ANNEX 9.A

Methodological annex to the 2014 OECD STI Outlook country profiles

Introduction

The country profiles (Chapter 9) present the main features, strengths and weaknesses of national STI systems and major recent changes in national STI policy. This annex describes the conceptual background, sources and methodology used to design these profiles.

Following the expansion of the statistical framework in the 2012 edition, which included some 20 indicators, the country profiles 2014 include over 300 indicators in selected STI areas. The policy dimension has been also reinforced through a more systematic and comprehensive use of national science, technology and innovation (STI) policy information.

The country profiles are at the interface of two main streams of work carried out under the auspices of the Committee for Scientific and Technological Policy (CSTP):

- The policy research conducted by the Working Party on Technology and Innovation Policy (TIP), on the links between innovation and sustainable growth and the evaluation of national STI public support schemes, and the work of the former Working Party on Research Institutions and Human Resources (RIHR), on the main institutional, regulatory and management conditions needed to strengthen the knowledge base for innovation and the research capabilities of public research institutions (PRIs). The policy dimension of the country profiles has also benefited from experience gained through the OECD Country Reviews of Innovation Policy and previous OECD work on national innovation systems (NIS). The main and most recent source of country-specific STI policy information is provided by countries' responses to the STIO policy questionnaire 2014 which was circulated to CSTP delegates between November 2013 and January 2014. Official documents and external sources, such as the EU Erawatch/TrendChart reports were also used when appropriate.
- The statistical work and empirical analysis conducted by the Working Party of National Experts on Science and Technology Indicators (NESTI) on the measurement of innovation and the development of internationally comparable S&T indicators for policy analysis. The statistical dimension of the country profiles has also drawn on data collections and empirical work of the Committee on Industry, Innovation and Entrepreneurship (CIIE) and the Committee for Information, Computer and Communications Policy (ICCP), in their areas of work. Finally, the reviews of STI

indicators and STI trends carried out for the *OECD Science, Technology and Industry Scoreboard* are a key reference (OECD, 2009, 2011a, 2013a).

This methodological annex first introduces the conceptual framework used in this edition to assess national innovation systems (NIS). It then looks at the key indicators chosen to gauge the performance of innovation systems. It reviews the reasons for the choices made, the sources used, some limitations on interpretation of the data and certain technical aspects (calculations, normalisation criteria, etc.).

What should be measured: A conceptual framework

A particular effort has been made to improve evidence on how innovation systems function and perform by mapping and measuring input, output and outcomes (OECD, 2010a).

The following framework provides the standard structure used to describe the NIS and to map the innovation policy mix (OECD, 2010b). It is used throughout the *OECD STI Outlook 2014*, in particular to relate the policy profiles (thematic approach) to the country profiles (country approach). It served a role in the design of the policy questionnaire used to collect information and official data on major STI policy programmes and on recent changes in national STI policy.

Public intervention may seek to: *i)* improve STI policy governance; *ii)* improve the competences and capacity of STI actors to innovate in universities and public research institutes (PRIs), on the one hand, and firms, on the other; *iii)* improve interactions among STI actors to accelerate technology transfer and increase their capacity to connect to international knowledge networks; and *iv)* improve skills for innovation.

STI policy governance

As the portfolio of innovation policy instruments has broadened, STI policy has become increasingly sophisticated. The accumulation of STI policy initiatives over time has raised the risk of government failures and the dispersal of state power to supra- and sub-national, quasi-state and non-state actors; it has also favoured the emergence of new forms of multi-level and multi-actor governance (Flanagan et al., 2010) that make the possible side effects of public intervention increasingly difficult to detect and anticipate. Moreover, in the aftermath of the 2008 financial crisis, governments are under strong pressure to find new sources of growth, to meet social and global challenges and to consolidate their fiscal accounts (OECD, 2010c). Good governance requires identifying strategic priorities, combining the right instruments and making the most of stable, or even shrinking, resources.

More detailed information about the rationale for and major aspects of STI policy intervention, as well as recent STI policy trends, can be found in "Part II: STI policy profiles" of this volume.

STI actors' competences and capacity to innovate

Universities and public research

Public-sector research is considerably smaller than business research and development (R&D) in the majority of OECD countries; higher education and government expenditure on R&D account for 30% of total OECD expenditures on R&D (OECD, 2014a). However, PRIs and research universities play an extremely important role in innovation systems by providing new knowledge, especially in areas in which economic benefits are uncertain or less immediate. Public research also meets specific needs of national interest, such as defence, and of the population at large, e.g. health care (see the policy profile on "Public research missions and orientation"). In addition public research tends to be counter-cyclical and to serve as a buffer by complementing funding gaps arising from declines in private R&D investment during economic downturns (see Chapter 1). Gross domestic expenditures on R&D (GERD) declined by 1.3% in 2009 in the OECD area, driven by a sharp contraction of business R&D spending (-4.2%), while expenditure by higher education (+4.9%) and government (+4.0%) kept growing (OECD, 2014a). The same occurred in 2002 after the explosion of the IT bubble, although to a lesser extent.

Innovation in firms

Firms are major actors in national innovation systems (see Chapter 5 on "Innovation in firms"). They turn ideas into economic value, account for the largest share of domestic R&D in many countries and also carry out non-technological innovation. In addition, start-ups can exploit knowledge that is not used or is underused by existing companies and draw on existing knowledge to enter new or established markets (Acs et al., 2009). This is especially true in knowledge-intensive sectors.

Public sector innovation

Increasingly sophisticated public demand and new challenges due to fiscal pressures require innovative public-sector approaches. Public-sector innovation involves significant improvements in public services delivery in terms both of the content of these services and of the instruments used to deliver them. Many OECD countries intend to create services that are more user-focused, better defined and better target user demand. However, there is limited knowledge and awareness of the full range of tools available to policy makers for accelerating innovation in this area and the STI Outlook focuses on the other types of STI actors.

STI actors' interactions

Science is the basis of most innovation, especially in frontier fields (such as biotechnology). Innovation is increasingly achieved through the convergence of scientific fields and technologies (OECD, 2010c). The rapidly increasing amount of knowledge required for innovation has encouraged STI actors to co-operate and connect to global knowledge flows.

ICT and scientific infrastructure

Empirical studies point to a positive link between increased adoption and use of information and communication technologies (ICTs) and economic performance at the firm and macroeconomic level (OECD, 2012). Governments see ICTs and the Internet as a major platform for research and innovation (see the policy profile on "Innovation and the digital economy").

To conduct scientific research and to attract and retain world-class researchers requires a critical mass of large-scale scientific infrastructures, costly equipment and modern facilities and thus large amounts of public and private investments.

Clusters

Clusters are geographic concentrations of firms, universities, PRIs, and other public and private entities that facilitate collaboration on complementary economic activities.

Clusters facilitate knowledge spillovers and a collective pool of knowledge that result in higher productivity, more innovation and more competitive firms. Governments promote clusters through investments in ICT, scientific infrastructure and knowledge, networking activities and training (see the policy profile on "Cluster policy and smart specialisation").

Knowledge flows and the commercialisation of public research results

Various mechanisms facilitate knowledge valuation, circulation and commercialisation. Intellectual property rights (IPRs), such as patents or trademarks, facilitate the transfer of knowledge and technologies by ensuring that the knowledge generated will not be misappropriated and that much of the benefits can be internalised (see the policy profile on "Patent policies"). Technology transfer from academia is encouraged to increase the economic impact of investments in public research. The commercialisation of public research results via the cession of intellectual property (IP), the establishment of new ventures (e.g. academic spin-offs), contracting to universities and PRIs by industrial actors or the setting up of collaborative R&D projects may also create additional financial resources for universities and PRIs (see the policy profile on "Commercialisation of public research"). IPRs are therefore increasingly traded in markets and the number of intermediaries that broker commercialisation activities, notably IP services, has risen (see the policy profile on "IP markets"). Open science also increases the channels for transferring and diffusing research results (e.g. ICT tools and platforms, alternative copyright tools) and open innovation in firms creates a division of labour in the sourcing of ideas and their exploitation (see the policy profile on "Open science").

Globalisation of STI systems

Trade, investment and research systems are increasingly globalised (OECD, 2009). Countries and firms engage in international co-operation in STI with a view to tapping into global pools of knowledge, HR and major research facilities, to sharing costs, to obtaining more rapid results, and to managing the large-scale efforts needed to address challenges of a regional or global nature effectively (see Chapter 3 on "Globalisation of innovation policies").

Human resources for innovation

Education

Formal education remains the main vehicle for improving the supply of the diverse and complex skills required for innovation. Because it raises attainment levels and the general level of education, formal education can inspire talented young people to enter innovation-related occupations and equip people with the highest skills. In addition to scientific, technological, engineering and mathematics skills, innovation requires soft skills (entrepreneurship, creativity, leadership etc.) (see the policy profile on "Strengthening education and skills for innovation").

Employment and lifelong learning

The supply of the highly skilled can be further enlarged by improving the attractiveness of research and entrepreneurial careers, by facilitating the sectoral and international mobility that eases the cross-fertilisation of ideas and learning, or by facilitating the transition from higher education and training to employment and *vice versa*. The acceleration of technological change has made lifelong learning a key means of preserving and upgrading the pool of human resources for science and technology (HRST). Demand for the highly skilled can also be boosted through support for job openings in academia or in the business sector, especially in small and medium-sized enterprises (SMEs). Mismatches between demand and supply can be addressed by promoting mobility and training and by building knowledge about current and future skills needs (see the policy profile on "Labour market policies for the highly skilled").

Innovation culture

It is increasingly recognised that innovation is influenced by the social and cultural values, norms, attitudes and behaviours that inform an innovation culture. Building an innovation culture implies raising public awareness of and interest in S&T, especially among youth, valuing the contribution of S&T to well-being and social welfare, fostering an entrepreneurial spirit through a positive attitude towards risk taking, nurturing a research culture while raising awareness of IPRs in the research community, etc. (see the policy profile on "Building a science and innovation culture").

Key figures

The table of key figures provides an overview of a country's economic and environmental performance, the size of its national research system and the relative importance of the government's commitment to R&D through public funding. It also shows how these indicators have changed from 2007 to 2012. When data are not available for these years, the nearest years are used. Growth rates are compound annual growth rates* expressed in percentage.

Economic and environmental performance

Innovation is widely acknowledged as a major driver of productivity and economic performance and is seen as a key way to create new business values while also benefiting people and the planet and addressing global challenges.

