

## LUXEMBOURG

**Hot STI issues**

- Developing and consolidating the S&T infrastructure.
- Encouraging the efficiency of public research through performance contracts and policies to attract researchers.
- Intensifying connections between public research and industry.

**General features of the STI system:** Luxembourg is a small open economy of about half a million inhabitants with one of the world's largest GDP per capita. Relative to its size, it hosts the headquarters of the largest number of top corporate R&D investors among OECD countries (Panel 1<sup>(e)</sup>). However, BERD accounted for only 1.16% of GDP in 2010, almost at the OECD median (1<sup>(d)</sup>), but below the OECD average (1.27%). Large firms accounted for 83% of national BERD in 2009 (Panel 2). The entrepreneurship index (1<sup>(j)</sup>) reflects the very small contribution of SMEs and young firms to the national innovation system (Panel 2). Luxembourg files more trademarks (1<sup>(g)</sup>) than triadic patents (1<sup>(f)</sup>), partly owing to the service orientation of its industry structure. Links between research and industry by industry funding of public R&D expenditure are weak (1<sup>(o)</sup>). During 2005-09 Luxembourg had one of the lowest relative number of patents filed by universities and public labs among OECD countries (1<sup>(p)</sup>). With 36% of the adult population tertiary-qualified (1<sup>(s)</sup>) and PISA performance in science below the OECD median (1<sup>(t)</sup>) in 2009, Luxembourg led in S&T occupations (1<sup>(v)</sup>). A salient feature of the labour market is the high proportion of cross-border workers. High shares of international co-authorship (1<sup>(q)</sup>) and international co-invention (56% of total PCT patent applications, 1<sup>(r)</sup>) reflect the country's small size and its close economic integration with Belgium, France and Germany. The national ICT infrastructure is well

developed (1<sup>(k)(l)(m)</sup>). The e-government readiness index is on a par with the OECD median (1<sup>(n)</sup>).

**Recent developments in STI expenditures:** Luxembourg's R&D efforts are below the OECD and EU27 averages: GERD was 1.63% of GDP in 2010 and increased on average by 2.8% annually over 2005-10. The Luxembourg 2020 Strategy targets R&D spending of 2.3-2.6% of GDP by 2020, with 1.5-1.6% from the private sector, and 0.7-0.8% from the public sector.

**Overall STI strategy:** The objectives of the EU Horizon 2020 figure in the national reform programme, Luxembourg 2020, which was approved in 2011. The main objectives are to foster R&D and innovation in the public and private sectors by increasing R&D efforts, human capital supply, and encouraging and facilitating the creation of innovative new companies.

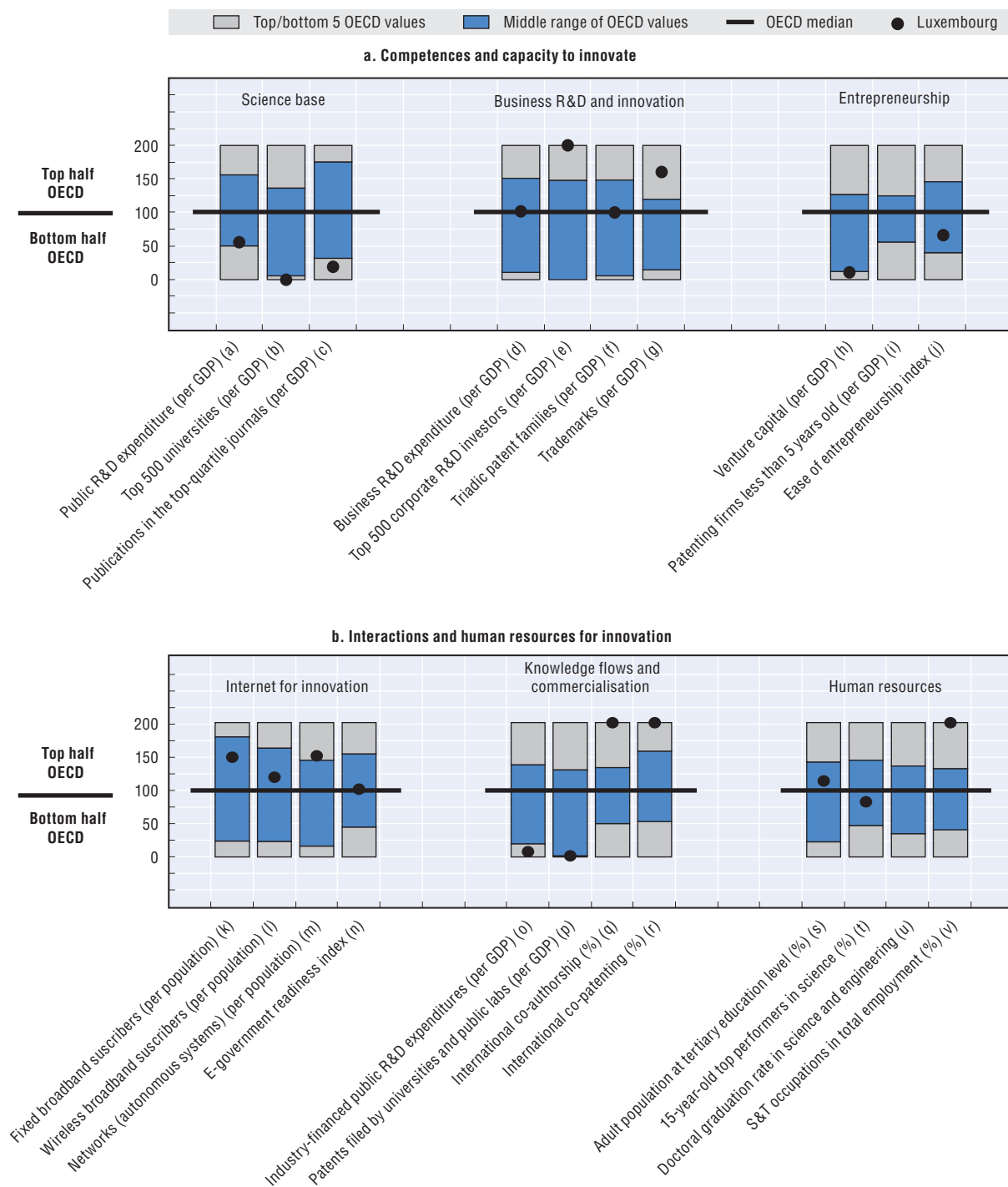
**STI policy governance:** No major changes were introduced recently. Among the most significant recent changes in STI governance are the introduction of performance contracts in 2008 (renewed in 2011) between the government and the University of Luxembourg, Luxinnovation, the National Research Fund, and the public research centres (PRCs) which were established on the basis of the OECD recommendations formulated in the 2007 *OECD Reviews of Innovation Policy: Luxembourg*.

