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United States

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UNITED STATES

The United States has long been, and still is, at the forefront of cutting-edge science, technology and innovation. However, indicators such as business innovation surveys and data on growth of multi-factor productivity suggest that the US lead is narrowing in spite of its world-class universities and global technology companies. R&D and patenting by businesses have also grown less rapidly than in the past. The 2009 Strategy for American Innovation: Driving towards Sustainable Growth and Quality Jobs, which was updated and re-released in February 2011, provides the strategic directions for government policies to further an innovation-based economy.

Hot issue 1: Improving the framework conditions for innovation (including competitiveness). Overall, US STI policy is oriented to job creation, laying the foundations for future industries, and improving economic competitiveness. Several reforms to the patent system aim to bolster innovation. The America Invents Act of 2011 switched the US patent regime from the previous "first to invent" to a "first to file" system for patent applications filed on or after 16 March 2013. The Act also aims to improve patent quality and increase inventors' ability to protect intellectual property abroad. The US Patent and Trademark Office now offers a fast-track option for processing a patent within 12 months, reducing patent backlogs and limiting litigation.

Hot issue 2: Strengthening public R&D capacity and infrastructures. Overall, the United States has the world's largest and strongest science base, although this may not be very apparent in the aggregate performance indicators, which are around or below the OECD median (Panel 1[a, b, c]). For instance, the United States is home to 35 of the world's top 50 universities, and accounts for 26% of the world's articles in science and engineering. In addition to generating many publications, universities and PRIs are active in filing patents (Panel 1[p]), especially in bio- and nano- technologies (Panel 3). Under the President's Plan for Science and Innovation, the federal government prioritises investing in basic research capacity and in robust research infrastructure, including cyber infrastructure. Its support of basic and applied research increased from USD 59 billion in 2008 to a proposed USD 68.1 billion in 2014. In the 2014 budget, research accounts for 48% of total government R&D funding, up from 39% in 2008, with a concomitant decline in the share of development funding.

Hot issue 3: Improving overall human resources, skills and capacity building. With the second highest share of GDP spent on higher education in the OECD area, the United States has a good skills foundation and a high share of tertiary-qualified workforce (Panel 1[s, t]). However, there has been a relative decline in doctoral graduates in science and engineering and 15-year-olds perform below the OECD median in science (Panel 1[w, v]). The federal government is committed to improving STEM education at all levels to nurture a highly skilled, competitive US workforce for the future. President Obama's call for a new effort to prepare 100 000 STEM teachers was renewed in 2013, and in June 2013 the Five-Year Strategic Plan for Federal STEM Education (2013-17) was released. The 2014 budget sets a goal of increasing by a third (or by one million) the number of well-prepared college graduates with STEM degrees over the next decade. The federal budget invests USD 3.1 billion overall in programmes on STEM education.

Hot issue 4: Innovation to contribute to sustainable/green growth. The federal government envisions a United States that leads the world in the research, development, demonstration and deployment of clean energy technology. The 2014 budget proposed USD 7.9 billion for clean energy technologies; USD 379 million for transformational energy R&D in advanced research projects of the Department of Energy (DOE), and USD 2.8 billion for DOE's Energy Efficiency and Renewable Energy Office, with a focus on improving clean vehicles and on developing advanced materials.