Labour productivity, levels and annual growth. Welfare is traditionally gauged through the GDP per capita indicator. Changes in GDP per capita are explained by changes in labour productivity (GDP per hour worked) and labour utilisation (hours worked per person employed). Labour productivity is defined as the volume of output divided by the volume of labour input, namely GDP per hour worked, in current US dollars at purchasing power parity (PPP). Labour productivity is however a partial productivity measure and reflects the joint influence of a host of factors. It is easily misinterpreted as technical change or as the productivity of the individuals in the labour force. Data are drawn from the OECD Productivity Database which provides estimates of productivity growth and levels and allows for comparison of standards of living and underlying factors across countries (*www.oecd.org/std/productivity-stats/*).

* Compound annual growth rates are calculated based on indicator values in constant prices, according to the following formula in which CAGR is the compound annual growth rate, I is the value considered over the period of time between t_0 and t_1:

$$\text{CAGR}\ {}^{I}_{t_1,t_0} = \left[\left(I_{t_1} | I_{t_0} \right)^{\left(1|\left(t_1 - t_0\right)\right)} \right] - 1$$

A central element of green growth is the efficiency with which environmental and natural resources are used in production and consumption. A declining asset base and climate change constitute risks for growth and sustainable development. Environmental outcomes are also important determinants of health and wellbeing. The main concerns relate to the effects of increasing atmospheric greenhouse gas (GHG) concentrations on global temperatures and the Earth's climate, and the consequences for ecosystems, human settlements, agriculture and other socio-economic activities that can affect global economic output (OECD, 2011b). Carbon dioxide (CO_2) accounts for the largest share of GHG emissions. Fuel combustion in economic activities and by households is a main source of climate change and GHG emissions.

Green productivity, levels and annual growth. Green productivity, or environmental and resource productivity, is production-based CO_2 productivity, i.e. GDP generated per unit of CO_2 emitted through fuel consumption. Estimates are computed by the International Energy Agency (IEA) on the basis of the IEA energy balances and the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IEA, 2013).

Green demand, levels and annual growth. Green demand is demand-based CO_2 productivity, i.e. real net national income (NNI) generated per unit of CO_2 emitted or gross national income (GNI) per unit of CO_2 emitted for Brazil, the People's Republic of China, India, Indonesia, the Russian Federation and South Africa. Demand-based emissions reflect the CO_2 emissions embodied in final domestic demand from energy used during the various stages of production of the goods and services consumed, irrespective of where the stages of production occurred. Trends in demand-based emissions serve as a diagnostic complement to the more traditional production-based measures. The estimates of CO_2 emissions are calculated using a combination of input-output tables, bilateral trade data and production-based CO_2 emissions. Data are drawn from the OECD Green Growth Indicators Database.

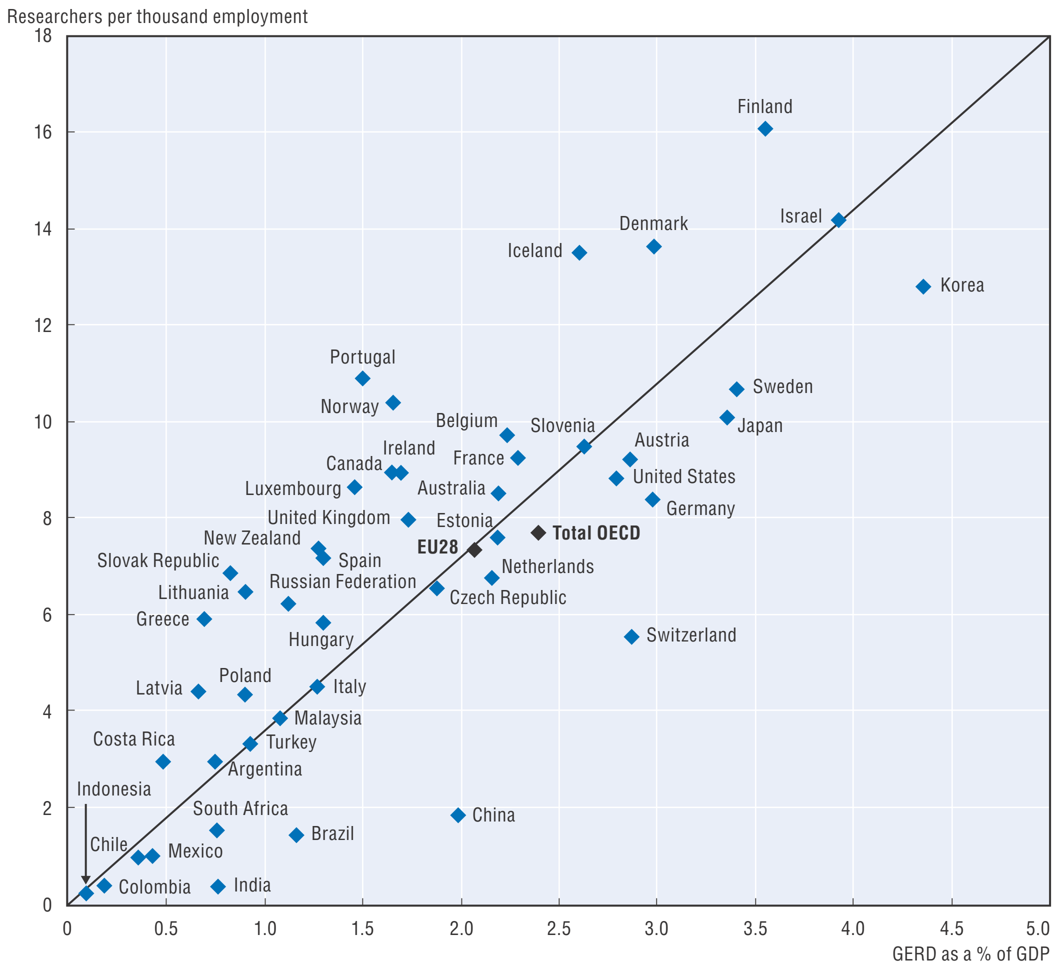
Gross domestic expenditure on R&D

Gross domestic expenditure on R&D (GERD) is total intramural expenditure on R&D performed on the national territory during a given period, i.e. it includes R&D performed within a country and funded from abroad but excludes payments for R&D performed abroad (OECD, 2002). GERD is one of the most widely used measures of innovation inputs. It reflects a country's R&D efforts and investments and its potential for generating new knowledge. GERD is expressed in current US dollars PPP. R&D expenditures are derived from harmonised national R&D surveys based on joint OECD/Eurostat efforts to collect internationally comparable data on resources for R&D. GERD data –including for the following indicators if not otherwise specified- are drawn from the OECD Main Science and Technology Indicators (MSTI) Database which seeks to reflect the level and structure of efforts in the field of science and technology (*www.oecd.org/sti/msti*). Additional data for Latvia and Lithuania are drawn from Eurostat Science, Technology and Innovation (STI) Databases and from the UNESCO Institute for Statistics (UIS) for Colombia, Costa Rica, India, Indonesia and Malaysia.

GERD, intensity and annual growth. Many OECD and non-OECD countries "target" a certain level of GERD intensity to help focus policy decisions and public funding (see the policy profile on "National strategies for STI"). The volume of GERD to be achieved is often expressed as a percentage of gross domestic product (GDP). Compound annual growth rates are calculated based on R&D expenditures at constant prices.

In many economies most R&D expenditures cover personnel costs, which include researcher salaries and compensation. GERD intensity as a percentage of GDP and researchers per thousand employment are therefore closely related (OECD, 2011a). To avoid redundancy, data on researcher density are not presented in the country profiles. The researcher population in Figure 9.A.1 is estimated in full-time equivalent (FTE).

Figure 9.A.1. **GERD as a percentage of GDP and researchers per thousand employment, 2013 or latest available year**



Note: For GERD: data for Austria refer to 2013; data for Colombia, Costa Rica, Iceland, Malaysia, Mexico, New Zealand and South Africa refer to 2011; data for Australia and Brazil refer to 2010; and data for Switzerland refer to 2008. For other countries, data refer to 2012.

For researchers: data for Canada, Costa Rica, France, Iceland, Israel, Latvia, Lithuania, Malaysia, Mexico, New Zealand, South Africa and the United States refer to 2011; data for Brazil and Colombia refer to 2010; data for Indonesia refer to 2009; data for Australia and Switzerland refer to 2008; and data for India refer to 2005. Otherwise data refer to 2012.

Source: OECD, based on *OECD Main Science and Technology Indicators (MSTI) Database*, June 2014, *www.oecd.org/sti/msti*; Eurostat, *Science, Technology and Innovation Databases*, June 2014, *http://epp.eurostat.ec.europa.eu/portal/page/portal/science_technology_innovation/data/database*; UNESCO Institute for Statistics (UIS), *Science, Technology and Innovation Database*, June 2014, *http://data.uis.unesco.org/Index.aspx?DataSetCode=SCN_DS*. Data retrieved from IPP.Stat on 08 July 2014, *http://stats.oecd.org//Index.aspx?QueryId=57863*.

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Publicly financed GERD, intensity and annual growth. GERD is financed by various sources: business enterprises (industry), government, higher education, private non-profit institutions (PNPs) and foreign funds (abroad). In the country profiles, public funding of GERD encompasses financing by the government and higher education sectors. It reflects public commitment to R&D relative to the size of the country. It is expressed as a percentage of GDP. Data are based on harmonised national R&D surveys and drawn from the OECD Research and Development Statistics (RDS) Database which provides detailed information on a range of R&D statistics (*www.oecd.org/sti/rds*), except for Latvia and Lithuania for which data come from Eurostat STI Databases and for Colombia, Costa Rica, India, Indonesia and Malaysia for which data come from the UIS.

Benchmarking national innovation performance (Panel 1 of the country profiles)

The performance of a country's national innovation systems as compared to all OECD countries is represented in Panel 1 of the country profiles. Panel 1 (double graph) reflects the country's strengths and weaknesses in several areas (see the conceptual framework discussed above). A standard set of indicators is used to: *i)* describe the competences and capacity of the science base and the business sector to innovate, as well as the framework conditions for entrepreneurship; *ii)* provide some insights on interactions between STI actors via the deployment and use of the Internet and their participation in domestic and international co-operation networks; and *iii)* depict the status of the human resources (HR) pool and prospects for increasing human capital further through inflows of new S&T talent.

