Country Profile

OECD

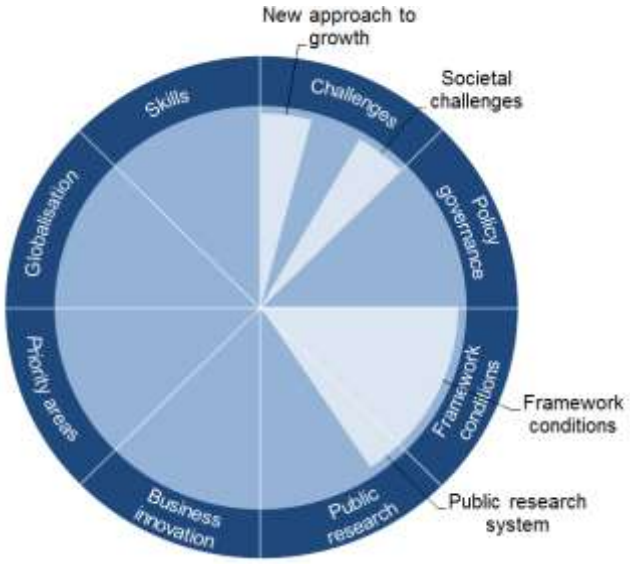
JAPAN

After two decades of sluggish growth, despite recent signs of renewed dynamism, Japan's growth prospects, which are projected to be 0.6% in 2016 and 0.7% in 2017, are still clouded by an ageing population, a high national debt (expected to reach 234% of GDP by 2017) and other socio-economic challenges. Thus, the 5th S&T Basic Plan (2016-20), prepared by the Cabinet Office with the input of experts, identifies sustainable development, the safety and security of the country and its people, climate change and biodiversity as overarching fields for determining a medium- to long-term STI strategy. As the world's third-largest economy after the United States and China, Japan is also the world's third most R&D-intensive country, with 3.59% of GDP dedicated to R&D in 2014.

Table 1. Gross domestic expenditure on R&D (GERD)

	JPN	OECD
GERD		
USD million PPP, 2014	166 861	1 181 495
As a % of total OECD, 2014	14.5	100
GERD intensity and growth		
As a % of GDP, 2014	3.59	2.38
(annual growth rate, 2009-14)	(+3.0)	(+2.3)
GERD publicly financed		
As a % of GDP, 2014	0.77	0.61
(annual growth rate, 2009-14)	(+3.0)	(+2.5)

Figure 1. Major STI policy priorities, 2016



Hot issues

Addressing societal challenges

Main societal challenges identified for STI policy include: i) energy, ii) health and longevity, iii) next-generation infrastructure, iv) local resources and v) reconstruction after the Great East Japan Earthquake. Along with the 5th S&T Basic Plan, the government established the Comprehensive Strategy on STI in May 2016. It focuses on shaping a world-leading "super smart society" (Society 5.0) that addresses both economic development and societal challenges. The Comprehensive Strategy will be revised annually to facilitate flexible policy management. In the field of health care and medicine, the government is seeking to become a "health country" with world-class health and medical technology and improved medical supply. The Research Center Network for Realisation of Regenerative Medicine was launched in 2013 to advance induced pluripotent stem cell research, which has been administered by the Japan Agency for Medical Research and Development since 2015. Japan also promotes preventive medicine and supportive nursing, in addition to medical treatment. The 3rd Basic Programme for Shokuiku Promotion was established in March 2016 and encourages education on food and nutrition. In terms of building modern R&D frameworks, new infrastructures that use cutting-edge technologies (e.g. information technologies) and integrated approaches (e.g. Smart Life Project) are being developed to meet the needs of an ageing population.

Promoting structural adjustment and a new approach to growth

Japan's economic performance as measured by trends in labour productivity is on par with the OECD median (figure 2). The Growth Strategy Council towards Investment for the Future, founded in 2016, serves as the government's headquarters to promote Japan's growth strategy and structural reform. The 5th S&T Basic Plan (2016-20) aims to develop fields at the knowledge frontier and to create more knowledge assets. It foresees initiatives for the future creation of industries with a view to increasing the country's manufacturing competitiveness. In keeping with Japan's ambition to become a global leader in the health and medical areas, it aims to raise the international competitiveness of its medical supply and medical equipment industries. In addition, Japan has strong technological traditions in the fields of nanotechnology and related material technologies. Japan is pursuing efforts to maintain a global nanotechnology research complex, operated by four institutions in Tsukuba and Tokyo University (TIA), which includes world-class advanced nanotechnology research facilities and human resources.

