



## UK Science and Innovation Network Country Snapshot

# Japan

### Japan Science and Innovation Facts (£1= ¥160)

According to the Statistics Bureau of Japan, Japan's total expenditure on R&D during FY2021 was ¥19.74 trillion (£123bn) (£61.8bn in 2020 for the UK), a 2.6% increase on the previous fiscal year's R&D spend. Expenditure on R&D as a percentage of GDP was 3.59% (1.74% for the UK in 2019). A large portion (72.1%) of Japan's R&D expenditure comes from the private sector (67% for the UK in 2019, also the largest contribution to UK total R&D expenditure). Business enterprises invested ¥14.22 trillion (£88.9bn) in R&D expenditure in FY2021, a 2.6% increase on the previous year. Universities accounted for 19.2%, investing ¥3.78 trillion (£23.6bn) in FY 2021 with a 2.9% increase on the previous year. Non-profit organisations and public agencies accounted for 8.8%, investing in ¥1.73 trillion (£10.8bn) in FY 2021 with a 1.9% increase on the previous year.

According to the latest OECD data, there are 10.106 researchers per 1,000 employed in Japan in 2020 (9.645 for the UK in latest figures from 2019). In 2020, the total number of researchers in Japan is 951,726 (UK was 548,498 in latest figures from 2019). In 2019, Japan produces 15,599 new doctoral graduates per year (UK 29,340). Only 17.5% of researchers in Japan were women in 2020 (39.0% in the UK in latest figures from 2019).

Japan is 5th in the 2022 Nature Index (the UK ranked 4th) and 13th in the 2022 Global Innovation Index (the UK is 4th). In Clarivate's analysis of global top 100 business innovators, 38 are in Japan, more than any other country. Since 2000, Japan has received the second most Nobel Prizes in the natural sciences. This includes Manabe (the physical modelling of Earth's climate, 2021), Yoshino (lithium ion batteries, 2019) Honjo (cancer, 2018), Ohsumi (autophagy, 2016), Kajita (neutrinos, 2015), Omura (parasites, 2015), and Amano and Akasaki (blue LED, 2014).

### Japan Science and Innovation Landscape

The following four funding agencies are responsible for allocating the majority of Japan's competitive public R&D funds:

- Japan Society for the Promotion of Science (JSPS)
- Japan Science and Technology Agency (JST)
- Japan Agency for Medical Research and Development (AMED)
- New Energy and Industrial Technology Development Organisation (NEDO)

JSPS has the largest budget and provides competitive, bottom-up funding through grants-in-aid for scientific research. It also offers both inbound and outbound fellowships to encourage international collaboration. JST provides top-down funding aimed at implementing national science and innovation policies. NEDO is affiliated with the Ministry of Economy, Trade and Industry (METI) and promotes R&D and commercialisation of industrial technologies. AMED funds integrated R&D in medicine from basic research to clinical trials.

Public sector research in Japan is conducted in dedicated research institutions and higher education institutes. As of 2022, there are 86 national universities, 101 public universities and 620 private universities in Japan. Japan also has 27 national research institutions. Each institution is under the jurisdiction of a ministry and is expected to serve as a base for open innovation supporting national and societal needs.

### Leading universities

- Aoyama Gakuin University
- Gakushuin University
- Hokkaido University
- Keio University
- Kyoto University
- Kyushu University
- Nara Institute of Science and Technology
- Nagoya Institute of Technology
- Nagoya University
- Osaka University
- Okinawa Institute of Science and Technology
- The University of Tokyo
- Tohoku University
- Tokyo University of Science
- Tokyo Institute of Technology\*
- Tokyo Medical and Dental University\*
- University of Tsukuba
- Waseda University

\*Tokyo Institute of Technology and Tokyo Medical and Dental University will be integrated into one university as "Institute of Science Tokyo" in FY2024.

## Important national research institutions

- The Institute of Physical and Chemical Research (RIKEN)
- National Institute of Advanced Industrial Science and Technology (AIST)
- National Institute for Materials Science (NIMS)
- National Institute for Natural Science (NINS)
- Japan Aerospace Exploration Agency (JAXA)
- Japan Atomic Energy Agency (JAEA)
- Japan Agency for Marine-Earth Science and Technology (JAMSTEC)
- National Institute for Quantum and Radiological Science and Technology (QST)
- National Research Institute for Earth Science and Disaster Prevention (NIED)
- Fukushima Institute for Research, Education and Innovation (F-REI)

## Japan S&I Strengths

It is widely agreed that Japan is strong in the following fields of science and innovation:

**Biotechnology and Biological Sciences:** structural analysis, fisheries science, functional foods, plant science, and animal science.

**Economic and Social Sciences:** social impact of technology, Asia studies, and ancient literature

**Engineering and Physical Sciences:** novel materials, element science, composites, microscopy, battery components, electronic materials, power electronics, quantum sensing and metrology, thermal and nuclear power, chemical energy uses (storage, conversion, CCU), heat utilisation, combustion, tribology, industrial robotics, factory automation systems, supercomputers, and biometrics.

**Medicine:** extracellular fine particles, optical imaging, magnetic resonance imaging, immunology, chronobiology, macromolecular drugs, neuroscience, stem cells and regenerative medicine, organoids, lifestyle diseases, and neurology.