Indicators are normalised (by GDP or population) to take account of the size of the country. Data for GDP are drawn from the OECD MSTI Database and are based on national accounts. Data for GDP for Latvia and Lithuania are drawn from Eurostat Annual National Accounts (ANA) Databases and for Brazil, Colombia, Costa Rica, India, Indonesia and Malaysia from the World Economic Outlook (WEO) Databases of the International Monetary Fund (IMF).

The country's values are compared to the median value observed in the OECD area, i.e. the middle position among OECD countries for which data are available. Non-OECD countries are also compared and may appear out of range (e.g. lower than the lowest OECD country). The use of the median avoids a statistical bias towards large players that skew the average, while still reflecting international rankings. The median has also the advantage over a simple ranking that it preserves the deviation between country values. The distance of the country's value from the median value will appear on the chart at a proportional distance from the median. This applies equally to all countries. In a simple ranking, the difference between two successive country values is 1 and the distance to the median is the rank. All indicators are presented in indices and reported on a common scale from 0 to 200 (0 being the lowest OECD value, 100 the median value and 200 the highest) to make them comparable. The benchmark charts also highlight the position and dispersion of the top five and bottom five OECD values. When data are not available, the country's relative position does not figure on the graph (no dot).

Given X_t^c the indicator for country *c* at time *t*, and X_t^{Max}, X_t^{Med} and X_t^{Min} the respective OECD maximum, median and minimum values for this indicator, the country index I_t^c shown in Panel 1 is calculated as followed:

If $X_t^c > X_t^{Med}$ then $I_t^c = 100 + \left(X_t^c - X_t^{Med}\right) / \left(X_t^{Max} - X_t^{Med}\right) * 100$

If $X_t^c < X_t^{Med}$ then $I_t^c = 100 - \left(X_t^c - X_t^{Med}\right) / \left(X_t^{Min} - X_t^{Med}\right) * 100$

The standard set of indicators includes the following:

Universities and public research

(a) Public expenditure on R&D (per GDP). Higher education and government research institutions play a key role in the national STI system. Public expenditure on R&D (per GDP) measures the public sector's relative R&D performance. Public expenditure on R&D is the sum of higher education expenditure on R&D (HERD) and government expenditure on R&D (GOVERD) and is expressed as a percentage of GDP. Data are drawn from OECD MSTI Database and based on harmonised national R&D surveys and national accounts. Data for Latvia and Lithuania are drawn from Eurostat STI Databases and data for Colombia, Costa Rica, India, Indonesia and Malaysia from the UIS.

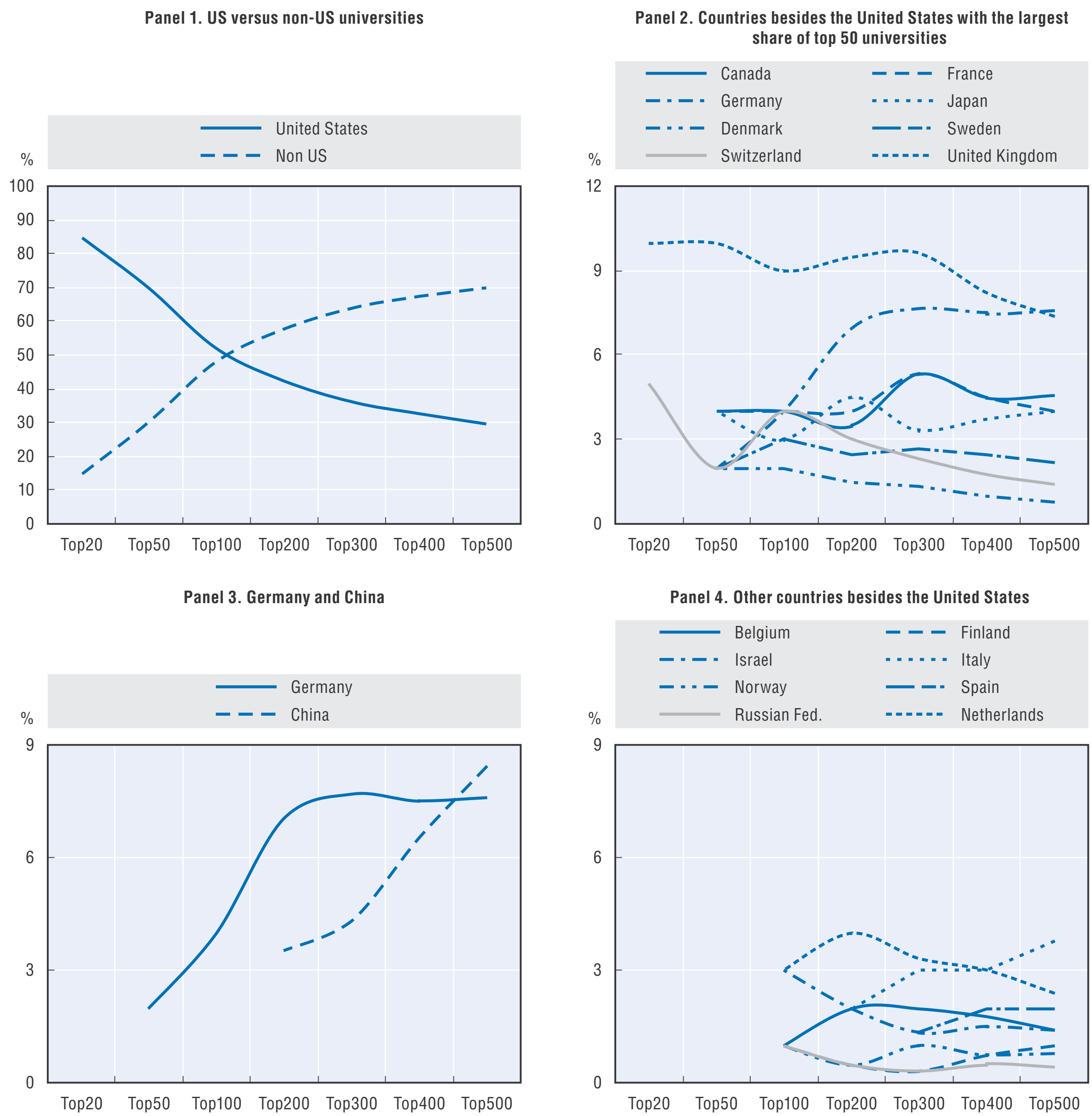
(b) Top 500 universities (per GDP). Excellent research is often concentrated in a few higher education institutions with strong international impact. The Academic Ranking of World Universities (ARWU), also known as the Shanghai ranking, ranks the world's top universities and medium-high performing institutions according to a composite indicator based on number of alumni; staff winning Nobel Prizes and Fields Medals; number of highly cited researchers selected by Thomson Scientific; number of articles published in *Nature* and *Science*; number of articles indexed in the Science Citation Index Expanded and Social Sciences Citation Index; and per capita performance with respect to the size of the institution (Table 9.A.2). More than 1 000 universities have been ranked by the ARWU every year since 2003 and the list of the leading 500 are published on the web (*www.shanghairanking.com*). This indicator has certain limits however. The bibliometrics-based indicators skew the ARWU ranking towards English-speaking institutions and emphasise the natural sciences over the social sciences or humanities, as well as research excellence over the quality of teaching. However, this last is less an issue for benchmarking the performance of the science base, as this publication seeks to do. In addition, the ranking tends to focus on larger institutions and does not reflect research performance in PRIs; this may disadvantage countries in which the science base relies heavily on public labs. The top 500 universities are expressed per million US dollars of GDP PPP to take into account countries' size and relative wealth.

According to the ARWU data, most countries have a relatively constant share of world-class universities as measured at different performance thresholds (Panels 2 and 4). This may reflect a homogeneous science base of institutions of different classes and of different visibility. The United States, Germany and China deserve further attention however (Panels 1 and 3). The United States has the world's best universities with 17 of the top 20 and 35 of the top 50, but its share drops rapidly when the performance threshold is lowered to include institutions below the top 50, i.e. high- and medium-high-performing institutions. The situation is different for Germany and China, which lack universities in the top 20 and top 50 but whose share in the world's top universities increases markedly from the top 50 to the top 200 for the former and from the top 300 to the top 500 for the latter. The selected benchmark threshold will therefore have an impact on these three countries' performance compared to other countries. With a higher benchmark threshold, the United States will perform better and Germany and China will perform less well. With a lower benchmark threshold, the reverse will be true.

For the top 50, US universities lead eight other countries in 2013: the United Kingdom (5), Canada (2), France (2), Japan (2) and Denmark, Germany, Sweden and Switzerland (all at 1). A similar exercise was conducted for the *OECD STI Scoreboard* on the basis of bibliometric data (OECD, 2013a). University hotspots were identified as the higher

Figure 9.A.2. **Impact of ranking thresholds on country's performance in ARWU ranking, 2013**

Country share in ARWU ranking of universities



Source: Based on Academic Ranking of World Universities (ARWU) (2013), "Shanghai ranking" 2003-13, *www.shanghairanking.com*.

StatLink http://dx.doi.org/10.1787/888933152496 education institutions with the highest impact as measured by the average number of citations received by an article compared to the world average of citations in the same time period, document type and subject area. The normalised impact of an institution (main author affiliated to the institution) was calculated for 2007-11. These results are presented in Table 9.A.1 beside the top 50 ranking based on ARWU data. The ARWU ranking has little effect on US performance or tends to increase slightly the number of US institutions in the top 50 as well as the impact of countries with larger institutions (see comments on the limitations of this indicator above).

Table 9.A.1. **The world's top 50 universities, according to the OECD STI Scoreboard 2013 and ARWU ranking 2013, 2007-11**

	STI Scoreboard 2013	ARWU ranking 2013				
	2007-11	2007	2008	2009	2010	2011
United States	34	37	36	37	35	34
United Kingdom	8	5	5	5	5	5
Netherlands	2	1	1	..	1	1
Canada	..	2	2	2	2	2
Switzerland	2	1	1	1	1	1
Denmark	1	1	1	1	1	1
Sweden	..	..	..	1	1	1
Japan	..	2	2	2	2	2
Chinese Taipei	2	..	..	..	..	..
Israel	1	..	..	..	..	..
France	..	1	2	2	2	2
Total number of countries	**7**	**8**	**8**	**8**	**9**	**9**

Source: OECD (2013), *OECD Science, Technology and Industry Scoreboard 2013: Innovation for Growth*, OECD Publishing, Paris, *http://dx.doi.org/10.1787/sti_scoreboard-2013-en* and Academic Ranking of World Universities (ARWU) (2013), "Shanghai ranking" 2003-13, *www.shanghairanking.com*.

