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Sweden

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SWEDEN

Following the 2008-09 crisis, Sweden's economy has grown significantly faster than that of the OECD area as a whole. Sustainable economic growth will depend on Sweden's future research and innovation performance. To secure Sweden's future as a leader in research and innovation, the government's Research and Innovation Bill 2013-16 establishes a more selective, quality-based funding approach, with a significantly increased government budget for R&D.

Hot issue 1: Innovation to contribute to addressing social challenges (including inclusiveness). Already in the 2008 research and innovation bill, the government presented 24 research areas of strategic importance for Swedish science, society and business, and invested USD 205 million (SEK 1.8 billion) a year. An additional USD 34.5 million (SEK 300 million) was invested in areas of strategic importance for society and business, following the research and innovation bill 2012. The Swedish Agency for Innovation Systems (VINNOVA), together with the Swedish Energy Agency and The Swedish Research Council Formas has launched a new initiative, Strategic Innovation Areas (SIA). VINNOVA has also launched a related programme, Challenge-Driven Innovation (CDI) to address specific social challenges and international competitiveness through "systems innovation". In both initiatives, the actors, primarily the main end users in industry and the public sector, are developing the agendas and defining the targets. Funding for SIA was around USD 16.8 million (SEK 145 million) in 2013, including around USD 2.3 million (SEK 20 million) from the private sector. It will increase to USD 145 million (SEK 1.25 billion) for 2016, with around 50% from the private sector.

Hot issue 2: Encouraging innovation in firms and supporting entrepreneurship and SMEs. BERD is relatively high, at 2.31% of GDP (Panel 1^d), though substantially below the level of a decade ago. Industry R&D is concentrated in large firms, which dominate the Swedish economy. While venture capital investment as a share of GDP is at the top of the OECD middle range (Panel 1^h), there are gaps in the supply of business angel and early-stage VC. In 2013, the public Innovation Bridge Foundation was merged into ALMI to develop a single public entity focused on early-stage funding, e.g. by offering risk-bearing loans, seed and expansion capital, as well as advisory services and incubator funding, to entre-

preneurs and small businesses. VINNOVA's Research&Grow programme for innovative SMEs continues to be a key policy support measure worth USD 16.2 million (SEK 140 million) in 2013.

Hot issue 3: Reforming and improving the public research system (including university research). Public expenditure on R&D is high (Panel 1^a). Much goes for research at Swedish universities, which are well placed in global rankings of world-class universities and publications (Panel 1^{b, c}). HERD, at 0.92% of GDP in 2012, is the second highest in the OECD area. To raise the innovation-generating power of universities, the Swedish Research Council and VINNOVA are exploring ways to reform the incentive structures for university management and researchers created by the criteria and procedures for the distribution of basic funding (block grants) to universities.

Hot issue 4: Improving the framework conditions for innovation. Improving the framework conditions for innovation is a key theme of the recent National Innovation Strategy. A government-appointed committee was set up in 2011 to propose potential regulatory or tax reforms to improve conditions for business growth and R&D. Its recommendation to introduce R&D tax relief has been taken up by the government, which has proposed a 10% reduction in the employers' social security contributions for employees engaged in R&D. As the maximum total reduction per group will be USD 26 700 (SEK 230 000) a month, the tax relief will primarily benefit smaller firms.

Hot issue 5: Improving the governance of the innovation system and policy. The Ministry of Education and Research and the Ministry of Enterprise, Energy and Communications are largely responsible for research and innovation policy. A National Innovation Strategy was published in 2012 to improve co-ordination and to lay out the principles and direction of Swedish innovation policy with a 2020 perspective. Various agencies, led by VINNOVA, will monitor its implementation annually.