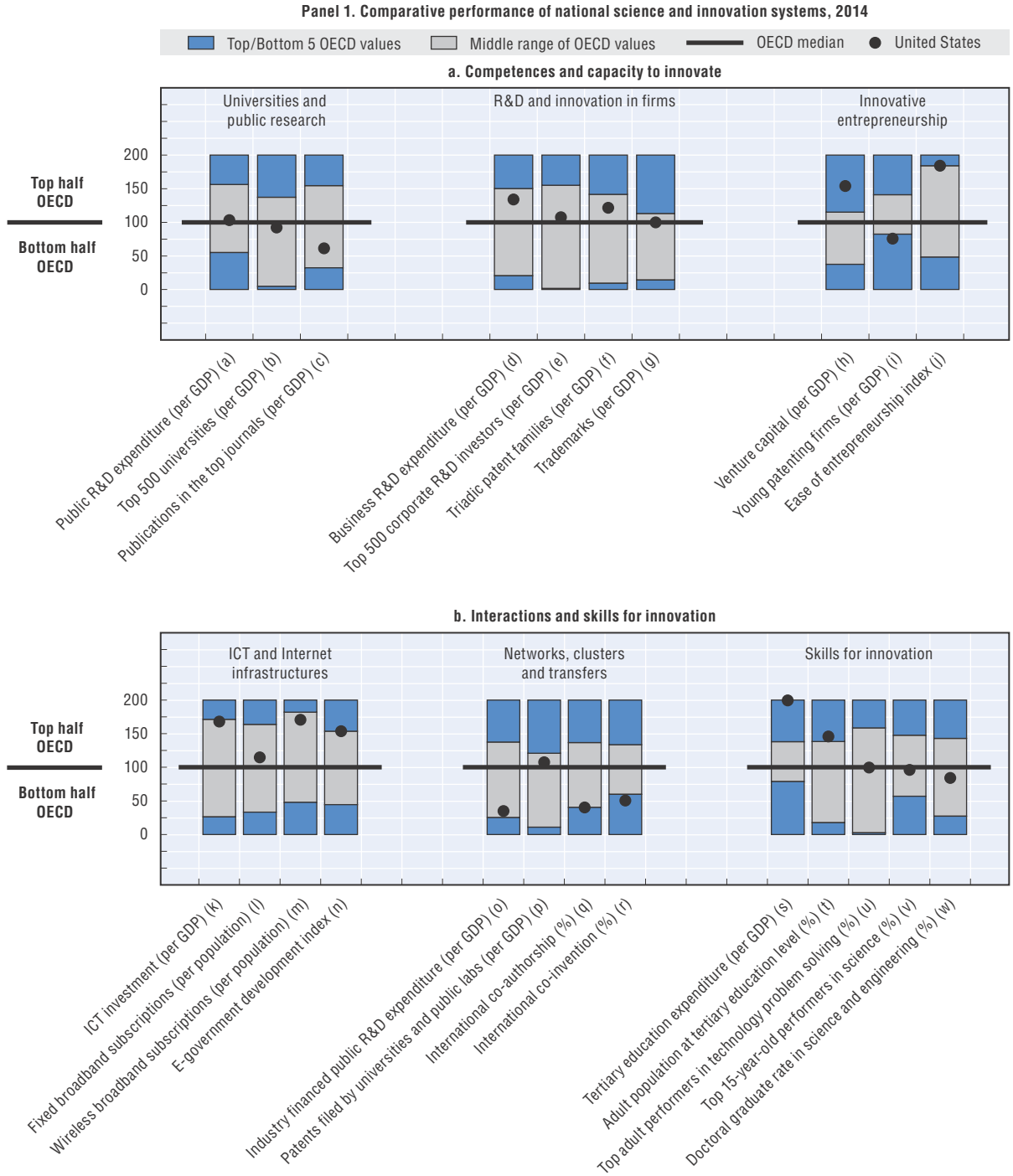
A Climate Action Plan was announced in June 2013 to address the impacts of global climate change. The 2014 budget proposes USD 2.7 billion for the US Global Change Research Programme (USGCRP) to better understand, predict, mitigate and adapt to global climate change.

Hot issue 5: Improving the returns and impact of science. A government-wide policy mandating increased public access to scientific publications and digital data resulting from federally funded research was issued in 2013 and will be further implemented in 2014. Additionally, a second

Key figures, 2013

Economic and environmental performance	USA	OECD	Gross domestic expenditure on R&D	USA	OECD
Labour productivity			**GERD**		
GDP per hour worked, USD PPP, 2013	66.6	47.7	Million USD PPP, 2012	453 544	1 107 398
(annual growth rate, 2008-13)	(+1.5)	(+0.8)	As a % of total OECD, 2012	41.0	100
Green productivity			**GERD intensity and growth**		
GDP per unit of CO_2 emitted, USD, 2011	2.5	3.0	As a % of GDP, 2012	2.79	2.40
(annual growth rate, 2007-11)	(+1.9)	(+1.8)	(annual growth rate, 2007-12)	(+2.0)	(+2.0)
Green demand			**GERD publicly financed**		
NNI per unit of CO_2 emitted, USD, 2011	2.5	3.0	As a % of GDP, 2012	0.94	0.77
(annual growth rate, 2007-11)	(+1.9)	(+1.6)	(annual growth rate, 2007-12)	(+3.1)	(+2.8)

Figure 9.46. **Science and innovation in the United States**



Note: Normalised index of performance relative to the median values in the OECD area (Index median = 100).