StatLink http://dx.doi.org/10.1787/888933152508

The STI Outlook presents one indicator to compare the performance of universities across countries. A more detailed approach would require considering a wider range of indicators to reflect other dimensions of performance (e.g. teaching quality, technology transfer, innovative and entrepreneurial activities etc.).

(c) Publications in top-quartile journals (per GDP). Publication is the main means of validating and disseminating research results. Publications in top journals provide a measure of "quality-adjusted" research output and serve as an indicator of the expected impact of institutions' scientific production. Publications in the top-quartile journals are defined as documents published in the most influential 25% of the world's scholarly journals (in their category, in the reference period, by authors' institutional affiliation, in a given country). This ranking is based on the Scientific Journal Ranking (SJR) an impact-factor normalised index that takes the prestige of the journals as a measure of quality. Scientific production is based on whole counts of documents by authors' institutional affiliation in the country. Bibliometric data are drawn from the Elsevier Research Intelligence database. However, although publications are commonly used as proxies for academic research output, it is worth mentioning that publishing institutions are not necessarily all public sector research institutions. Publications counts are expressed in per million US dollars of GDP at PPP to take into account the size and the relative wealth of the country.

Table 9.A.2. **Indicators and weights used for the ARWU ranking of universities**

Criteria	Indicator	Definition	Weight
Quality of education	Alumni of an institution winning Nobel Prizes and Fields Medals	Defined as those who obtain bachelor's, master's or doctoral degrees from the institution. Different weights are given according to the period of obtaining a degree. The weight is 100% for alumni obtaining degrees after 1991, 90% for alumni obtaining degrees in 1981-90, 80% in 1971-80, and so on, and finally 10% in 1901-10. If a person obtains more than one degree from an institution, the institution is only considered once.	10%
Quality of faculty	Staff of an institution winning Nobel Prizes and Fields Medals in Physics, Chemistry, Medicine and Economics and Fields Medal in Mathematics.	Defined as those who work at an institution at the time of winning the prize. Different weights are given according to the period of winning the prize. The weight is 100% for winners after 2001, 90% for winners in 1991-2000, 80% in 1981-90, 70% in 1971-80, and so on, and finally 10% in 1911-20. If a winner is affiliated with more than one institution, each institution is assigned the reciprocal of the number of institutions. For Nobel prizes, if a prize is shared by more than one person, weights are set for winners according to their share of the prize.	20%
	Highly cited researchers in 21 broad subject categories	These individuals are the most highly cited within each category. The definition of categories and detailed procedures can be found at the website of Thomson ISI (see source).	20%
Research output	Papers published in *Nature* and in *Science* in the four years preceding the publication of the ARWU ranking	To distinguish the order of author affiliation, a weight of 100% is assigned for corresponding author affiliation, 50% for first author affiliation (second author affiliation if the first author affiliation is the same as corresponding author affiliation), 25% for the next author affiliation, and 10% for other author affiliations. Only publications of "articles" and "proceedings papers" are considered. Institutions specialised in humanities and social sciences are not taken into account and weighting in the ARWU composite index is reallocated proportionally to other criteria.	20%
	Papers indexed in Science Citation Index-expanded and Social Science Citation Index in the year preceding the publication of the ARWU ranking	Only publications of "articles" and "proceedings papers" are considered. When calculating the total number of papers of an institution, a special weight of two was introduced for papers indexed in Social Science Citation Index.	20%
Per capita academic performance	Weighted scores of the above five indicators divided by the number of full-time equivalent (FTE) academic staff.	If the number of academic staff of a country's institutions cannot be obtained, a weighted score of the above five indicators is used. The data are obtained from national agencies such as the Ministry of Education, the Bureau of Statistics, the Association of Universities and Colleges, the Rector's Conference.	10%
Total			100%

Source: Academic Ranking of World Universities (ARWU) (2013), "Shanghai ranking" 2003-13, *www.shanghairanking.com* (accessed on 5 June 2014); based on the official website of the Nobel Prize, *www.nobelprize.org*; International Mathematical Union, List of fields medallists web page, *www.mathunion.org/index.php?id=prizewinners*; Thomson Reuters, Highly Cited Researchers website, *www.highlycited.com*; Thomson Reuters, Web of Science website, *www.webofknowledge.com* (papers published in *Nature* and *Science* and articles indexed in Science Citation Index-Expanded and Social Science Citation Index); national sources (number of FTE academic staff).

Business R&D and innovation

(d) Business R&D expenditure (per GDP). Business enterprise expenditure on R&D (BERD) accounts for the bulk of R&D activity in most OECD countries. It is frequently used to compare countries' private-sector efforts on innovation since industrial R&D is more closely linked to the creation of new products and production techniques and mirrors market-oriented innovation efforts. Data are drawn from the OECD MSTI Database and are based on harmonised national R&D surveys and national accounts, except for Latvia and Lithuania for which data come from Eurostat STI Databases and for Colombia, Costa Rica, India, Indonesia and Malaysia for which data come from the UIS.

(e) Top 500 corporate R&D investors (per GDP). Big companies make an important contribution to R&D and innovation. Large firms tend to introduce innovations of larger scale and bigger impact than SMEs which more frequently tend to be "adopters" and "pioneers" (OECD, 2009). In addition, large firms often drive collaboration, as they play a

structuring role in innovation clusters that also include SMEs. Large firms also play the role of "innovation assemblers": by integrating innovations from SMEs in their own products, they bring SMEs' innovations to markets. The 2013 *EU Industrial R&D Investment Scoreboard* (*http://iri.jrc.ec.europa.eu/scoreboard13.html*) presents economic and financial information about the world's 2 000 largest companies ranked according to the level of their own-funded R&D investments. The top 500 accounted in 2012 for 82% of the 2 000 firms' total R&D investments. Data are based on companies' publicly available audited accounts. The EU Scoreboard is intended to raise awareness of the importance of R&D for businesses and to encourage firms to disclose information about their R&D investments and other intangible assets. It gathers information about a sample of 527 European and 1 473 non-European firms that invested more than EUR 22.6 million in R&D in 2012. For different reasons (changes in exchange rates, mergers and acquisitions, etc.), the composition of the sample may vary from year to year and data are not fully comparable from one edition of the EU Scoreboard to the next. It is worth noting that companies' accounts do not include information on where R&D is actually performed and that companies' total R&D investment is attributed to the country in which it is registered. The EU Scoreboard's approach to BERD is, therefore, different from that of statistical offices or the OECD which attribute data to a specific territory. The EU Scoreboard data are primarily of interest to those concerned with benchmarking company commitments and performance (e.g. companies, investors and policy makers), while BERD data are primarily used by economists, governments and international organisations interested in the R&D performance of territorial units defined by political boundaries (EC, 2013). The two approaches are complementary. The number of top 500 corporate R&D investors is expressed per million US dollars of GDP at PPP to take account of the size of the country.

(f) Triadic patents (per GDP). Patents provide a uniquely detailed source of information on the inventive activity of countries. Triadic patents are typically of relatively high value and eliminate biases arising from home advantage and the influence of geographical location. Triadic patent families are defined as patents applied for at the European Patent Office (EPO), the Japan Patent Office (JPO) and the US Patent and Trademark Office (USPTO) to protect a same invention. Counts are presented according to the priority date and the residence of the inventors. The number of triadic patent families applied for over the 2009-11 period is expressed per billion US dollars of GDP at PPP. Data for patents are drawn from the OECD Patent Database (*www.oecd.org/sti/ipr-statistics*).

(g) Trademarks (per GDP). A trademark is a sign that distinguishes the goods and services of one undertaking from those of other undertakings. Firms use trademarks to launch new products on the market in order to signal novelty, promote their brand and appropriate the benefits of their innovations. Trademarks convey information not only on product innovations, but also on marketing innovations and innovations in the services sector. The number of trademark applications is highly correlated with other innovation indicators (OECD, 2011a). Because the data relating to trademark applications are publicly available immediately after filing, trademark-based indicators can provide timely information on the level of innovative activity (OECD, 2011a). Trademark-based indicators are therefore a good predictor of economic downturns (OECD, 2010c). However, trademarks counts are subject to home bias as firms tend to file trademarks in their home country first. Trademarks abroad correspond to the number of applications filed at the USPTO (Graham, 2013), the Office for Harmonization in the Internal Market (OHIM), and the JPO, by application date and country of residence of the applicant. For the United States, EU

members and Japan, counts exclude applications in their domestic market (USPTO, OHIM and JPO, respectively). Counts are rescaled by taking into account the relative average propensity of other countries to file in these three offices (OECD, 2013a). The number of trademarks applied for over the 2010-12 period is expressed per billion US dollars of GDP at PPP. Data for trademarks are drawn from OECD calculations based on USPTO Bulk Downloads: Trademark Application Text hosted by Reed Technology Information Services; OHIM Community Trademark Database CTM Download; JPO Annual Reports 2001-13.

Entrepreneurship

(h) Venture capital (per GDP). A financial and policy environment that fosters the start-up and growth of new firms is essential for innovation to flourish. Access to finance for new and innovative small firms is vital but banks may be reluctant to lend to risky ventures. For entrepreneurial firms, especially if they are young, technology-based and have high growth potential, venture capital is an important source of funding during the seed, start-up and growth phases. Venture capital (VC) is private equity provided by specialised firms acting as intermediaries between primary sources of finance (insurance, pension funds, banks, etc.) and private companies whose shares are not freely traded on any stock market. Data for VC investments are drawn from the OECD Entrepreneurship Financing Database (OECD, 2014b).

(i) Patenting firms less than 5 years old (per GDP). The presence of young firms among patent applicants underlines the inventive dynamics of firms early in their development. Young firms are defined as firms less than five years old with an incorporation date in business registers (ORBIS©) between 2004 and 2011. Patenting firms are those filing patent applications at the European Patent Office (EPO), at the US Patent and Trademark Office (USPTO) or through the Patent Cooperation Treaty (PCT) between 2008 and 2011. It should be stressed that this experimental indicator is obtained by matching patent (EPO/USPTO/PCT patent filings) and business (listed in the ORBIS database) data: the names of applicants as they appear in the patent were linked with those of firms listed in business registers. Counts are limited to a set of patent applicants which have been successfully matched with business register data. In addition, only countries with average matching rates over 70% over the period are included. Counts of young patenting firms are expressed per billion USD GDP using PPPs. Data for young patenting firms are based on the OECD Patent Database and the ORBIS Database (Bureau Van Dijk Electronic Publishing).