Strengthening the public research system

Japan's public R&D expenditure per GDP amounted to 0.71% in 2014, a relatively stable level since 2000 and slightly above the OECD median (figure 5a), but modest in light of Japan's high GERD intensity. Applied R&D and experimental development absorbed about 70% of public R&D expenditure in 2014 and basic research about 30% (figure 8). However, the number of universities of global stature, the level of publications in top academic journals and the international mobility of researchers rank low compared to the OECD median (figure 5b,c). To address the problem of young researchers having few opportunities to secure stable academic positions, the Programme to Distinguished Researchers was launched in 2016 to ensure stable employment and an independent research environment. It aims both at creating new career paths across industry, universities and the national research system and at developing a new agency for excellent researchers. Similarly, the 5th S&T Basic Plan follows the 4th edition in fostering world-class basic research, and it emphasises the development and shared use of advanced research facilities as well as open data and open science infrastructures. The Department for the Promotion of S&T was created to make recommendations on the reform of the S&T system, and the Act for Strengthening R&D Capability and the Efficient Promotion of R&D with Promotion of R&D System Reform (2008) was amended in 2013 to allow independent administrative agencies to contribute, including through IPR, to start-ups in order to encourage the commercialisation of R&D results.

Improving the framework conditions for innovation

Japan has recently reinforced the IP legislative framework in light of the global momentum to harmonise IP systems across countries. The Patent Law was amended in 2015 to enhance relief measures and to establish a new system that enables any person to file an opposition to a granted patent within six months from the date of publication of the gazette of the patent. Under the revised Design Act, applicants will be able to file single applications to register their designs in multiple countries. Under the revised Trademark Act, legal protection will be expanded so that non-traditional trademarks will be given protection, and more entities will become eligible to register regional collective trademarks. In 2013, the Japan Patent Office (JPO) introduced a system of "collective examination for IP portfolios" to examine cross-sectional applications. The JPO revised the examination guideline comprehensively in terms of simplification, clarification, greater information about sample cases and international acceptability in 2015.

Some key STI performance indicators

Figure 2. Economic performance

Labour productivity, GDP per hour worked, index 2005=100

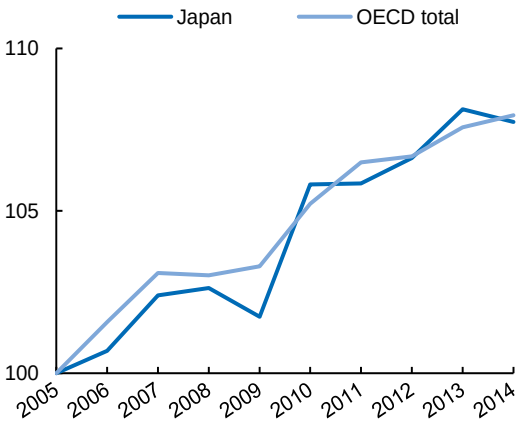


Figure 3. Environmental performance

Green productivity, GDP per unit of CO_2 emitted, index 2005=100

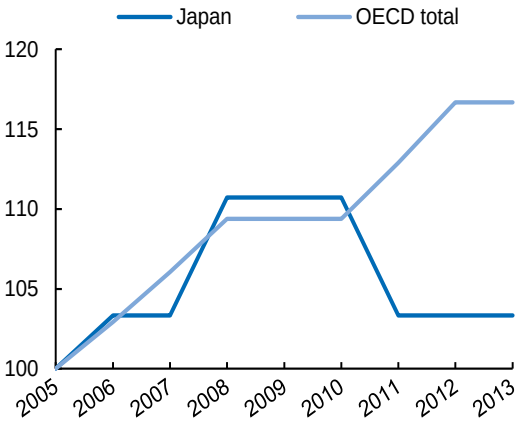
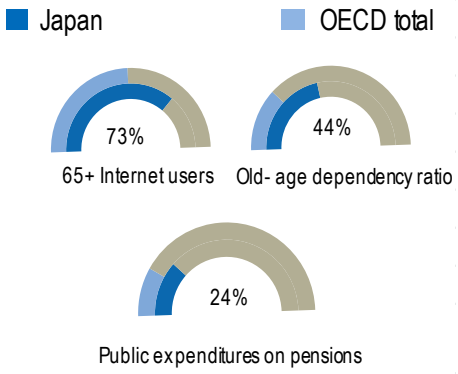