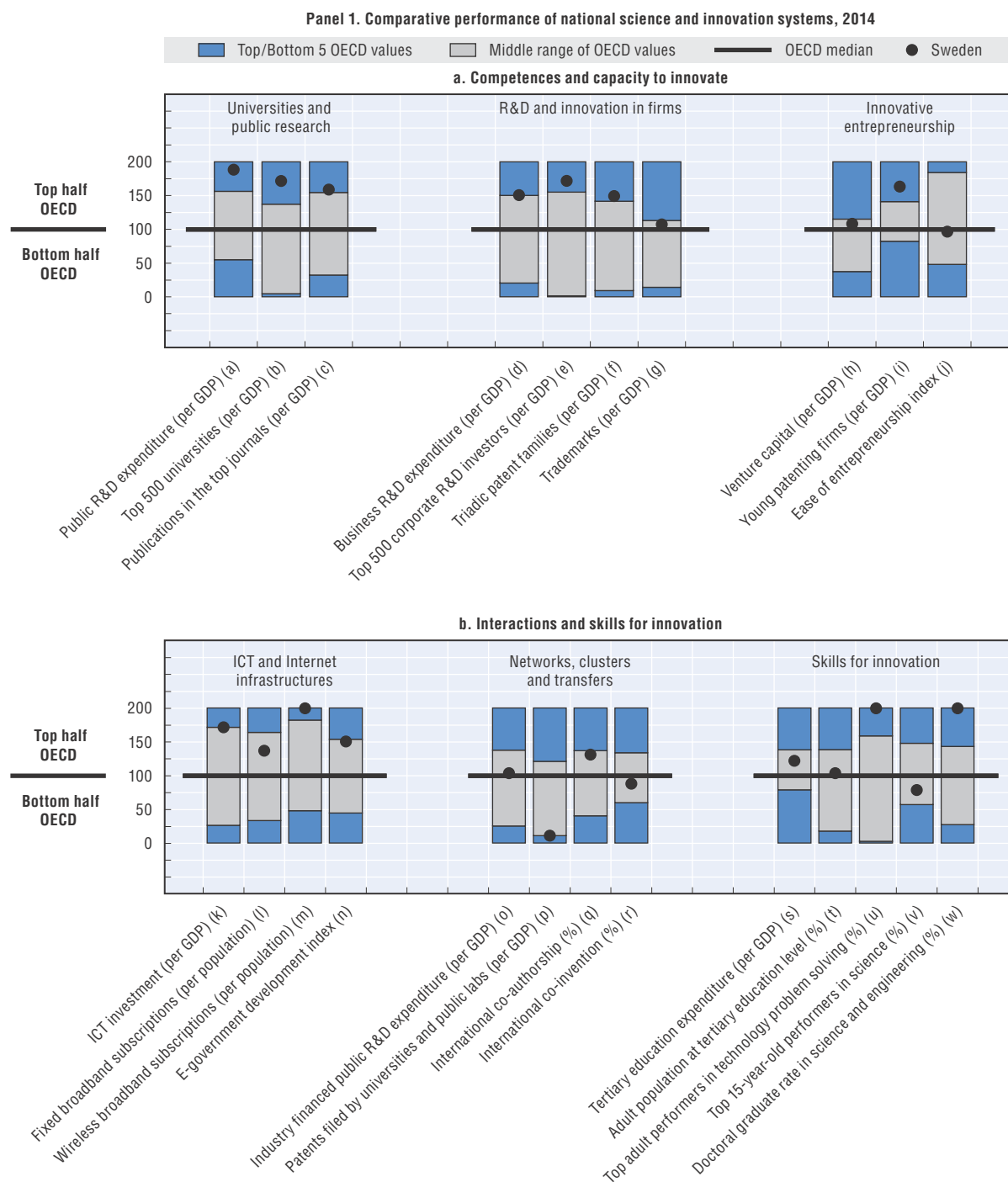
Highlights of the Swedish STI system

New sources of growth: Since 2012, the government has given USD 1 million (SEK 9 million) a year to VINNOVA to