**Key figures**

<b>Labour productivity, GDP per hour worked in USD, 2010</b> (annual growth rate, 2005-10)	<b>75.3</b> (-1.8)	<b>GERD, as % of GDP, 2010</b> (annual growth rate, 2005-10)	<b>1.63</b> (+2.8)
<b>Environmental productivity, GDP per unit of CO<sub>2</sub> emitted in USD, 2009</b> (annual growth rate, 2005-09)	<b>4.13</b> (+5.6)	<b>GERD publicly financed, as % of GDP, 2010</b> (annual growth rate, 2005-10)	<b>0.49</b> (+15.5)

Figure 10.27. Science and innovation in Luxembourg

Panel 1. Comparative performance of national science and innovation systems, 2011



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

**Science base:** Luxembourg has a poorly developed science base. In 2010 public R&D expenditures (0.48% of GDP) (1<sup>(a)</sup>) and publications in scientific journals (1<sup>(c)</sup>) were both below the OECD median. Weaknesses in Luxembourg's science base are also due to its relative youth; its university was founded in 2003 and its PRIs were created after 1987. To improve performance, public funding is based on performance contracts, with targets of up to 40% of additional external funding in 2011. Publication indicators are also used. Regular evaluation exercises have been introduced: from 2010, one or two departments of a research centre are evaluated each year. A bill under discussion would give the public research sector more autonomy and accountability.

**Business R&D and innovation:** A law on state aid for R&D implemented in June 2009 extended the scope of an earlier law of 1993. It supports process and organisational innovation and includes special subsidies for SMEs and schemes to promote knowledge flows between academia and industry.

**Knowledge flows and commercialisation:** Luxembourg places great emphasis on public-private collaboration, which is currently weak. The Cités des Sciences, a massive infrastructure project, will bring together on one campus the university, PRCs, facilities for public-private partnerships (PPPs) and an incubator for start-ups. The first research facilities are expected to be operational by 2012. Specific measures to promote PPPs include funding for joint public-private research projects. The Luxembourg Cluster Initiative, launched