Figure 4. Ageing

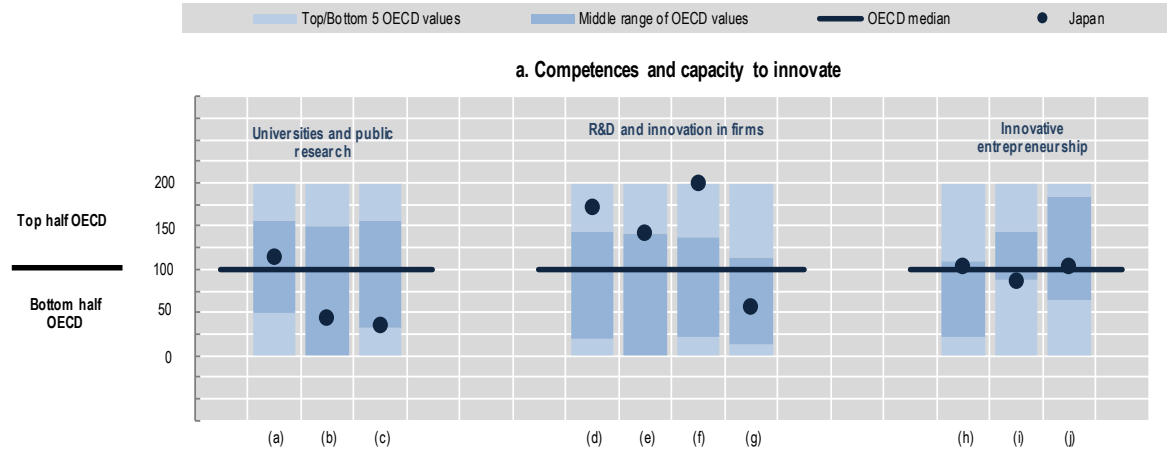
2015 or latest year available, percentages



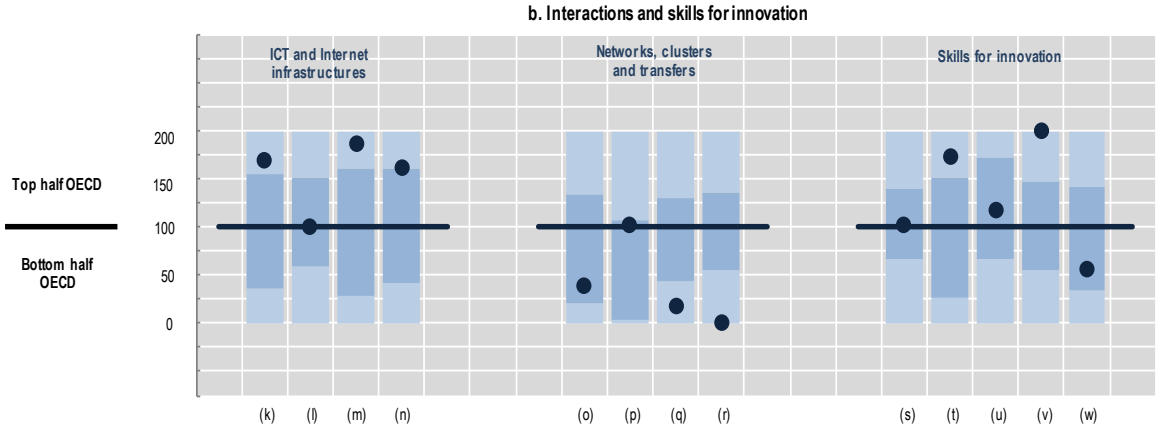
Benchmarking national STI systems

Figure 5. Science and Innovation in Japan

Comparative performance of national science and innovation systems, 2016



(a) Public R&D expenditure (per GDP)
(b) Top 500 universities (per GDP)
(c) Publications in the top journals (per GDP)
(d) Business R&D expenditure (per GDP)
(e) Top 500 corporate R&D investors (per GDP)
(f) Triadic patent families (per GDP)
(g) Trademarks (per GDP)
(h) Venture capital (per GDP)
(i) Young patenting firms (per GDP)
(j) Ease of entrepreneurship index