(j) Ease of entrepreneurship index. For businesses to enter the market and grow they need a suitable regulatory framework. Most OECD countries have lowered barriers to entrepreneurship during the last decade (OECD, 2010c). The "barriers to entrepreneurship" indicator is one of the OECD Indicators of Product Market Regulation (PMR) and measures regulations affecting entrepreneurship. The index uses a scale of zero to six to evaluate: i) complexity of regulatory procedures (e.g. licences and permits system, communication and simplification of rules and procedures); ii) administrative burdens on start-ups (e.g. administrative burdens for corporations and sole proprietor firms, barriers in services sector) and iii) regulatory protection of incumbents (e.g. legal barriers to entry, antitrust exemptions, barriers in network sectors). As lower values suggest lower barriers, the barriers to entrepreneurship index is reversed so as to be read in the same way as other indicators used in this international benchmark. The ease of entrepreneurship index is calculated as 6 minus the barriers to entrepreneurship index. Calculations are made with 2013 data drawn from the OECD, Product Market Regulation Database (*www.oecd.org/economy/pmr*).

Internet for innovation

The Internet has become a critical infrastructure for businesses, consumers/users and the public sector (OECD, 2011a). In terms of data transmission, traffic levels have increased exponentially and are expected to continue to do so. New network applications and the expected migration of mobile users to more advanced 3G networks place larger demands on existing infrastructures by generating more traffic flow.

(k) ICT investment (per GDP). ICT investment is defined according to the 1993 System of National Accounts (SNA). It has three components: *i)* information technology equipment (computers and related hardware); *ii)* communications equipment; and *iii)* software. Software includes acquisition of pre-packaged software, customised software and software developed in house. Measuring investment in software is often problematic, as its capitalisation in national accounts is recent, methodologies vary and there are difficulties linked to its acquisition (e.g. rental and licence, embedded in hardware, or developed on own account). ICT investment is expressed as a percentage of GDP. Data for ICT investment are taken from *Measuring the Digital Economy: A New Perspective* (OECD, 2014c), except for Latvia and Lithuania for which data come from Eurostat ANA Databases.

(l) Fixed broadband subscriptions (per population). Broadband provides high-speed Internet access and enables the broader participation of customers, suppliers, competitors, government laboratories and universities in the innovation process. It makes outsourcing and off-shoring more efficient and has changed personal and business practices dramatically (OECD, 2010c). OECD work also indicates a strong correlation between the penetration of broadband and the use of e-government services by citizens (OECD, 2009). While mobile broadband is developing rapidly and has become the dominant broadband access channel in OECD countries, fixed wired broadband connections are still the foundation of high-speed data transport (OECD, 2012). Fixed broadband includes all subscriptions to DSL lines offering Internet connectivity (the DSL line is excluded if it is not used for Internet connectivity, e.g. leased lines), cable modem, fibre-to-the-premises (e.g. house, apartment) and fibre-to-the-building (e.g. apartment LAN) and other broadband over power lines capable of download speeds of at least 256 kbit/s. It does not include 3G mobile technologies and Wi-Fi. The number of fixed broadband subscriptions includes business and residential connections and is expressed per 100 inhabitants. Data for fixed broadband subscriptions are drawn from the OECD Broadband Statistics portal (*www.oecd.org/sti/ict/broadband*) which are compiled from information collected directly from telecommunications firms and national regulators twice a year. For non-OECD countries, data come from the ITU World Telecommunication/ICT Indicators 2013 Database and population data come from Eurostat and the UIS.

(m) Wireless broadband subscriptions (per population). Wireless broadband includes subscriptions with advertised download speeds of at least 256 kbit/s through satellites, terrestrial fixed wireless, terrestrial mobile wireless (including standard mobile subscriptions and dedicated data subscriptions). It does not include Wi-Fi. The number of wireless broadband subscriptions includes business and residential connections, to the exclusion of satellite subscriptions that tend to be null,and is expressed per 100 inhabitants. Data for fixed broadband subscriptions are drawn from the OECD Broadband Statistics which are compiled from information collected directly from telecommunications firms and national regulators twice a year. For non-OECD countries,

data come from the ITU World Telecommunication/ICT Indicators 2013. Database and population data come from Eurostat and the UIS.

(n) E-government readiness index. Governments increasingly use the Internet to improve their interaction with citizens by making it easier for them to obtain information, fill out necessary forms and file taxes (OECD, 2012). ICTs support changes in public services delivery by allowing more personalised, better-quality services, changes in work organisation and management through greater back-office coherence and efficiency; this improves the transparency of government activities as well as citizen engagement. OECD countries are transforming government through the use of ICT and ICT-enabled governance structures, new collaboration models (i.e. sharing data, processes and portals), and networked or joined-up administrations. ICTs increasingly drive public-sector innovation. The e-government readiness index is a composite index which shows how prepared a country is to use ICT-enabled public administrations for greater efficiency and measures its capacity to develop and implement e-government services. The index ranges from 0 (low level of readiness) to 1 (high level). Data are drawn from the UN e-government survey 2013.

Knowledge flows and commercialisation

Public research is the source of significant scientific and technological breakthroughs. To optimise the economic and social benefits from public research and the return on public R&D investments, effective linkages are needed between academia and industry. Knowledge flows between public research institutions and industry are channelled through spin-offs, joint research projects, training, consultancy and contract work, the commercialisation of public research output, staff mobility between workplaces and informal co-operation by researchers.

(o) Industry-financed public R&D expenditures (per GDP). Direct funding of public research by industry takes the form of grants, donations and contracts and influences the scope and orientation of public research, generally steering it towards more applied and commercial activities. The share of public R&D expenditure financed by industry is the domestic business enterprise sector's contribution to the intramural R&D expenditures of the higher education (HERD) and government (GOVERD) sectors. Data are drawn from the OECD MSTI Database and are based on harmonised national R&D surveys and national accounts, except for Latvia and Lithuania for which data come from Eurostat STI databases and for Colombia, Costa Rica, India, Indonesia and Malaysia for which data come from the UIS.

(p) Patents filed by universities and public labs (per GDP): The pool of available public research output can be diffused and commercialised via patenting and licensing. Patents applications by universities and public research institutions cover the government sector, higher education and hospitals. They include patent applications filed under the PCT between 2007 and 2011, by priority date and applicant's country of residence. Patent applicant names are allocated to institutional sectors using a dataset developed by Eurostat and Katholieke Universiteit Leuven (KUL). Because there are important variations in the names recorded in patent documents, misallocations to sectors may occur and thus introduce biases in the resulting indicator. Patent data are drawn from the Worldwide Patent Statistical Database (PATSTAT), EPO, Spring 2014 and ECOOM-EUROSTAT-EPO PATSTAT Person Augmented Table (EEE-PPAT), October 2013. Only countries having filed at least 250 patents over the period are included. Patent counts by universities and PRIs are expressed per billion USD GDP PPP.

(q) International co-authorship in total scientific articles (%). The growing specialisation of scientific disciplines and the increasing complexity of research encourage scientists to engage in collaborative research. Production of scientific knowledge is shifting from individuals to groups, from single to multiple institutions, and from a national to an international focus. Researchers increasingly network across national and organisational borders (OECD, 2009). International co-authorship of research publications provides a direct measure of international collaboration in science. International co-authorship is measured as the share of scientific articles produced in collaboration by two or more authors from different countries between 2011 and 2013. Data are drawn from the Elsevier Research Intelligence database.

(r) International co-invention in PCT patent applications (%). International co-invention of patents is a measure of the internationalisation of research and illustrates formal R&D co-operation and knowledge exchange among inventors in different countries. International collaboration by researchers can take place either within a multinational corporation (with research facilities in several countries) or through a research joint venture among several firms or institutions (e.g. universities or public research institutions). International co-operation is less widespread for patented inventions than for scientific publications (OECD, 2011a). International co-invention is measured as the share in total patents invented domestically of patent applications filed under the PCT between 2009 and 2011 with at least one co-inventor located abroad. Data are drawn from the OECD Patent Database.

Human resources for innovation

Education systems play a broad role in supporting innovation because knowledge-based societies rely on a highly qualified and flexible labour force. While basic competences are generally considered important for absorbing new technologies, high-level competences are essential for the creation of new knowledge and technologies.

(s) Tertiary education expenditure (per GDP). Education expenditure represent the total cost of services provided by all types of educational institutions (e.g. public institutions, government-dependent private institutions, and independent private institutions), without regard to sources of funds (whether they are public or private). Tertiary-level programmes include those delivering university degree, vocational qualifications, or advanced research degrees of doctorate standard, at a minimum at Level 5 of the International Standard Classification of Education (ISCED) 1997. Education expenditure data are drawn from the OECD Education and Training Database, based on the UNESCO-OECD-Eurostat (UOE) data collection on education statistics, compiled from national administrative sources, reported by ministries of education or national statistical offices.

(t) Adult population at tertiary education level (%). The adult population with tertiary educational attainment is a measure of a country's pool of workers with advanced, specialised knowledge and skills. It indicates its potential to absorb, develop and diffuse knowledge and shows its capacity to upgrade continuously its high-end skills supply. Educational attainment affects all aspects of adult learning. Adults with higher levels of educational attainment are more likely to participate in formal and non-formal education during their working lives than adults with lower levels of attainment. Tertiary graduates are those with a university degree, vocational qualifications, or advanced research degrees of doctorate standard, at a minimum at ISCED Level 5. The adult population is defined as

those aged 25 to 64 years old. Data on population and educational attainment are compiled from national labour force surveys (LFS). Data come from *OECD Education at a Glance 2014* (*www.oecd.org/edu/eag.htm*) (OECD, 2014d). For Latvia and Lithuania data are drawn from Eurostat Education and Training databases. For Argentina, China, Colombia, Costa Rica, Indonesia and South Africa, data are from the UIS Education Database.

(u) Top adult performers in technology problem solving (%). The Survey of Adult Skills defines problem solving in technology-rich environments as "using digital technology, communication tools and networks to acquire and evaluate information, communicate with others and perform practical tasks". It focuses on "the abilities to solve problems for personal, work and civic purposes by setting up appropriate goals and plans, and accessing and making use of information through computers and computer networks" (OECD, 2013b). Problem solving in technology-rich environments represents the intersection of what are sometimes described as "computer literacy" skills (i.e. the capacity to use ICT tools and applications) and the cognitive skills required to solve problems. Data are drawn from the OECD Skill Outlook 2013 based on countries' results in the Programme for the International Assessment of Adult Competencies (PIACC) (OECD, 2013b).