Open Government National Plan was released, which revised the Plan of 2012. In 2013, *data.gov*, which provides information and tools to leverage federal datasets, was expanded to improve public access.

Highlights of the US STI system

STI policy governance: Because of fiscal austerity, federal R&D investments are expected to decrease from USD 147 billion in 2010 to USD 142.7 billion in 2014, but then to rebound. Efforts have been made to strengthen STI policy and evaluation. In 2013, new guidance was published to strengthen the federal grant-making process by streamlining eight federal regulations to be fully implemented in 2014. Federal agencies jointly identified a Roadmap for Science of Science Policy (SOSP) in 2008 and have been working since to improve evaluation and impact assessment of science. In addition, the National Science Foundation is carrying out a research programme on the Science of Science and Innovation Policy to build an analytical and knowledge base for SOSP and an academic SOSP community.

New sources of growth: The 2014 federal budget invests USD 2.9 billion in order to create high-quality manufacturing jobs and make America a magnet for manufacturing. The aim is to expand R&D on innovative manufacturing processes, advanced industrial materials and robotics, to encourage entrepreneurship, and to improve the transition from discovery to the marketplace.

New challenges: Improving the health of Americans, while maintaining American leadership in biomedical research and building the bioeconomy of the future, is an emerging policy issue. The Administration is committed to funding health research with a focus on neuroscience and on increasing the impact of these investments on health outcomes. Launched with USD 100 million in 2014, the BRAIN initiative searches for new ways to treat, cure and prevent brain disorders, such as Alzheimer's disease, epilepsy and traumatic brain injury.

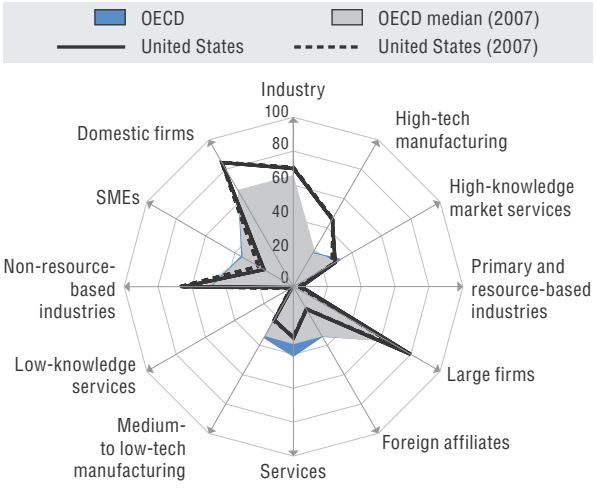
Innovation in firms: While public funding of business R&D has declined since 2008, primarily because of declines in defence budgets, more emphasis has recently been placed on direct support for business R&D and innovation. The Research and Experimentation Tax Credit expired in 2013, however, negotiations continue on a retroactive extension. Over the next several years, a greater share of US R&D investments for competitive R&D grants will go to small businesses and small business-led consortia. Technology consulting services/extension programmes were introduced in 2013 with a focus on manufacturing and new firms arising from advances in basic research. The US government continues to propose expansions of loan guarantees and risk-sharing mechanisms, particularly in the clean-energy sector.

Technology transfer and commercialisation: US federal agencies continue to make progress on reshaping their priorities and programmes to meet the goals laid out in the President's October 2011 Memorandum on Accelerating Technology Transfer and Commercialization of Federal Research in Support of High Growth Businesses. The environment for innovative entrepreneurship is very good (Panel $1^{h, j}$). In late 2011, the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programmes were re-authorised through 2017 and expanded. The SBIR funds R&D and innovation activities in SMEs and young firms, and the STTR supports collaboration on R&D by SMEs and universities.

Clusters and smart specialisation: The federal government works with agencies such as the Small Business Administration and the Economic Development Administration to develop regional clusters on advanced technologies (e.g. robotics, energy, cybersecurity), food systems, broadband and recreation. The Office of Innovation and Entrepreneurship promotes entrepreneurship at the regional level through the i6 Challenge, a multiagency competitive grant programme.