**Natural and Environmental Sciences:** oceanographic observation, climate science, hydrology, and purification (exhaust gas purification, etc.).

**Large Research Infrastructure:** SACLA X-Ray Free-Electron Laser, SPring-8 Synchrotron, KAGRA Gravitational Wave Detector, Chikyu Scientific Drilling Ship, Super Kamiokande, Hyper Kamiokande Neutrino Detector (under construction), and Fugaku Supercomputer.

Source: Summary of Panoramic View Reports by Centre for Research and Development Strategy (CRDS), Japan Science and Technology (JST)

## Japan S&I Priorities and Policies

**6th Science, Technology and Innovation Basic Plan:** This is Japan's central, strategic science plan agreed by Japan's Cabinet Office, and sets out Japan's priorities for the years 2021-25. The plan aims to realise "Society 5.0", defined as "a human-centred society that achieves both economic development and solutions to social issues through a system that highly integrates cyberspace and physical space". The key three pillars of the policy are: transformation into a sustainable and resilient society (social structural reform premised on the use of digital technologies), creation of "knowledge" (strengthening research capability), and development of human resources (strengthening of the "ability to explore ideas" and "a continuous learning mindset").

**Moonshot Programme:** In January 2020, the Government of Japan announced nine 'Moonshot Goals' they hope to achieve by 2050. The projects are in the fields of cybernetics, preventative medicine, autonomous robotics, food production systems, sustainable resource circulation, quantum technologies, healthy ageing, weather control and mental health.

**SIP Programme:** The third 5-year phase of the Cross-ministerial Strategic Innovation Promotion Programme (SIP) has started in FY2023 and is expected to have a budget of around 28 billion yen in FY2023 (roughly £175 mn). SIP covers 14 projects in fields such as integrated healthcare system, maritime security platform, smart energy management system, and circular economy system. The first phase of SIP Programme covered 11 areas in FY2014-2018, and the second phase covered 12 areas in FY2018-2022.

**WPI Centres:** First established in 2007, the World Premier International Research Centre Initiative aims to establish globally competitive centres of excellence that will attract top researchers from around the world. Hosted by universities and national research institutes across the country, there are currently 17 centres each receiving annual funding of 700 million to 1.4 billion yen for 10-15 years. The working language at WPI Centres is English and around 40% of researchers are from overseas.

**UK and Japan S&I Cooperation:** The UK is Japan's 4th biggest collaborator on scientific research. Japan is the UK's 14th biggest collaborator on scientific research. The quality of UK-Japan research is 3½ times the world average (measured by field-weighted citation impact), higher than with the USA, Germany or China for both countries. In certain fields such as medicine, the quality of UK-Japan research is over 6½ times the world average. Other fields with very high quality collaborative research are immunology and microbiology; environmental science; social sciences; biochemistry, genetics and molecular biology; neuroscience; earth and planetary sciences; physics and astronomy; engineering; and agriculture and biological sciences. For FY 2021, UK researchers are the 6th largest group of visiting researchers to Japan (after China, the USA, South Korea, India and France) accounting for 4.0% of the total. The UK is the 4<sup>th</sup> most popular destination for Japanese researchers on mid to long-term overseas placements (6.2% of the total, after the USA, Germany and France).

## Recent Joint Projects

### 2023

[Clinical Research \(NIHR-AMED, MRC-AMED as a part of AMED ASPIRE Programme\)](#)

UK-Japan Arctic Research Bursary Scheme ([BAS and NERC](#))

Semiconductor Partnership (DSIT-METI)

Implementing Arrangement on Industrial Science, Innovation and Technology (DSIT-METI)

### 2022

UK-Japan Digital Partnership (DCMS and [GDS – Digital Agency, METI, MIC](#))

[Neuroscience \(MRC – AMED\)](#)

Nuclear Decommissioning Phase 9 ([EPSRC – MEXT](#))

### 2021

Social Science and Humanities to Address COVID-19 Challenges (UKRI – JSPS)

Space Situational Awareness (DSTL – JAXA)

Nuclear Decommissioning Phase 8 (EPSRC – MEXT)

### 2020

Regenerative Medicine (MRC – AMED)

Nuclear Decommissioning Phase 7 (EPSRC – MEXT)

### 2019

Infectious Diseases (MRC – AMED)

Social Impact of AI (ESRC – JST/RISTEX)

Nuclear Decommissioning Phase 6 (EPSRC – MEXT)

### 2018

Life Sciences and Environmental Sciences (UKRI – JSPS)

Marine Sensor Technology (NERC – JST)

Nuclear Decommissioning Phase 5 (EPSRC – MEXT)

### 2017

Nuclear Decommissioning Phase 4 (EPSRC – MEXT)

## Follow us

SIN Global on Twitter: [@UKSINet](#)

Our Ambassador on Twitter: [@JuliaLongbottom](#)

Our Embassy on Twitter: [@UKinJapan](#)

Our Embassy on [Facebook](#)

**Last updated in July 2023 by Science, Innovation and Digital Section, British Embassy Tokyo**

The information in this document is believed correct at the time of distribution. However, HM Government accepts no liability for any loss or damage incurred as a result of any inaccuracies, however caused.