(v) 15-year-old top performers in science (%). Demand for skills increasingly emphasises capabilities for adapting and combining multidisciplinary knowledge and solving complex problems. The acquisition of such skills starts at a very early age. The top performers in science are the students who reach the two highest levels of proficiency (levels 5 and 6) in the OECD Programme for International Student Assessment (PISA) 2013 science assessment (i.e. they have obtained scores of more than 633.33 points). The number of top performers is expressed as a percentage of 15-year-olds. Data are drawn from the OECD PISA 2013 Database (*www.pisa.oecd.org*).

(w) Graduation rate in science and engineering at doctoral level. Doctoral graduates are those with the highest educational level and are key players in research and innovation. They have been specifically trained to conduct research and are considered best qualified to create and diffuse knowledge (OECD, 2010c). They have attained the second stage of university education and obtain a degree at ISCED Level 6. They have successfully completed an advanced research programme and gained an advanced research qualification (e.g. Ph.D.). Graduation rates represent the estimated percentage of an age cohort that will complete the corresponding level of education during its lifetime (the number of graduates, regardless of their age, is divided by the population at the typical age of graduation). However, in some countries, graduation rates at the doctoral level are inflated by a high proportion of international students (e.g. Germany, Sweden and Switzerland). Science degrees include: life sciences; physical sciences; mathematics and statistics; and computing. Engineering degrees comprise: engineering and engineering trades; manufacturing and processing; and architecture and building. The rates presented combine graduation rates at doctoral level and the share of doctorate graduates by field of study. They constitute a good proxy of graduation rates in science and engineering at doctoral level. Data are drawn from *OECD Education at a Glance 2014* (OECD, 2014d) and the OECD Education Database (*www.oecd.org/edu/database*). For Latvia and Lithuania data are drawn from Eurostat Education and Training databases. For Argentina, China, Colombia, Costa Rica, Indonesia and South Africa, data are from UIS.

Structural composition of BERD (Panel 2 of the country profiles)

A country's industrial structure determines the composition of its BERD and affects the growth prospects of its business research system.

Industrial structure

Industries and services are defined on the basis of the International Standard Industrial Classification (ISIC) Rev.4. The sectors are classified according to their R&D intensity (R&D expenditures relative to output). Data are drawn from the OECD ANBERD Database (*www.oecd.org/sti/anberd*). ANBERD has recently moved to the new sectoral classification, ISIC Rev.4, in line with the OECD STAN family of sectoral databases. Sectoral groupings may refer to years anterior to those for which industrial breakdown is available for countries in which recent data are available according to the new classification. For Latvia and Lithuania data are drawn from Eurostat STI databases.

The sectoral groupings are defined as:

Industry includes Mining (Section B), Manufacturing (Section C) utilities, i.e. Electricity, gas, steam and air conditioning supply (Section D) and Water supply, sewerage, waste management and remediation activities (Section E) and Construction (Section F). *Services* includes market-sector services (Sections G-N Divisions 45-82) and non-market-sector services (Sections O-T). Public-sector services encompass government (84), education (85), health (86-88), other community, social and personal services (90-96), and services to private households (97-98). However the distinction between market and public services on an industry-based definition is only approximate, as some services can be provided by public or private entities, or by a mix of the two (OECD, 2013a).

High-technology manufacturing includes manufacture of basic pharmaceutical products and pharmaceutical preparations (Section C Division 21), manufacture of computer, electronic and optical products (26), manufacture of air and spacecraft and related machinery (30.3). *Medium-high to low-technology industries* includes all other manufacturing industries. High- and medium-high-technology manufacturing is usually defined on the basis of industry R&D intensity, i.e. R&D expenditures relative to output. As countries are adopting the new ISIC revision and ISIC Rev.4 data are becoming available, technology aggregates are currently being redefined. In the meantime, an approximate correspondence from the ISIC Rev.3 definition has been adopted.

High-knowledge market services refer to ISIC Rev.4 Section J: Information and communication (Divisions 58-63); K: Finance and insurance (64-66); and M: Professional, scientific and technical activities (69-75), including scientific research and development (72). *Low-knowledge services* include all other market services.

Primary-resource-based industries are those that involve the harvesting, extraction and processing of natural resources. This aggregate includes: Agriculture, forestry and fishing (Section A), Mining and quarrying (Section B), Food products, beverages and tobacco (Section C Divisions 10-12), Wood and products of wood and cork (16), Pulp, paper and paper products (17), Coke, refined petroleum products and nuclear fuel (19), Other non-metallic mineral products (23), Basic metals (24) and Electricity, gas and water supply (Sections D-E). Owing to their small contribution to total BERD and issues of data availability, Wearing apparel, dressing and dying of fur (14) and Leather, leather products and footwear (15) are not included. This sectoral grouping is not represented in the charts of countries in which these industries contribute marginally to business R&D expenditures.

Firm population

SMEs play a key role in the R&D and innovation system. They are defined as firms with fewer than 250 employees; large firms have 250 employees and more. BERD data by firm size come from the OECD RDS Database.

Role of multinationals

Foreign affiliates contribute in many ways to a host country's international competitiveness by providing domestic firms with access to new markets, introducing new technologies and generating knowledge spillovers. In particular, foreign affiliates invest a higher share of their revenue in R&D than domestic firms (OECD, 2009). In addition, in the search for new technological competences, larger local market opportunities and lower R&D costs, companies are moving their research activities abroad. The geographical origin of a foreign affiliate is the country of residence of the ultimate controller. An investor (company or individual) is considered to be the investor of ultimate control if it is at the head of a chain of companies and controls directly or indirectly all the enterprises in the chain without itself being controlled by any other company or individual. The notion of control implies the ability to appoint a majority of administrators empowered to direct an enterprise, to guide its activities and determine its strategy. In most cases, this ability can be exercised by a single investor holding more than 50% of the shares with voting rights. Data come from the OECD AMNE Database.

Revealed technology advantage in selected technological areas (Panel 3 of the country profiles)

The revealed technology advantage (RTA) index provides an indication of the relative specialisation of a given country in selected technological domains and is based on patent applications filed under the Patent Cooperation Treaty. It is defined as a country's share of patents in a particular technology field divided by the country's share in all patent fields. The index is equal to zero when the country holds no patents in a given sector; is equal to 1 when the country's share in the sector equals its share in all fields (no specialisation); and above 1 when a positive specialisation is observed. Only economies with more than 250 patents over the period reviewed are included. Data are drawn from the OECD Patent Database.

Allocation of public funds to R&D, by sector, type and mode of funding (Panel 4 of the country profiles)

This figure shows several features of national research systems that are areas of direct or indirect public intervention.

Public research

Universities versus public research institutes (by sector of performance). Public research is traditionally performed by universities and PRIs (see the policy profile on "Public research missions and orientation"). Although there is a general trend in the OECD area towards reinforcing the role of universities, PRIs still make a major contribution in several countries (e.g. China, Luxembourg, the Russian Federation). The figure shows the balance between R&D performed by universities and R&D performed by PRIs, as a percentage of total public expenditures on R&D. Public expenditure on R&D is the sum of HERD and GOVERD. Data are drawn from the OECD MSTI Database and are based on harmonised national R&D

surveys. Data for Latvia and Lithuania are drawn from Eurostat STI Databases and data for Colombia, Costa Rica, India, Indonesia and Malaysia from the UIS.

Basic research versus applied research/development (by mission/orientation). Most basic research is performed by universities and PRIs (see the policy profile on "Public research missions and orientation"). Basic research is essential for developing new scientific and technological knowledge and builds the long-term foundations of knowledge societies. It is experimental or theoretical work undertaken primarily to acquire new knowledge, without any particular application or use in view. The figure shows the balance between public expenditure on R&D for basic research and public expenditure on R&D for the purpose of applied research and experimental development. Total public expenditure on R&D is the sum of HERD and GOVERD. Data are drawn from the OECD RDS Database and are based on harmonised national R&D surveys. Data for Latvia and Lithuania are drawn from Eurostat STI databases and data for Colombia, Costa Rica, India, Indonesia and Malaysia from the UIS.

Civil-oriented versus defence-oriented (by socio-economic objective). Government budget appropriations or outlays for R&D (GBAORD) by socio-economic objective indicate the relative importance of various socio-economic objectives, such as defence, health and the environment, in public R&D spending. These are the funds committed by the federal/central government for R&D (GBAORD generally covers only the federal or central government). Programmes are allocated according to socio-economic objectives on the basis of intentions when the funds are committed and may not reflect the actual content of the projects implemented. They reflect policies at a given moment in time. The classification used is the European Commission's Nomenclature for the Analysis and Comparison of Scientific Programmes and Budgets – NABS (see the *OECD Frascati Manual,* OECD, 2002). The GBAORD data are based on funders' reports; they are less accurate than "performer-reported" data, but they are more timely and can be linked back to policy issues by means of a classification by "objectives" or "goals".

Civil GBAORD equals to total GBAORD less defence. Defence R&D financed by government, including military nuclear and space but excluding civilian R&D financed by ministries of defence (e.g. meteorology). Data are drawn from the OECD RDS Database and based on budget data assembled by national authorities using statistics collected for budgets. Data for Latvia and Lithuania are drawn from Eurostat.

Generic research versus thematic research (by socio-economic objective). Generic public research includes: general university funds (GUF), a block grant which includes an estimated R&D content, granted by government to the higher education sector; and non-oriented GBAORD, which covers research programmes financed with a view to the advancement of knowledge. Thematic public research includes all other GBAORD. Data are drawn from the OECD RDS Database and based on budget data assembled by national authorities using statistics collected for budgets. Data for Latvia and Lithuania are drawn from Eurostat.

Institutional versus project-based funding (by funding mechanism). Governments support public research by means of institutional and project-based funding (see the policy profile on "Financing public research"). Institutional "block" grants provide stable long-run funding of research, while project-based funding can promote competition within the research system and target strategic areas. Project funding is defined as funding attributed on the basis of a project submission by a group or individuals for an R&D activity that is limited in scope, budget and time. Institutional funding is defined as the general funding of institutions with no direct selection of R&D projects or programmes (OECD, 2010c). The figure shows the balance between institutional funding and project funding for selected

OECD countries. However it does not reflect the share of block funding allocated on performance criteria and the spread of new performance-based funding mechanisms, e.g. the research excellence initiatives. Data are based on an exploratory project carried out by NESTI on public R&D funding and comparability may be limited (Van Steen, 2012; OECD, 2013). Complementary data are drawn from Eurostat STI Databases.

