mobile broadband services covers services provided over a handset or smartphone.

The 30 calls/100MB, 100calls/500MB and 900calls/2GB OECD baskets of mobile telephone charges include fixed and usage charges for respectively 30, 100 and 900 voice calls, and a volume of 100 MB, 500 MB and 2GB of data traffic per month. These baskets approximately portray small, average and large users of voice and mobile data. USD purchasing power parities (PPP) are used to facilitate international comparisons. Additional information on the computation methodology can be found in the *OECD Communications Outlook 2013*.

#### 4.8. Fixed and wireless broadband

##### Wireless broadband penetration by technology, December 2009 and 2012

Wireless terrestrial broadband includes standard (voice plus data) and dedicated mobile data subscriptions, as well as terrestrial fixed wireless and satellite broadband. The latter two categories in the family of wireless technologies are widespread in only a few countries and, from the usage perspective, correspond to fixed broadband connections.

Standard mobile broadband subscriptions may include dedicated mobile data subscriptions when breakdowns are not available. Data for Israel, Mexico, Switzerland and the United States are estimates.

##### Fixed wired broadband penetration by speed tiers, December 2009 and 2012

OECD subscription data (December 2012) merged with Akamai's actual speed data (2nd quarter, 2012).

Figures on fixed wired broadband subscriptions exclude fixed terrestrial wireless and satellite broadband technologies, which are typically used in fixed locations. These are grouped with other wireless subscriptions, and are relevant for only a few countries, and in particular, the Czech Republic (with a penetration rate of 8.6%) and the Slovak Republic (4.8%).

Data for Mexico, Switzerland and the United States are OECD estimates.

##### Household Internet access by income quartile, 2008 and 2012

For Australia, data refer to 2010/11 (fiscal year ending 30 June 2011) instead of 2012.

For Canada, the Czech Republic, Denmark, Israel, the Netherlands and the United States, data refer to 2011 instead of 2012.

For Chile, data refer to 2009 instead of 2008.

For Korea, data are not available by income quartiles but by thresholds. The bottom quartile was made equivalent to an income of less than KRW 100 million and the top quartile to an income of more than KRW 300 million.

For New Zealand, data refer to 2006 instead of 2008.

For Switzerland and Turkey, data refer to 2010 instead of 2012.

For the United States, data refer to 2007 instead of 2008.

For Australia, Canada, France, Ireland, Mexico, Turkey and the United Kingdom, data by quartile are not available.

#### 4.9. Internet users

##### Regular Internet users by age, 2012

National source for the Russian Federation is the Institute for Statistical Studies and Economics of Knowledge, Higher School of Economics (HSE) of the National Research University, May 2013.

For the Czech Republic, Denmark and the Netherlands, data refer to 2011.

For Korea and Mexico, Internet users are defined for a recall period of 12 months.

For Switzerland, data refer to daily Internet users. Internet users are defined for a recall period of 6 months.

##### Regular Internet users by educational attainment and age, 2012

For EU countries and Turkey, data by educational attainment for 16-24 and 65-74 year-olds are OECD estimates based on Eurostat; for 16-24 year-olds, they are a 2010-12 average.

For the Czech Republic, Denmark and the Netherlands, data by educational attainment for 65-74 year-olds refer to 2011.

For Turkey, data refer to 2010.

For Switzerland, Internet users are defined for a recall period of 6 months.

For Mexico data refer to all Internet users defined for a recall period of 12 months.

For Chile and Switzerland, data for the lower educational level include all individuals without tertiary education.

**Individuals who purchased on line in the last three months, by age class, 2012**

For Australia, Canada, Chile, Mexico, New Zealand and Switzerland the reference period is the last 12 months.

For Australia, data refer to the financial year ending 30 June 2010 (2009/10) instead of 2012.

For Canada, the question refers to “ordering goods or services over the Internet from any location (for personal or household use, not business use)”.

For the Czech Republic, Denmark and the Netherlands data refer to 2011 instead of 2012.

For Chile, data refer to 2009 instead of 2007. In 2009, no time period is specified, instead of last 12 months.

For Israel, data refer to all individuals aged 20 and over instead of individuals aged 16-74 and to 2006 instead of 2007.

For Japan, details by age are not available. Data refer to all individuals aged 6 and over instead of 16-74.

For New Zealand, data refer to 2006 instead of 2007 and relate to e-purchases for personal use only requiring an on line payment.

For Switzerland, data refer to 2005 instead of 2007.

For Turkey, data refer to 2010 instead of 2012.

For the United States, data are drawn from the PEW Research Center and cover all individuals aged 18 and over, instead of 16-74, who ever purchased a product on line. Data refer to September 2007 and May 2011.

**4.10. Emerging technologies****Acceleration in the development of patented technologies, 2000-11**

Data relate to patent applications filed under the Patent Cooperation Treaty (PCT). Patent counts are based on the application date, the International Patent Classification (IPC) codes and fractional counts. Patent “bursts” correspond to periods characterised by the sudden and persistent increase in the number of patents filed at the 4-digit IPC class level. Top patent bursts are identified by comparing the filing patterns of all 4-digit IPC classes. The intensity of a patent burst refers to the relative strength of the observed increase in filing patterns. Only IPC classes featuring a positive burst intensity in the 2000s are included.

Descriptions of IPC codes are available at: [www.wipo.int/classifications/ipc/en](http://www.wipo.int/classifications/ipc/en).

**Acceleration in the co-development of patented technologies, 1996-2001 and 2006-11**

Data relate to patent applications filed under the Patent Cooperation Treaty (PCT). Patent counts are based on the application date and the co-occurrence of IPC codes in patents, using fractional counts. Patent “bursts” correspond to periods characterised by the sudden and persistent increase in the number of patents filed in the pairs of 4-digit IPC classes considered. Top patent bursts are identified by comparing the filing patterns of all possible pairs of 4-digit IPC classes. The intensity of a patent burst refers to the relative strength of the observed increases in the filing patterns. Technology domains have been identified through text analysis of the combinations of IPC codes considered. Only IPC combinations with a positive burst intensity in the 2000s (either starting or ending burst) are included.

Descriptions of IPC codes are available at: [www.wipo.int/classifications/ipc/en](http://www.wipo.int/classifications/ipc/en).

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