Key figures, 2013

Economic and environmental performance	SWE	OECD	Gross domestic expenditure on R&D	SWE	OECD
Labour productivity			GERD		
GDP per hour worked, USD PPP, 2013	56.0	47.7	Million USD PPP, 2012	13 899	1 107 398
(annual growth rate, 2008-13)	(+1.0)	(+0.8)	As a % of total OECD, 2012	1.3	100
Green productivity			GERD intensity and growth		
GDP per unit of CO ₂ emitted, USD, 2011	7.1	3.0	As a % of GDP, 2012	3.41	2.40
(annual growth rate, 2007-11)	(+2.7)	(+1.8)	(annual growth rate, 2007-12)	(+0.7)	(+2.0)
Green demand			GERD publicly financed		
NNI per unit of CO ₂ emitted, USD, 2011	7.7	3.0	As a % of GDP, 2011	0.97	0.77
(annual growth rate, 2007-11)	(+2.7)	(+1.6)	(annual growth rate, 2007-11)	(+3.5)	(+2.8)

Figure 9.42. Science and innovation in Sweden



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

develop competence, support systems, networks, etc., for pre-commercial innovative procurement. From 2014, the Swedish Competition Authority (KKV) will have the main responsibility for practical support for public procurement, including innovative procurement. VINNOVA will, however, encourage agencies and municipalities to identify and specify their strategic development needs and targets, and this may eventually lead to innovative procurement.

Technology transfer and commercialisation: Closer collaboration between industry and academia is an integral part of the SIA and CDI programmes. Furthermore, other VINNOVA programmes, such as VINNVAXT and VINN Excellence Centres, as well as thematic programmes, aim to support mission-oriented, pre-competitive collaboration between R&D providers and industry. Several schemes continue to support centres of excellence at universities, which seek to create excellent academic research environments in which industry participates actively. The low number of patents filed by universities (Panel 1^P) is due to the “professor’s privilege” which entitles researchers (instead of institutions) to patent their inventions. The public research institutes, which were grouped into a single holding (known as RISE – the Research Institutes of Sweden Holding AB) in 2009, remain relatively small (Panel 4). Their purpose is to serve as a knowledge partner for businesses, as an intermediary between academia and industry, and as a nexus for participation in EU R&D projects.

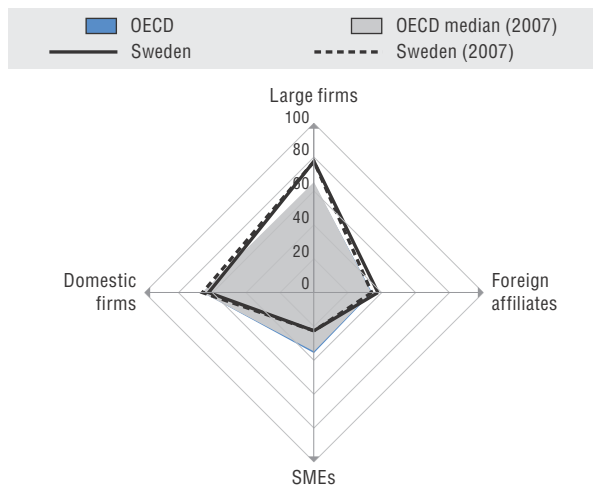
ICT and Internet infrastructures: ICT infrastructures are strong (Panel 1^{k, l}). The programme ICT for Everyone – A Digital Agenda for Sweden was adopted in 2011. It sets an ICT policy goal for Sweden to become the world’s leading economy in exploiting the opportunities of digitisation. Sweden’s e-government development index is above the OECD median (Panel 1ⁿ). Preparations for the construction of the European Spallation Source (ESS) are now under way in Lund, as is the construction of Max the IV facility for a new-generation synchrotron radiation light source.

Skills for innovation: Sweden’s share of doctorate graduates in science and engineering and adults’ ability to solve technical problems top the OECD countries (Panel 1^{w, u}). However, 15-year-olds’ performance in science is below the OECD median (Panel 1^v). Skill development is integral in most of VINNOVA’s schemes. A specific on-going initiative in support of skill development is the Mobility for Growth scheme. In the new school curriculum, the teaching of entrepreneurship is mandatory. To attract overseas talent, the tax exemption rules for foreign experts and highly qualified personnel have been simplified, allowing those with remuneration above a ceiling value to be exempt from certain parts of income tax.