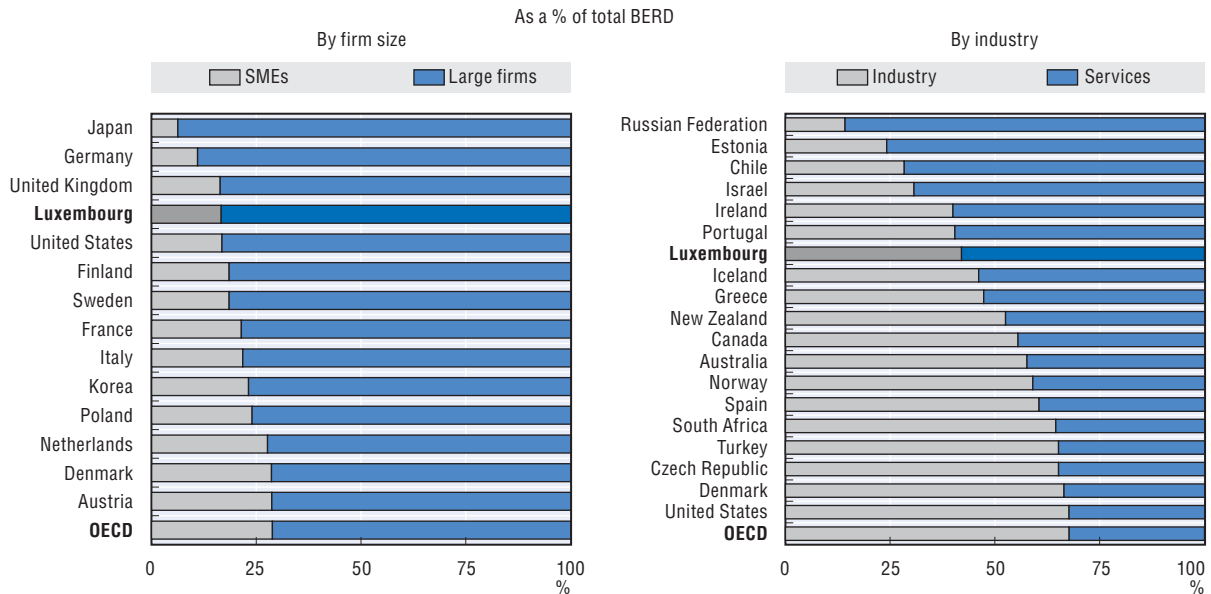
in 2002, also supports the transfer of knowledge and know-how.

**Globalisation:** Because Luxembourg has a small and young science base, it actively supports co-operation with researchers from other countries through measures for training and mobility of researchers (AM2c, which also finances national researchers carrying out research abroad) and ATTRACT and PEARL, which provide institutions with funding to attract senior researchers and young researchers from abroad. Moreover, its Fit4Europe programme provides financial support for companies to prepare research proposals for EU FP7 calls that emphasise cross-country collaborative research projects.

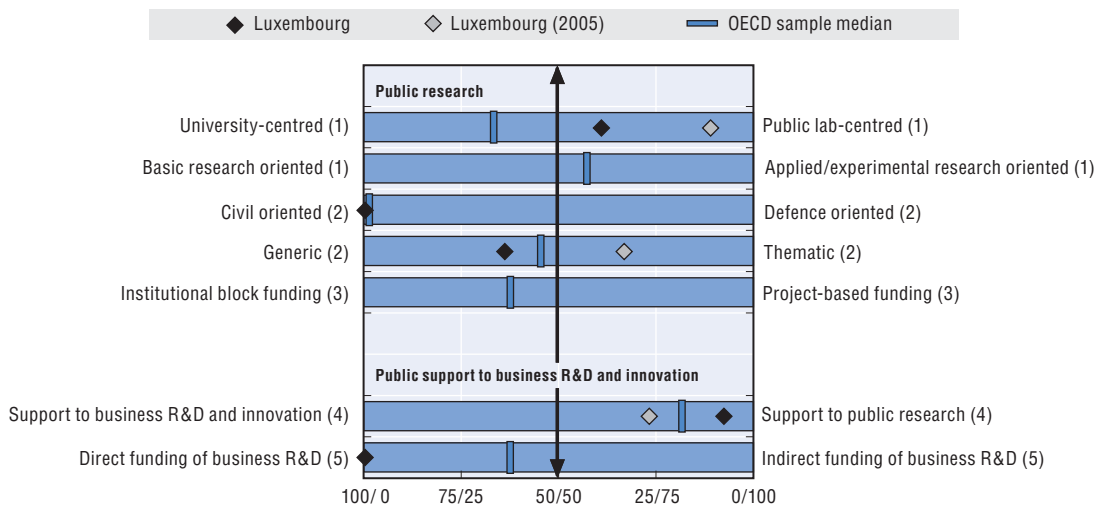
**Human resources:** The Luxembourg 2020 Strategy identified a need for more qualified researchers, especially in the public research sector. One measure aimed at making researchers' careers more attractive is the AFR programme, which supports PhD and postdoctoral students by offering better work contracts, working conditions and training opportunities.

**Green innovation:** Eco-technologies are a priority sector of the Luxembourg 2020 Strategy. The Ecotechnologies Action Plan aims at improving energy efficiency but also at developing a private eco-technology sector. Support for R&D in environmental technologies amounts to some USD 6 million. Public aid to support the development of environmentally sustainable businesses has also increased.

**Panel 2. Structural composition of BERD, selected countries, 2009**



**Panel 3. Overview of national innovation policy mix, 2010**



- Balance as a percentage of the sum of HERD and GOVERD.
- Balance as a percentage of total GBAORD.
- Balance as a percentage of total funding to national performers.
- Balance as a percentage of the sum of HERD and GOVERD funded by government and higher education and components of (5).
- Balance as a percentage of the sum of indirect funding of business R&D and innovation through R&D tax incentives and direct funding of BERD through grants, contracts and loans.

Source: See reader's guide and methodological annex.

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