Business R&D

Private investment in R&D and innovation may be below a socially optimal level, mainly because returns are uncertain or the innovator cannot appropriate all of the benefits. Governments therefore play an important role in fostering investment in R&D and innovation (see the policy profile on "Government financing business R&D and innovation"). They can choose among various tools to leverage private-sector R&D. They can offer firms direct support via grants, loans or procurement or they can use fiscal incentives, such as R&D tax incentives (R&D tax credits, R&D allowances, reductions in R&D workers' wage taxes and social security contributions, and accelerated depreciation of R&D capital (see the policy profile on "Tax incentives for R&D and innovation").

Direct versus indirect funding (by funding mechanism). Direct R&D grants or subsidies target specific projects with high potential social returns. Tax credits reduce the marginal cost of R&D activities and allow private firms to choose which projects to fund. The optimal balance of direct and indirect R&D support varies from country to country, as each tool addresses different market failures and stimulates different types of R&D. For instance, tax credits mostly encourage short-term applied research, while direct subsidies foster more long-term research. Direct government funding of R&D is the amount of business R&D funded by the government as reported by firms. It is the sum of different components (contracts, loans, grants/subsidies) with different impacts on the cost of performing R&D. R&D grants and loans decrease the cost of performing R&D, but contracts (usually awarded through competitive bidding) do not directly affect the cost of performing R&D. Foregone revenues on R&D and innovation tax incentives are an estimated cost of the R&D tax concession. As the cost of tax incentives is estimated and reported in different ways across counties, these indicators are experimental. Eligible R&D expenditures can differ, and companies may use R&D tax incentives in some circumstances to fund intramural or extramural R&D, some of which may take place in other sectors. Tax incentives are excluded from the definition of government-funded BERD to minimise the risk of double counting. Data are drawn from the OECD RDS Database and from the NESTI data collection on R&D tax incentives (*www.oecd.org/sti/rd-tax-stats.htm*).

Balance

Business R&D versus public research. Governments support both public-sector research and business R&D and innovation but in different proportions. Most public money spent on R&D goes to universities and PRIs. However, public support to business R&D seems to have gained ground in many countries over the past five years. The figure shows the relative balance between government funding to universities and PRIs and government funding to business R&D. The former is defined as the sum of HERD and GOVERD funded by both government and higher education. The latter is defined as the sum of government-funded BERD and the estimated cost of R&D tax incentives, if any. The balance is expressed as a percentage of the sum of the two. Data are drawn from the OECD RDS Database and the NESTI data collection on R&D tax incentives.

Most relevant instruments of public funding of business R&D (Panel 5 of the country profiles)

Governments finance business R&D and innovation through a mix of complementary direct and indirect instruments (see Chapter 1 and the policy profile on "Government financing business R&D and innovation"). Direct funding allows governments to target specific R&D activities and depends on discretionary decisions by governments and arm-length organisations (e.g. national funding agencies). Tax incentives reduce the marginal cost of R&D and innovation spending and are usually more neutral in terms of industry, region and firm characteristics. While direct subsidies tend to target long-term research, R&D tax schemes are more likely to encourage short-term applied research and boost incremental innovation rather than radical breakthroughs.

Direct funding. Governments may offer financial support to firms through a variety of competitive grants, repayable advances (e.g. subordinated to profit making by firms), debt financing mechanisms (e.g. loans at preferential rate, credit guarantee schemes that reimburse a pre-defined share of the outstanding loan to the lender in the event of a loan default, risk-sharing mechanisms such as guarantee funds and mutual guarantee associations that provide lenders with insurance against firms' risk of default, etc.). Many countries have schemes and funds to access early-stage finance, particularly for equity, and to support the venture capital industry, e.g. through public venture capital funds, co-investment funds with private investments and "funds of funds" (see the policy profile on "Financing innovative entrepreneurship"). Technology consulting and extension programmes, albeit not a funding instrument per se, help firms access expertise, knowledge and technology at low or no cost. Innovation vouchers whose face value varies across countries are granted to firms for the purchase of knowledge services from universities and public research and education providers. Direct funding through public procurement is not included in the figure.

Indirect funding. Tax incentives applicable to different tax arrangements, including corporate and personal income taxes, are also widely used to encourage private investments in R&D and the exploitation of IP assets, to attract business angels and leverage early-stage finance, and to attract foreign talent or foreign multinationals (see the policy profiles on "Tax incentives for R&D and innovation" and "Financing innovative entrepreneurship"). In the figure, a distinction is made between tax breaks that are granted on the basis of expenditures incurred for R&D and innovation activities (expenditure-based) and tax breaks that are granted on gains from innovative activities (income-based).

Data are drawn from country responses to the STI Outlook policy questionnaire 2014. Responses were provided by self-assessment by Delegates to the OECD Committee for Scientific and Technological Policy to the question: "C.3) Which of the following are the principal instruments of public funding of business R&D and innovation in your country? How has the relative balance between these instruments changed recently, if at all? Please rate the relative relevance of the following financial instruments in your country's policy mix (high; medium; low; and not used) and indicate whether their share in the total has increased/decreased or is remained unchanged." Responses have been aggregated as followed: 0 = not used; 1 = low and decreasing relevance; 2 = low and stable relevance; 3 = low and increasing relevance; 4 = medium and decreasing relevance; 5 = medium and stable relevance; 6 = medium and increasing relevance; 7 = high and decreasing relevance; 8 = high and stable relevance; 9= high and increasing relevance.

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STI country profiles reader's guide

The country profiles (CPs) in the 2014 *OECD STI Outlook* (STIO) are designed to provide a concise overview of science, technology and innovation (STI) policy and performance in OECD members and selected non-OECD economies. Each country profile is based on information gathered from the country's response to the OECD STIO policy questionnaires 2012 and 2014, as well as various additional OECD and non-OECD sources.

Headings in the country profiles are linked to the STIO policy profiles, which examine the main global STI policy trends across countries. Issues featuring in both the policy and country profiles are: *i)* innovation policy governance; *ii)* new sources of growth; *iii)* new challenges; *iv)* universities and public research; *v)* innovation in firms; *vi)* innovative entrepreneurship; *vii)* technology transfer and commercialisation; *viii)* clusters and smart specialisation; *ix)* globalisation; and *x)* skills for innovation.

The table of key figures presents indicators on the country's economic performance (labour productivity), environmental performance (green productivity and demand), the size of its R&D system as measured by gross domestic expenditure on R&D (GERD), the degree of public commitment to S&T as measured by the share of GERD that is publicly financed, and the changes in these indicators over the past five years. In the text, all amounts are given both in USD in purchasing power parities (PPP) of the relevant year (if available) and in national currencies.

Panel 1 contains a double figure that sheds light on the strengths and weaknesses of the country's STI performance. It uses indicators on the country's national innovation system and performance with respect to: universities and public research, business R&D and innovation, innovative entrepreneurship, information and communication technology (ICT) and Internet infrastructure, networks, clusters and transfers, and skills for innovation. The dot for each indicator positions the country relative to the OECD median and to the top and bottom five OECD countries. Non-OECD countries are also compared to the OECD benchmarks, and may fall out of the range indicated in the figure (e.g. below the lowest OECD country). All indicators are normalised (by GDP and population cohorts) to take account of the size of the economy and the relevant population cohorts, and are presented as indices (OECD median = 100) for benchmarking purposes.

Panel 2 shows the structural composition of business expenditure on R&D (BERD) in terms of performance of the main industry sectors, firm size and firms' national affiliation. It reflects the country's industry structure and its business innovation efforts. Panel 3 presents the country's revealed technological advantage (RTA), as measured by international patent applications filed under the Patent Cooperation Treaty (PCT) in three key technology fields (bio- and nano-technology, ICTs, and environment-related technologies). It also shows the number of patents filed by universities and public research institutions in these fields.

Panel 4 gives an overview of the country's policy mix for public R&D, i.e. the orientation and funding modes of public research. It also illustrates changes in the policy mix for R&D over the past five years. Finally, Panel 5, a new feature in STIO 2014, reflects the balance and relative importance of various government measures to support business R&D and innovation. It is based on the country's self-assessment in its reply to the OECD STIO 2014 policy questionnaire.

Further details on the methodology, data sources and descriptions of indicators used in the country profile are provided in Annex 9.A. Data, metadata as well as the original sources and databases of the indicators used in the STIO 2014 are accessible at the statistical portal IPP.Stat (cut-off date: 8 July 2014).

Abbreviations used in the country profiles

BERD: Business expenditure on research and development

EU: European Union

FDI: Foreign direct investment

GDP: Gross domestic product

GERD: Gross expenditure on research and development

HEIs: Higher education institutions

IPRs: Intellectual property rights

MNEs: Multinational enterprises

PRIs: Public research institutes

R&D: Research and development

S&E: Science and engineering

SSS: Smart specialisation strategy (also known as 3S)

STI: Science, technology and innovation

S&T: Science and technology

3S: See SSS

STEM: Science, technology, engineering and mathematics

USD: United States dollars
(converted using the purchasing power parities of the relevant year)

VC: Venture capital

Synthetic table

Table 9.1. **Comparative performance of national science and innovation systems, 2014**

Country relative position: in the top 5 OECD or above (★), in the middle range on par or above OECD median (▲), in the middle range below OECD median (Δ) and in the bottom 5 OECD or below (○)