Recent developments in STI expenditures: Spending 3.41% of GDP on R&D (2012), Sweden has the world’ fourth highest R&D intensity. The Research and Innovation Bill 2012 has increased the government budget for STI for 2013-16 by USD 464.6 million (SEK 4 billion) or by 15% compared to 2012.

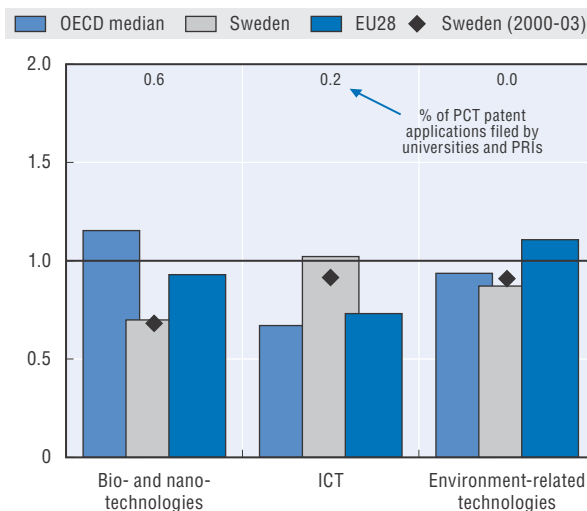
Panel 2. Structural composition of BERD, 2011

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

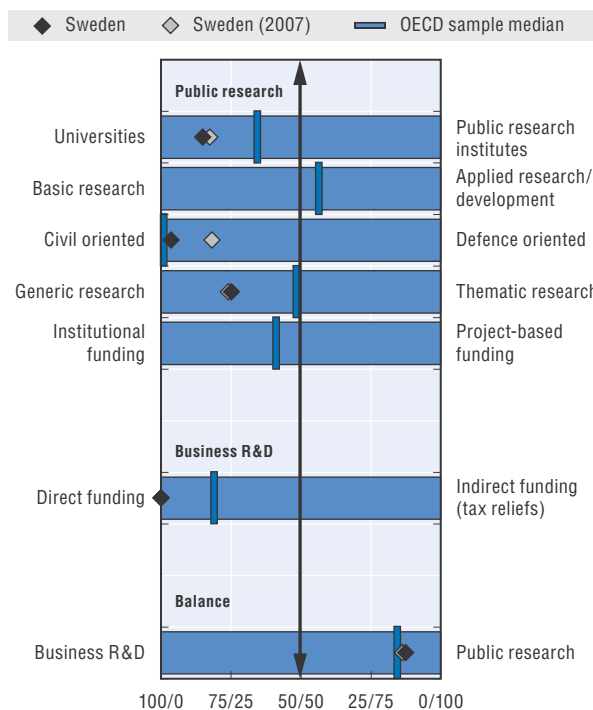


Panel 3. Revealed technology advantage in selected fields, 2009-11

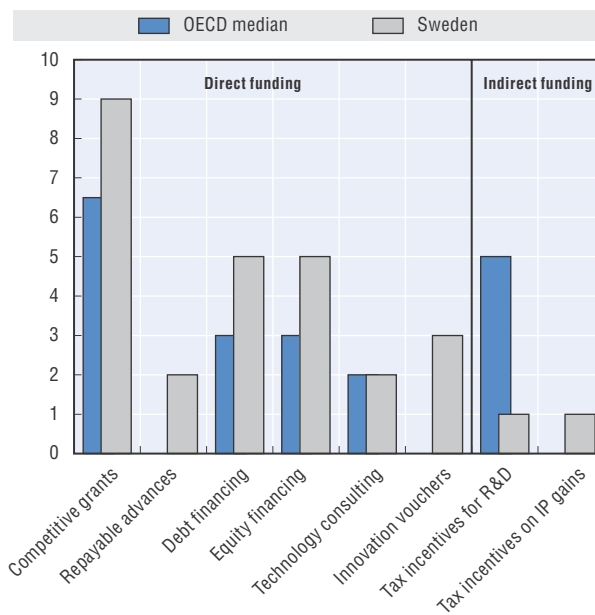
Index based on PCT patent applications



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. Sweden's responses are available in the OECD STI Outlook Policy Database, edition 2014 at <http://qdd.oecd.org/Table.aspx?Query=4A329A44-560E-4875-AA34-14291D8061C6>. Source: See reader's guide and methodological annex.