(k) ICT investment (per GDP)
(l) Fixed broadband subscriptions (per population)
(m) Wireless broadband subscriptions (per population)
(n) E-government development index
(o) Industry-financed public R&D expenditure (per GDP)
(p) Patents filed by universities and public labs (per GDP)
(q) International co-authorship (%)
(r) International co-invention (%)
(s) Tertiary education expenditure (per GDP)
(t) Adult population at tertiary education level (%)
(u) Top adult performers in technology problem-solving (%)
(v) Top 15 year-old performers in science (%)
(w) Doctoral graduate rate in science and engineering (%)

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

Highlights of the Japanese STI system

STI policy governance

The Cabinet Office has set up an Expert Panel on Open Science based on Global Perspectives in November 2014 to identify the guiding principles to promote open science based on a "whole of government" approach. Following discussion with experts from academia and R&D institutions, the expert panel defined these principles in a report finalised in March 2015. One of the major outcomes was the need to improve the efficiency and productivity of scientific research activities. In 2014, the Council for Science, Technology and Innovation approved Draft Guidelines on Establishing Medium to Long-term Objectives and Conducting the Evaluation for the National Research and Development Institutes, in response to the revision of the Act on General Rules for Incorporated Administrative Agencies. The objective is to promote the formulation of proper targets for the maximization of R&D results and the performance of evaluations.

Innovation in firms

Japan's business sector is one of the world's most R&D-intensive (2.79% of GDP in 2014). The STI system is dominated by major corporate groups, which are among the world's largest corporate R&D investors (figure 5[d,e]). Business investment in high-technology and medium-high-technology R&D (pharmaceuticals, communication equipment and motor vehicles) (figure 6) has made Japan a world technology leader. However, the country's performance in non-technological innovation, as measured by trademarks, is modest (figure 5[g]). Public support for the business sector is limited, as firms finance 98% of their R&D activities. The R&D tax credit is the main public funding instrument. The system for carrying forward the excess over the limit for R&D tax credits was abolished in the FY2015 Tax Reform.

ICT and Internet infrastructures

Japan still enjoys a relative specialisation in ICT as measured by its patent applications in the field, but this comparative advantage is dwarfed compared to a decade ago (figure 7). A major challenge for Japan is to develop next-generation infrastructure, especially in relation to cyber-space uses and the spread of the Internet of Things. Japan's ambitious Declaration to be the World's Most Advanced IT Nation aims to make the country "a leading digital economy by 2020", by securing IT infrastructure at the world's highest levels and by supporting the development of infrastructure industries. Japan's national digital strategy targets cutting-edge network technologies, in particular: ultra-high-speed network transmission technologies; data processing and analysis technologies, including pattern recognition technologies; device, sensor and robotics technologies; software development and non-destructive testing; and highly developed multilingual speech translation systems. E-government and open data are key axes for future policy development.

Technology transfer and commercialisation

In Japan, innovation by large firms relies less on co-operation with the science base, e.g. contract research with public research institutions (figure 5[o]), and more on co-operation within corporate groups. As a consequence, researchers are highly mobile in the private business sector, but much less so between industry and academia. To address this challenge, a public-private consortium formed in 2014 encourages the intersectoral mobility of researchers. The commercialisation of scientific research has been a priority of Japanese STI policy in recent decades, with a number of measures implemented since the mid-1990s. Through the Centres of Innovation Programme, the government subsidises high-risk collaborative R&D projects on social challenges for the coming decade. Although technology transfer through industry-science co-operation remains weak, universities and PRIs are active in patenting (figure 5[p]).

Clusters and regional policies

The Comprehensive STI Strategy and the Japan Revitalisation Strategy, revised in 2014, promote regional revitalisation by taking advantage of regional resources, by developing regional infrastructures for innovation, particularly for transfer between universities and industry, and by providing greater autonomy in the management of regional projects. Capitalising on prior cluster initiatives, Japan adopted a new Industrial Cluster Plan in 2014 with comprehensive initiatives to revitalise Japanese industry.

Globalisation

Unlike in the field of international trade and investment, Japan remains weakly linked to international S&T co-operation networks (figure 5[q,r]) and attracts little R&D investment by foreign firms (figure 6). The Japanese Society for the Promotion of Science allocated USD 18 million PPP (JPY 1.9 billion) in 2015 to the Programme for advancing Strategic International Networks to Accelerate the Circulation of Talented Researchers, which supports Japanese universities and research institutes to engage in international joint research through sending young Japanese researchers abroad and hosting foreign researchers in Japan. Similarly, a collaborative research programme (Japan Initiative for Global Research Network on Infectious Diseases) with African partner countries, launched in 2005, covers research and development in the medical and public hygiene fields, ranging from basic research to the establishment of methods for diagnosis, surveillance, prevention and drug discovery. The Act for Promotion of Japan as an Asian Business Centre has helped to accelerate patent examinations, reduce patent fees, and cut examination times for residence permits to encourage the establishment of foreign R&D centres and headquarters in Japan.

