

Japan's 5th Science and Technology Basic Plan (2016- 2020)

Sammanfattning

I april 2016 publicerades Japans femte basplan för vetenskap och teknik (Science and Technology Basic Plan). Japan har 20 års erfarenhet med dessa femåriga planeringscykler. Planen innehåller inte prioriteringar inom forskning och utveckling på detaljnivå, utan ska snarare regeringens ambition att identifiera viktiga breda forskningsområden och strävan efter systeminnovation. En tydlig trend i den femte planen relativt tidigare planer är användandet av begrepp som 'open science', 'networked science', och 'citizen science' vilket visar på ambitionen att ytterligare öppna upp landets FoU-system. Planen innehåller generellt ovanligt skarpa varningar om att Japan tappar i konkurrenskraft. Detta ska åtgärdas med en bättre politisk samordning mellan departement, inom departement, och bland forskningsfinansiärerna, och tydligare fokus på FoU-systemets fundamenta (människor och excellens) tillsammans med öppnare innovation. Planen innehåller en rad numeriska mål för de kommande fem åren, och identifierar några teknikområden (t.ex. Internet of Things och Artificial Intelligence) som viktiga disciplinöverskridande möjliggörare.

Summary

In April 2016 Japan published its fifth Basic Plan for science and technology (Science and Technology Basic Plan). Japan has used these five year planning cycles for twenty years. The plan does not include research and development priorities on a detailed level, but rather the ambition of the government to identify important broad research areas as well as its aspiration for system innovation. A clear trend in the fifth plan, in relation to earlier plans, is the use of terms like 'open science', 'networked science', and 'citizen science' which displays the ambition to further open up the country's system for research and innovation. Overall, the plan contains unusually sharp warnings that Japan is dropping in competitiveness. This issue is addressed with improved political coordination between and within departments and research councils, as well as a clearer focus on the basic components of the R&D-system (People and Excellens) together with more open innovation. The plan contains a number of numerical goals for the coming five years and identifies several technology areas (for example Internet of Things and Artificial Intelligence) as important boundary spanning enablers.

20 years of Science and Technology Basic Plans

Japan's public S&T administration operates under the basic policies of the Council for Science, Technology and Innovation (CSTI) chaired by the Prime Minister, and works to promote S&T in coordination with related ministries. Basic plans are made every five years and four Science and Technology Basic Plans have been established since the enactment of the Science and Technology Basic Law in 1995. The 5th Science and Technology Basic Plan (from 2016 to 2020) is taking effect April 2016. In parallel with the five year plans, parallel so called STI Comprehensive Strategies with a planning horizon of two years are published.

The Basic Plan does not contain priorities in R&D on a detailed level, but can rather be seen as the government's broad identification of important research fields, and the aspirations for system innovation. System innovation implies improvements, often on a high level of abstraction like "open science", to a variety of systems relating to science and technology. In the end these directions should translate down to changes in e.g. methods of managing science and technology budgets and a range of rules relating to scientific and technological research. Identification of important research fields is the national government's indication for what academic fields that are seen as strategic in R&D for the next five years. The objective is to concentrate the government's policy resources into those fields. Prioritization has in the two recent plans been firmly grounded in the grand challenges for Japan, such as sustainable growth including stable energy sources, the ageing society, and public safety and security related to both natural (earthquakes) and man-made (cyber threats) disasters.

Sense of urgency not to fall behind in R&D

Japan has the world's second highest number of Nobel Prize laureates in the natural sciences in the 21st century, symbolizing the country's presence in science and technology in the world. The 5th Plan however stresses that Japan's world standing in science and technology is falling as a whole relative to other countries that are further strengthening their STI policies. In the very first chapter of the 5th Plan, several pressing issues behind that declining tendency are mentioned. For example, Japan's research papers are dropping in international rank due to the rise of China and other countries. This is a fact both in quantitative and qualitative terms. Universities are explicitly said to lag behind in terms of management, human resource systems, and international network expansion. Environments are lacking where young researchers can fully demonstrate their abilities, and many of the high-capability students are hesitant to pursue doctoral courses. Women's career prospects in the academic world are weak. Barriers for human resources mobility between universities and industry hamper innovation. Industry-academia collaboration for R&D has yet to reach full maturity. In addition, the shift from pure science and technology policy to a policy encompassing innovation as given in the 4th Basic Plan may not be progressing sufficiently.

Addressing the problems by stronger fundamentals and inclusive science

The 5th plan¹ addresses these problems as systematic failures that have to be addressed, but also gives a number of numerical targets for later follow-up, as well as several enabling technologies which can give benefits regardless of R&D-area.

Summarizing the new trends compared to the 4th Basic Plan, concepts like open science, networked science, and citizen science indicate a more inclusive approach to managing the country's R&D-system. There is an acknowledgement that Japan is in need of better policy coordination between ministries, within ministries, and among funding agencies.