StatLink <http://dx.doi.org/10.1787/888933152423>

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 (△) 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	△	△	○	○	○	○	○			
Australia	AUS	▲	▲	▲	▲	△	△	▲	△		▲
Austria	AUT	▲	★	▲	▲	▲	▲	△	△	★	▲
Belgium	BEL	△	▲	▲	▲	△	▲	△	▲	△	△
Brazil	BRA		△	○		△	○	○			△
Canada	CAN	▲	▲	▲	△	△	▲	★	★	○	▲
Chile	CHL	○	△	○	○	○	○	△			△
China	CHN	△	△	○	▲	△	△	○			○
Colombia	COL	○	○	○	○						
Costa Rica	CRI	○	○	○	○	○					
Czech Republic	CZE	▲	△	△	△	△	△	△	○		△
Denmark	DNK	★	▲	★	▲	★	▲	▲	▲		▲
Estonia	EST	▲		▲	▲	○	△	△	▲		▲
Finland	FIN	★	★	▲	★	★	★	▲	★	★	▲
France	FRA	▲	△	△	▲	▲	▲	▲	▲	△	▲
Germany	DEU	★	▲	△	▲	▲	★	▲	▲	★	▲
Greece	GRC	○	△	△	○	△	○	○	○		△
Hungary	HUN	○	△	△	△	△	△	○	△		△
Iceland	ISL	★	○	★	▲	▲	△	★			△
India	IND	△	○	○	○	○	△	○			○
Indonesia	IDN		○	○	○		○	○			△
Ireland	IRL	△	▲	▲	△	▲	▲	▲	★	○	△
Israel	ISR	△	★	▲	★	▲	▲	▲	★		○
Italy	ITA	△	△	△	△	△	△	△	○	▲	★
Japan	JPN	▲	△	○	★	▲	★	△	△	○	▲
Korea	KOR	▲	△	△	★	▲	▲	▲	▲		△
Latvia	LVA	△	○	○	○		△				
Lithuania	LTU	△	○	○	○		△				
Luxembourg	LUX	○	○	△	△	★	▲	★	△		△
Malaysia	MYS	△	△	○	△	△					
Mexico	MEX	○	○	○	○	○	○	△			○
Netherlands	NLD	▲	▲	★	▲	▲	▲	▲	▲	▲	★
New Zealand	NZL	△	★	▲	△	△	△	★	△		★
Norway	NOR	▲	▲	△	△	▲	△	△	△	▲	△
Poland	POL	△	△	△	○	○	△	○	○		○
Portugal	PRT	△	▲	▲	△	△	△	△	△		▲
Russian Federation	RUS	△	○	○	△	△	○	○	△		△
Slovak Republic	SVK	△	○	○	○	○	○	○			★
Slovenia	SVN	△	▲	▲	▲	△	△	△	△		△
South Africa	ZAF	○	△	○	△	△	△	△	△		○
Spain	ESP	△	△	△	△	△	△	△	○	○	○
Sweden	SWE	★	★	★	★	★	★	▲	▲	★	△
Switzerland	CHE	▲	▲	★	▲	★	★	★	▲	★	▲
Turkey	TUR	△	○	○	△	△	○	○			○
United Kingdom	GBR	△	▲	▲	△	▲	▲	▲	▲	△	▲
United States	USA	▲	△	△	▲	▲	▲	▲	★	○	★
EU28	EU28	▲	▲	★	▲	△	▲	△	▲	▲	