Skills for innovation

Japan has a sound skills foundation with a large pool of university graduates (figure 5[t]) and high scores on international assessments of adults in technology problem-solving and of young students in science (figure 5[u,v]). However, there are relatively few doctoral graduates in science and engineering (figure 5[w]) owing both to the low participation of youth (especially women) in doctoral programmes and to the lack of interest among youth in S&T studies. Japan has therefore sought to improve the attractiveness of research careers and to build a broader science culture. The Co-creation dialogue is an instrument to foster industrial creation and a societal shift towards scientific and technological innovation. Its objective is to promote the science and technology literacy of the country's citizens. In order to broaden the range of human resources with an entrepreneurial spirit and improve the social acceptance and status of start-ups and venture businesses, the government will support various human resource initiatives in elementary, secondary and higher education. The Comprehensive Strategy on STI (2016) has a special focus on strengthening human resources. The Strategy supports the introduction of tenure track systems in order to improve the career prospects of young researchers. The Initiative for Realising Diversity in the Research Environment supports the integration of female researchers in science – women accounted for only 14.7% of all researchers in Japan in 2015 according to national statistics – by improving the working environment so that female researchers can balance childbirth, childrearing and nursing care with research.

Structural aspects and specialisation

Figure 6. Structural composition of BERD, 2013 or latest year available

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

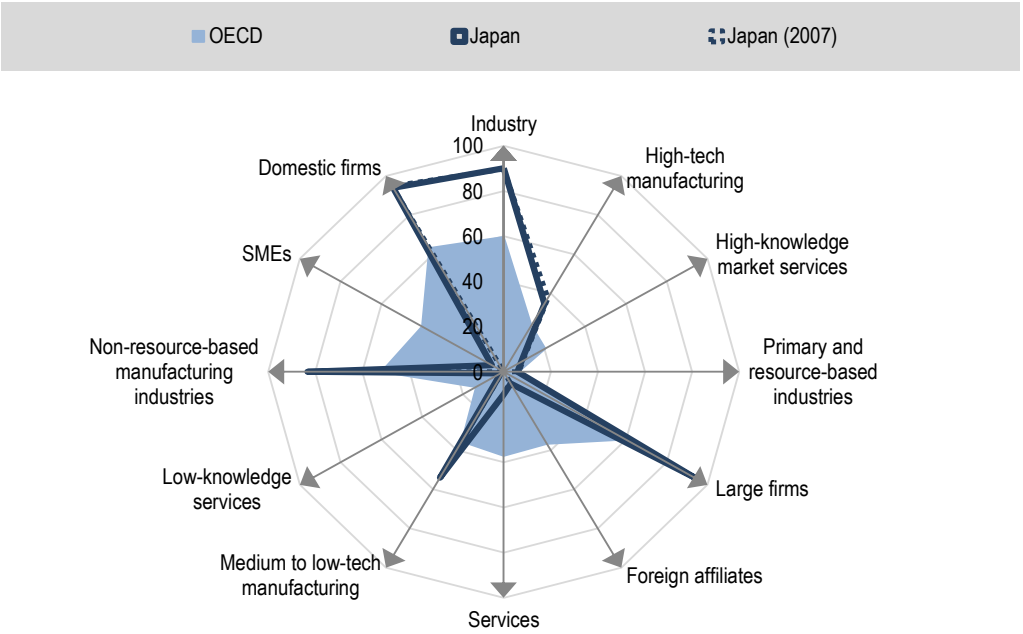
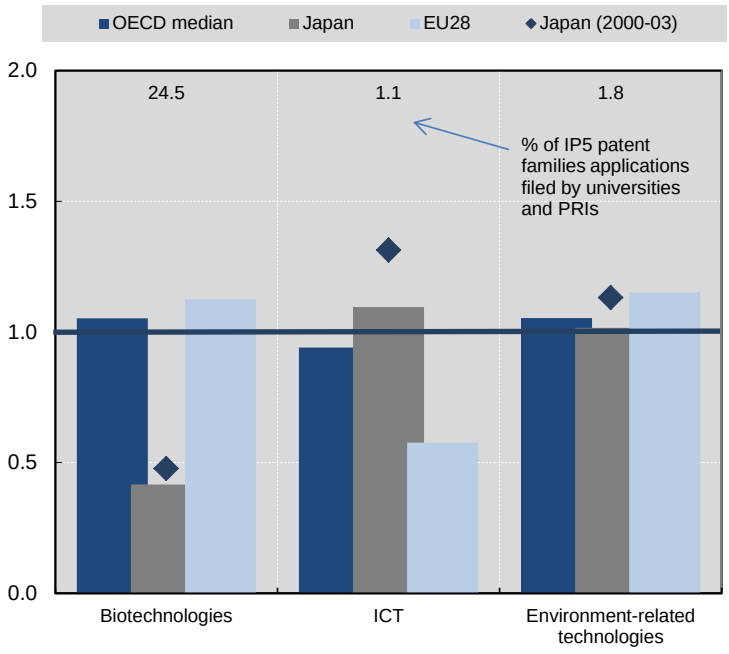