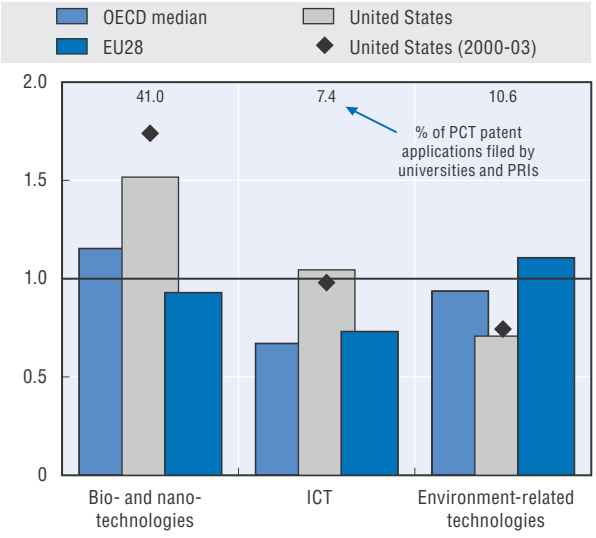
Panel 2. Structural composition of BERD, 2011

As a % of total BERD or sub-parts of BERD

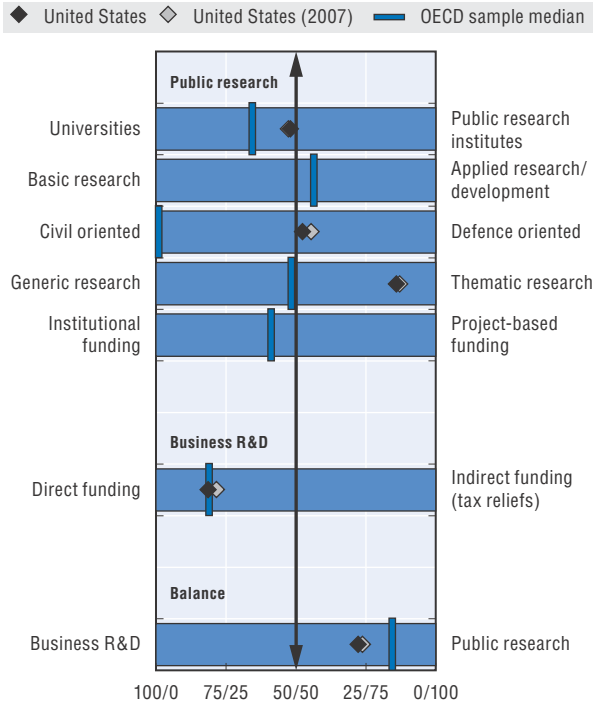


Panel 3. Revealed technology advantage in selected fields, 2009-11

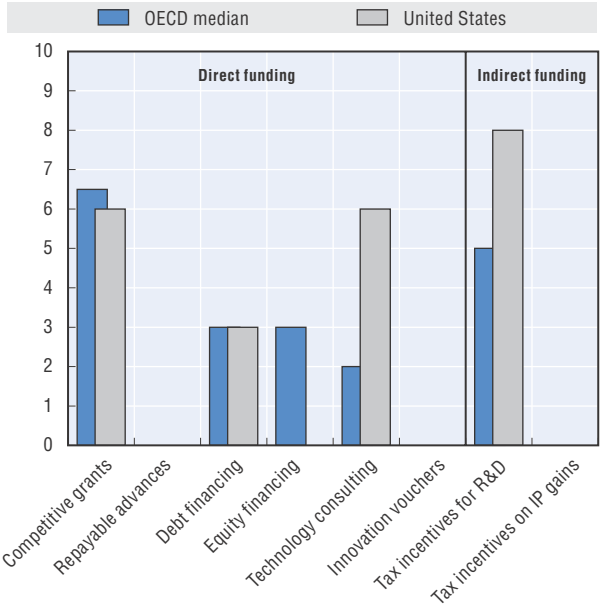
Index based on PCT patent applications



Panel 4. Allocation of public funds to R&D, by sector, type and mode of funding, 2012



Panel 5. Most relevant instruments of public funding of business R&D, 2014



Note: Policy information comes from country responses to the OECD STI Outlook policy questionnaires 2014 and 2012 and the OECD Economic Survey of the United States, 2012. The United States' responses are available in the *OECD STI Outlook Policy Database*, edition 2014 at *http://qdd.oecd.org/Table.aspx?Query=BFE08001-3733-4D05-A8F3-537B47DCF18E*.

Source: See reader's guide and methodological annex.

StatLink *http://dx.doi.org/10.1787/888933152463*

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 entrepreneur-ship 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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