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 (△) 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	○	○	○	○	○		△	★	▲	○		○	○
Australia	AUS	▲	△	★	▲	▲	▲	△	△	▲	▲	▲	★	▲
Austria	AUT	▲	△	▲	△	▲	△	★	▲	△	△	△	△	▲
Belgium	BEL	▲	▲	△	△	▲	▲	★	★	△	▲		▲	▲
Brazil	BRA		○	△	○		△	○	△	○	○		○	○
Canada	CAN	△	▲	△	▲	▲	▲	△	▲	★	★	▲	▲	▲
Chile	CHL		○	○	△	○	△	▲	△	★	○		○	○
China	CHN		○	○	○	▲	△	○	○		○			○
Colombia	COL		○	○	△			▲	△	★	△		○	
Costa Rica	CRI		○	○	○			★	★		△		○	
Czech Republic	CZE	△	△	△	○	△	△	△	▲	△	△	△	△	△
Denmark	DNK	★	★	★	★	△	★	▲	▲	▲	△	★	△	▲
Estonia	EST		△	▲	△	△		▲	★	▲	▲	○	★	△
Finland	FIN	△	▲	★	▲	★	▲	▲	△	★	▲	★	★	★
France	FRA	△	★	△	▲	△	★	▲	△	▲	△		▲	▲
Germany	DEU	△	▲	△	▲	★	▲	△	△	△	△	▲	▲	★
Greece	GRC	○	△	△	△	△	○	△	▲	▲	△		○	△
Hungary	HUN		△	○	△	▲	○	▲	▲	○	△		△	○
Iceland	ISL		▲	▲	△	★		★	▲	○	▲		△	△
India	IND		○	○	○		△	○	▲	○				
Indonesia	IDN		○	○	○			▲	★	○	○		○	○
Ireland	IRL	○	△	▲	△	○	★	▲	▲	▲	▲	○	▲	▲
Israel	ISR		△	△	▲	▲	★	△	△	▲	★		△	▲
Italy	ITA	△	△	△	△	○	△	△	○	○	○		△	△
Japan	JPN	★	▲	▲	▲	△	▲	○	○	▲	★	▲	★	△
Korea	KOR	▲	★	★	★	▲	★	○	○	★	★	○	▲	△
Latvia	LVA		△	△	△	▲		△	★	▲	△		○	△
Lithuania	LTU		△	○	△	★		△	△		▲		△	
Luxembourg	LUX	○	▲	▲	▲	△	△	★	★	○	▲		▲	
Malaysia	MYS		○	○	△			△	△	★	○		○	
Mexico	MEX	○	○	○	○	○	○	△	▲	△	○		○	○
Netherlands	NLD	▲	★	▲	★	★	▲	▲	△	▲	△	★	▲	△
New Zealand	NZL	★	▲	▲	▲	★	△	▲	△	▲	▲		★	▲
Norway	NOR		▲	▲	▲	▲	△	▲	△	▲	▲	★	△	▲
Poland	POL		○	▲	○	△	△	○	★	△	△	○	▲	○
Portugal	PRT	▲	△	○	△	○	○	△	▲	△	○		○	△
Russian Federation	RUS		○	△	△	★	○	○	△	△	★		○	○
Slovak Republic	SVK	○	○	△	○	△		△	▲	○	△	○	△	▲
Slovenia	SVN	△	△	△	△	▲	△	△	△	△	△		▲	▲
South Africa	ZAF		○	○	○	△	△	△	△	○	○			○
Spain	ESP	△	△	△	△	▲	▲	△	△	△	△		△	△
Sweden	SWE	★	▲	★	▲	▲	○	▲	△	▲	▲	★	△	★
Switzerland	CHE	★	★	△	▲	▲	▲	★	★	△	▲		▲	★
Turkey	TUR		○	○	○	▲	○	○	○	△	○		○	○
United Kingdom	GBR	▲	▲	▲	★	△	▲	△	▲	△	▲		▲	★
United States	USA	▲	▲	▲	★	△	▲	○	○	★	★	△	△	△
EU28	EU28	△	▲	▲		△	▲	▲	▲		△		△	▲

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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