Figure 7. Revealed technology advantage in selected fields, 2011-2013

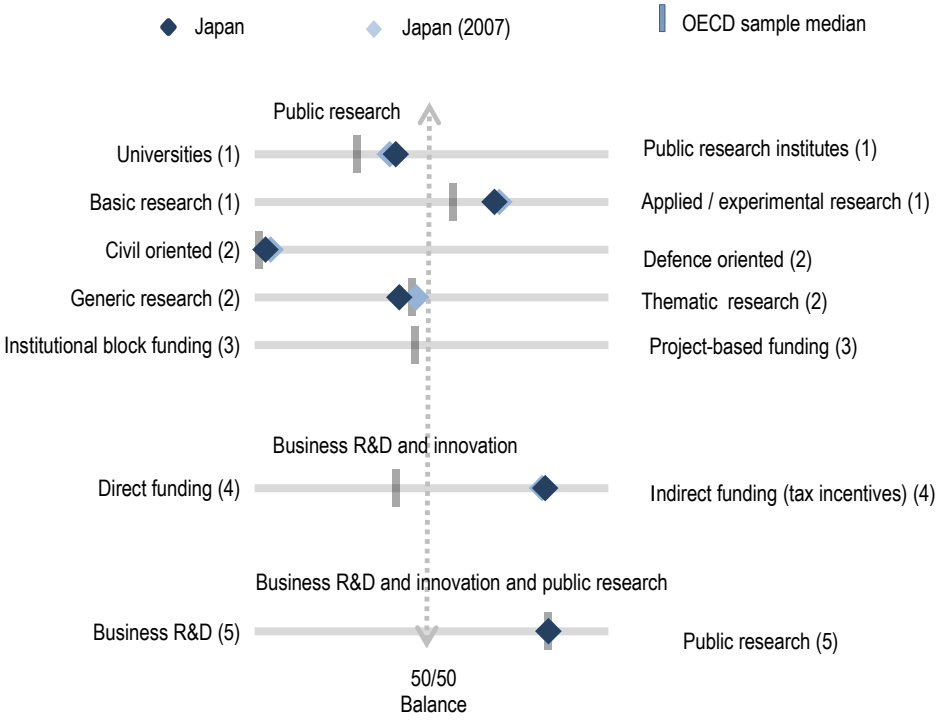
Index based on IP5 patent families applications



National STI policy mix

Figure 8. Allocation of public funds to R&D, 2014 or latest year available

By sector, type of R&D and mode of funding



(1). Balance as a share of both higher education (HERD) and government (GOVERD) R&D expenditure.
(2) Balance as a share of total government budget appropriations and outlays for R&D (GBAORD).
(3) Balance as a share of total funding to national performers.
(4) Balance as a share of both indirect funding (through R&D tax incentives) and direct funding (through grants, procurement, loans, etc.).
(5) Balance as a share of publicly-funded HERD and GOVERD and components of (4).

Note: Policy information comes from country responses to the *OECD STI Outlook* policy questionnaires 2016 and 2014. Japan's responses are available in the EC/OECD STI Policy Database, edition 2016 at http://qdd.oecd.org/DATA/STIPSurvey/JAP...STIO_2016.

Source: See the reader's guide and methodological annex.

StatLink http://dx.doi.org/10.1787/888933433901

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