The wording in the plan, as well as comments from the Council for Science, Technology and Innovation also softens up the ambition to set out firm plans for the next five years, and rather aims for enhancing preparedness for an unforeseeable future. This is to be done with investments in fundamentals (people and excellence), and better functioning STI-systems that can make better use of open innovation. Imminent needs to improve fundamentals are identified as the promotion of diversity and mobility among researchers. One measure in this regard is to build transparent hiring processes that ensure fair assessments regardless of gender.

One thing that stands out is emphasis on strategic intellectual property management and standardization. According to the plan, the government will intervene to support Japanese participation in international standardization, especially in emerging areas where standardization by an existing industrial organization is difficult, and for technologies developed by small and medium-sized companies. Public procurement should support new technologies developed by small and medium-sized companies, i.e. by a reformed tender systems that take into account technological sophistication.

¹ The Cabinet Office official English translation of the 5th S&T Basic Plan can be found here:

Main document: <http://www8.cao.go.jp/cstp/english/basic/5thbasicplan.pdf>

Outline: http://www8.cao.go.jp/cstp/english/basic/5thbasicplan_outline.pdf

Quantitative goals for follow up

To deal with these issues, in the 5th Plan, the Japanese government has set several numerical goals to be achieved by 2020. For example, the government aims to increase the proportion of full-time university faculty less than 40 years old (from 25 per cent in 2013) to 30 per cent or more by 2020 on a nationwide level. The government also aims to achieve the numerical target of the proportion of female researchers among new hires mentioned in the 4th Science and Technology Basic Plan (30% of the total in the natural sciences overall, 20% in the physical sciences, 15% in the engineering, 30% in the agriculture sciences, and 30% in medicine, dentistry and pharmacology combined), which has not yet been achieved.

The number of researchers moving among universities, research institutes and commercial companies will be increased (from 10,000 in 2013) to 12,000 by 2020. While promoting collaboration between universities and SMEs (including Global Niche Top companies²), the government aims to increase the number of license agreements on university patents (from 7,500 in 2013) to 15,000 by 2020. The government aims to increase the number of IPO (initial public offering) cases regarding venture companies engaging in R&D activities, many of which tend to be from university research projects, from 30 in 2014 to 60 by 2020 on an annual basis.

The government aims to increase the amount of investment from commercial companies into university-oriented research projects (from JPY 39 billion in 2013) to about JPY 80 billion by 2020. And, as a high-level goal, the government aims to make the total public and private-sector R&D investment reach at least 4% of GDP (about JPY 26 trillion) by 2020.

² RIETI 2013 Study on Global Niche-top Enterprises as Representatives of Excellent Small and Medium Manufacturing Companies in Japan. Available: <http://www.rieti.go.jp/en/publications/summary/13030003.html>

Enabling technologies – big data, artificial intelligence, bio- and nanotechnology

The plan particularly emphasizes the importance of realizing a “super smart society”³ or “Society 5.0.” For this purpose, the Japanese government stresses the significance of developing cutting-edge ICT (information and communication technology) and technology for IoT (Internet of Things) as one of the top-priority S&T policy targets, while paying particular attention to three other countries’ IoT-related technology promotion policy - Germany’s “Industry 4.0”, the United States’ “Advanced Manufacturing Partnership”, and China’s “Made in China 2025.” Some other exploratory fields mentioned are energy value chains, intelligent traffic systems, and integrated material development.

To realize a super smart society, the Japanese government will promote the creation of a common platform or “super smart society service platform” that allow for coordination and collaboration between multiple ICT or IoT systems and for a wide variety of data (e.g., web data, human activity data, 3D geographical data, transportation data, environmental observation data, production and distribution data of manufacturing and agricultural produce) to be collected, analyzed and applied across all the coordinating systems to produce new value and services.

In this regard, the Japanese government will further promote the development of technologies for IoT, big data analytics, high-speed processing device, AI (artificial intelligence), networking, edge-computing and cyber security as the “fundamental technologies necessary to build the super smart society service platform”, as well as such technologies as those for robotics, sensor and human interface as the “fundamental technologies that are Japan’s strengths, which form the core of new value creation.”

As an example of the ICT or IoT systems that are to be inter-connected within the super smart society service platform, the Japanese government mentions such system as intelligent transportation systems (ITS), systems for optimizing value chain, IoT-based manufacturing or production systems, integrated community care systems, smart food chain systems, and the Quasi-Zenith Satellite system. The importance of solving energy-related issues through the development and utilization of consolidated ICT systems based on AI, IoT and big data analysis for the above-mentioned “Society 5.0” is particularly emphasized in the final draft of the Innovation Strategy for Energy and the Environment published by the Cabinet Office of Japan in March 2016.

³ In the 5th Science and Technology Basic Plan, a super smart society is defined as “a society where the various needs of society are finely differentiated and met by providing the necessary products and services in the required amounts to the people who need them when they need them, and in which all the people can receive high-quality services and live a comfortable, vigorous life that makes allowances for their various differences such as age, sex, region, or language.”