		Competences and capacity to innovate									
		Universities and public research			R&D and innovation in firms				Innovative entrepreneurship		
		Public R&D expenditure (per GDP)	Top 500 universities (per GDP)	Publications in the top-quartile journals (per GDP)	Business R&D expenditure (per GDP)	Top 500 corporate R&D investors (per GDP)	Triadic patent families (per GDP)	Trademarks (per GDP)	Venture capital (per GDP)	Young patenting firms (per GDP)	Ease of entrepreneurship index
		PUB_XGDP	UNI500_GDP	PUB25_GDP	BE_XGDP	CORPRD500_GDP	PTRIAD_GDP	TRDMRK_GDP	VC_XGDP	PTYG_GDP	EASE_I
		(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Argentina	ARG	Δ	Δ	○	○	○	○	○			
Australia	AUS	▲	▲	▲	▲	Δ	Δ	▲	Δ		▲
Austria	AUT	▲	★	▲	▲	▲	▲	Δ	Δ	★	▲
Belgium	BEL	Δ	▲	▲	▲	Δ	▲	Δ	▲	Δ	Δ
Brazil	BRA		Δ	○		Δ	○	○			Δ
Canada	CAN	▲	▲	▲	Δ	Δ	▲	★	★	○	▲
Chile	CHL	○	Δ	○	○	○	○	Δ			Δ
China	CHN	Δ	Δ	○	▲	Δ	Δ	○			○
Colombia	COL	○	○	○	○						
Costa Rica	CRI	○	○	○	○	○					
Czech Republic	CZE	▲	Δ	Δ	Δ	Δ	Δ	Δ	○		Δ
Denmark	DNK	★	▲	★	▲	★	▲	▲	▲		▲
Estonia	EST	▲		▲	▲	○	Δ	Δ	▲		▲
Finland	FIN	★	★	▲	★	★	★	▲	★	★	▲
France	FRA	▲	Δ	Δ	▲	▲	▲	▲	▲	Δ	▲
Germany	DEU	★	▲	Δ	▲	▲	★	▲	▲	★	▲
Greece	GRC	○	Δ	Δ	○	Δ	○	○	○		Δ
Hungary	HUN	○	Δ	Δ	Δ	Δ	Δ	○	Δ		Δ
Iceland	ISL	★	○	★	▲	▲	Δ	★			Δ
India	IND	Δ	○	○	○	○	Δ	○			○
Indonesia	IDN		○	○	○		○	○			Δ
Ireland	IRL	Δ	▲	▲	Δ	▲	▲	▲	★	○	Δ
Israel	ISR	Δ	★	▲	★	▲	▲	▲	★		○
Italy	ITA	Δ	Δ	Δ	Δ	Δ	Δ	Δ	○	▲	★
Japan	JPN	▲	Δ	○	★	▲	★	Δ	Δ	○	▲
Korea	KOR	▲	Δ	Δ	★	▲	▲	▲	▲		Δ
Latvia	LVA	Δ	○	○	○		Δ				
Lithuania	LTU	Δ	○	○	○		Δ				
Luxembourg	LUX	○	○	Δ	Δ	★	▲	★	Δ		Δ
Malaysia	MYS	Δ	Δ	○	Δ	Δ					
Mexico	MEX	○	○	○	○	○	○	Δ			○
Netherlands	NLD	▲	▲	★	▲	▲	▲	▲	▲	▲	★
New Zealand	NZL	Δ	★	▲	Δ	Δ	Δ	★	Δ		★
Norway	NOR	▲	▲	Δ	Δ	▲	Δ	Δ	Δ	▲	Δ
Poland	POL	Δ	Δ	Δ	○	○	Δ	○	○		○
Portugal	PRT	Δ	▲	▲	Δ	Δ	Δ	Δ	Δ		▲
Russian Federation	RUS	Δ	○	○	Δ	Δ	○	○	Δ		Δ
Slovak Republic	SVK	Δ	○	○	○	○	○	○			★
Slovenia	SVN	Δ	▲	▲	▲	Δ	Δ	Δ	Δ		Δ
South Africa	ZAF	○	Δ	○	Δ	Δ	Δ	Δ	Δ		○
Spain	ESP	Δ	Δ	Δ	Δ	Δ	Δ	Δ	○	○	○
Sweden	SWE	★	★	★	★	★	★	▲	▲	★	Δ
Switzerland	CHE	▲	▲	★	▲	★	★	★	▲	★	▲
Turkey	TUR	Δ	○	○	Δ	Δ	○	○			○
United Kingdom	GBR	Δ	▲	▲	Δ	▲	▲	▲	▲	Δ	▲
United States	USA	▲	Δ	Δ	▲	▲	▲	▲	★	○	★
EU28	EU28	▲	▲	★	▲	Δ	▲	Δ	▲	▲	

Table 9.1. **Comparative performance of national science and innovation systems, 2014** *(cont.)*

Country relative position: in the top 5 OECD or above (★), in the middle range on par or above OECD median (▲), in the middle range below OECD median (Δ) and in the bottom 5 OECD or below (○)

		Interactions and skills for innovation												
		ICT and Internet infrastructures				Networks, clusters and transfers				Skills for innovation				
		ICT investment (per GDP)	Fixed broadband subscribers (per population)	Wireless broadband subscribers (per population)	E-government readiness index	Industry financed public R&D expenditure (per GDP)	Patents filed by universities and public labs (per GDP)	International co-authorship (%)	International co-invention (%)	Tertiary education expenditure (per GDP)	Adult population at tertiary education level (%)	Top adult performers in technology problem solving (%)	Top 15 year-old performers in science (%)	Doctoral graduate rate in science and engineering (%)
		ICTINV_XGDP	FBBAND_HAB	WBBAND_HAB	EGOV_I	PUB_BEF_XGDP	PATPRI_XGDP	INTCOA_XSA	COPAT_XPCT	TER_XGDP	ADTERPOP_XT	TOPAD_PST_XAD	TOP15_SCI_XT	PHDR_SCIENG_XCOH
		(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)	(s)	(t)	(u)	(v)	(w)
Argentina	ARG		○	○	○	○		Δ	★	▲	○		○	○
Australia	AUS	▲	Δ	★	▲	▲	▲	Δ	Δ	▲	▲	▲	★	▲
Austria	AUT	▲	Δ	▲	Δ	▲	Δ	★	▲	Δ	Δ	Δ	Δ	▲
Belgium	BEL	▲	▲	Δ	Δ	▲	▲	★	★	Δ	▲		▲	▲
Brazil	BRA		○	Δ	○		Δ	○	Δ	○	○		○	○
Canada	CAN	Δ	▲	Δ	▲	▲	▲	Δ	▲	★	★	▲	▲	▲
Chile	CHL		○	○	Δ	○	Δ	▲	Δ	★	○		○	○
China	CHN		○	○	○	▲	Δ	○	○		○			○
Colombia	COL		○	○	Δ			▲	Δ	★	Δ		○	
Costa Rica	CRI		○	○	○			★	★		Δ		○	
Czech Republic	CZE	Δ	Δ	Δ	○	Δ	Δ	Δ	▲	Δ	Δ	Δ	Δ	Δ
Denmark	DNK	★	★	★	★	Δ	★	▲	▲	▲	Δ	★	Δ	▲
Estonia	EST		Δ	▲	Δ	Δ		▲	★	▲	▲	○	★	Δ
Finland	FIN	Δ	▲	★	▲	★	▲	▲	Δ	★	▲	★	★	★
France	FRA	Δ	★	Δ	▲	Δ	★	▲	Δ	▲	Δ		▲	▲
Germany	DEU	Δ	▲	Δ	▲	★	▲	Δ	Δ	Δ	Δ	▲	▲	★
Greece	GRC	○	Δ	Δ	Δ	Δ	○	Δ	▲	▲	Δ		○	Δ
Hungary	HUN		Δ	○	Δ	▲	○	▲	▲	○	Δ		Δ	○
Iceland	ISL		▲	▲	Δ	★		★	▲	○	▲		Δ	Δ
India	IND		○	○	○		Δ	○	▲	○				
Indonesia	IDN		○	○	○			▲	★	○	○		○	○
Ireland	IRL	○	Δ	▲	Δ	○	★	▲	▲	▲	▲	○	▲	▲
Israel	ISR		Δ	Δ	▲	▲	★	Δ	Δ	▲	★		Δ	▲
Italy	ITA	Δ	Δ	Δ	Δ	○	Δ	Δ	○	○	○		Δ	Δ
Japan	JPN	★	▲	▲	▲	Δ	▲	○	○	▲	★	▲	★	Δ
Korea	KOR	▲	★	★	★	▲	★	○	○	★	★	○	▲	Δ
Latvia	LVA		Δ	Δ	Δ	▲		Δ	★	▲	Δ		○	Δ
Lithuania	LTU		Δ	○	Δ	★		Δ	Δ		▲		Δ	
Luxembourg	LUX	○	▲	▲	▲	Δ	Δ	★	★	○	▲		▲	
Malaysia	MYS		○	○	Δ			Δ	Δ	★	○		○	
Mexico	MEX	○	○	○	○	○	○	Δ	▲	Δ	○		○	○
Netherlands	NLD	▲	★	▲	★	★	▲	▲	Δ	▲	Δ	★	▲	Δ
New Zealand	NZL	★	▲	▲	▲	★	Δ	▲	Δ	▲	▲		★	▲
Norway	NOR		▲	▲	▲	▲	Δ	▲	Δ	▲	▲	★	Δ	▲
Poland	POL		○	▲	○	Δ	Δ	○	★	Δ	Δ	○	▲	○
Portugal	PRT	▲	Δ	○	Δ	○	Δ	▲	▲	Δ	○		○	Δ
Russian Federation	RUS		○	Δ	Δ	★	○	○	Δ	Δ	★		○	○
Slovak Republic	SVK	○	○	Δ	○	Δ		Δ	▲	○	Δ	○	Δ	▲
Slovenia	SVN	Δ	Δ	Δ	Δ	▲	Δ	Δ	Δ	Δ	Δ		▲	▲
South Africa	ZAF		○	○	○	Δ	Δ	Δ	Δ	○	○			○
Spain	ESP	Δ	Δ	Δ	Δ	▲	▲	Δ	Δ	Δ	Δ		Δ	Δ
Sweden	SWE	★	▲	★	▲	▲	○	▲	Δ	▲	▲	★	Δ	★
Switzerland	CHE	★	★	Δ	▲		▲	★	★	Δ	▲		▲	★
Turkey	TUR		○	○	○	▲	○	○	○	Δ	○		○	○
United Kingdom	GBR	▲	▲	▲	★	Δ	▲	Δ	▲	Δ	▲		▲	★
United States	USA	▲	▲	▲	★	Δ	▲	○	○	★	★	Δ	Δ	Δ
EU28	EU28	Δ	▲	▲		Δ	▲	▲	▲		Δ		Δ	▲

Note: Non-OECD countries are also compared to OECD countries and may therefore be out of range (e.g. lower than the lowest OECD country). They appear in this table with top five and bottom five OECD values

Israel: "The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. 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."

Source: See references and methodological annex of the OECD STI Outlook 2014 country profiles.

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