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# Country Study: Japan

Yukihiro Sato | Tateo Arimoto

March 2023

Cambridge Industrial Innovation Policy

# Contents



**Tokyo, Japan | March 2023**

# Introduction

Japan is currently facing complex socioeconomic challenges, such as COVID-19, low fertility, an ageing population, digitalisation and carbon neutrality. The government's Industrial Innovation Policy (IIP) plays an important role in addressing these challenges because relevant policy solutions are facilitated by science, technology, innovation and industry.

In this paper, the IIP is viewed as a series of policy frameworks, running from basic research through applied research to social implementation. The reason for this view is that policies to enhance industrialisation involve the use of existing technologies and new scientific discoveries, as well as deregulation, international standardisation and the expansion of industrial finance.

Japan is one of the world's leading science and manufacturing countries. According to the Nature Index (2022), Japan is one of the five leading countries for scientific excellence, alongside the United States, the United Kingdom, Germany and China. Furthermore, the World Economic Forum (2020) noted that Japan is a manufacturing superpower and had the third-largest share of global manufacturing output in 2018. This paper describes Stage 4 Japanese organisations, processes, contents and best practices (which partly overlap with those of Stage 3). This means that the paper is concerned with policy for innovation for policy.

# Organisations

Japan’s governance structure is based on a parliamentary cabinet system like that of the United Kingdom. The executive branch is headed by the prime minister, and the ministers who comprise the Cabinet oversee their respective ministries and/or agencies. Japanese ministries were restructured in 2001 (Prime Minister’s Office of Japan, n.d.c), and the 14 ministries and agencies, including the Digital Agency established in 2021 (Cabinet Secretariat, Japan, 2021), currently make up the Government of Japan, as shown in Figure 1.

Each of Japan's ministries/agencies formulates policies for science, technology, innovation and industry within its jurisdiction. The organisations that play a particularly important role in formulating these policies are the Cabinet Office, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Ministry of Economy, Trade and Industry (METI). Besides these ministries, many other ministries contribute to policies for science, technology, innovation and industry, including the Ministry of Health, Labour and Welfare (MHLW), the Ministry of Agriculture, Forestry and Fisheries (MAFF), the Ministry of the Environment (including the Nuclear Regulation Authority), the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), the Ministry of Internal Affairs and Communications (MIC) and the Ministry of Defence. MEXT and METI together accounted for 60% of the government's total science-related budget at the beginning of the financial year (FY)[1] 2021 (Japan Science and Technology Agency (JST), Japan, 2022).

[1]The relationship between policy for industrial innovation and industrial innovation for policy resembles that between policy for science and science for policy. Policy for science is the creation of an enabling environment for scientific research, as in the establishment of science budgets by governments; science for policy is the use of appropriate scientific evidence (e.g. science advice) by governments for policymaking (Royal Society of Biology, UK, n.d.).

[2]The Japanese financial year begins in April and ends in March.

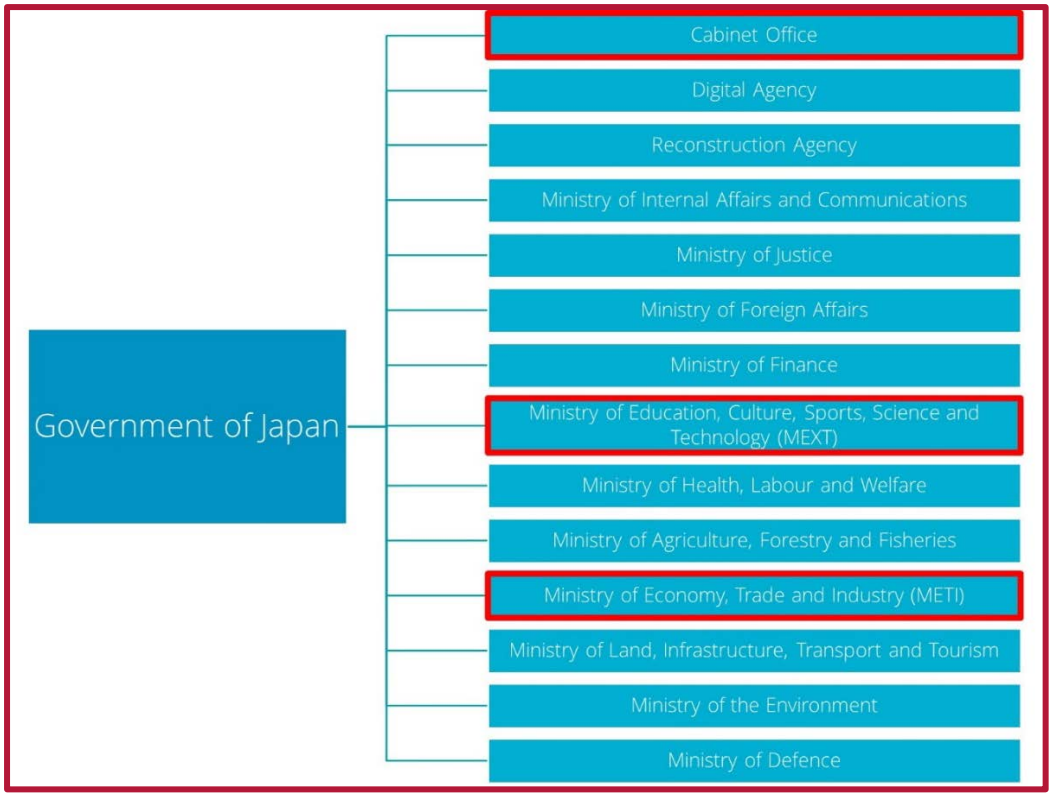


Figure 1. Japanese Ministerial Structure[2]

Regarding the roles of the three main ministries, the Cabinet Office coordinates the government overall, MEXT conducts basic research and human resource development, and METI handles industrialisation. The Cabinet Office has a Minister of State for Science and Technology Policy who assists the prime minister and coordinates the ministries at a level higher than that of other ministries with administrative responsibilities (Cabinet Office, Japan, n.d.b). MEXT mainly leads basic research and human resource development in important advanced fields, such as life sciences, materials, nanotechnology, space, ocean and nuclear energy (JST, Japan, 2021), whereas METI plays a leading role in applied research and industrialisation based on research results (Yasuhashi, 2022).

The independent administrative agencies established under MEXT and METI are also vital for promoting the IIP. MEXT has established seven research institutes—RIKEN, Japan Atomic Energy Agency (JAEA), Japan Aerospace Exploration Agency (JAXA), Japan Agency for Marine-Earth Science and Technology (JAMSTEC), National Institute for Materials Science (NIMS), National Institutes for Quantum Science and Technology (QST), National Research Institute for Earth Science and Disaster Resilience (NIED)—and two funding agencies—Japan Society for the Promotion of Science (JSPS) and Japan Science and Technology Agency (JST, Japan, 2021). In contrast, METI presides over the National Institute of Advanced Industrial Science and Technology (AIST), which is an industrial technology development agency and New Energy and Industrial Technology Development Organization (NEDO), which is a funding agency for the energy industry (JST, Japan, 2021). Notably, AIST was established when the Industrial Technology Research Institute (formerly part of METI) and 15 research institutes merged during the 2001 ministry reorganisation (AIST, Japan, n.d.). These administrative organisations work together with MEXT and METI to promote the IIP.

[2] Sources: Prime Minister's Office of Japan (n.d.c); Cabinet Secretariat (Japan, 2021); JST (Japan, 2021)

Although MEXT is primarily responsible for science, technology and innovation policy, METI focuses mainly on industrial policy. These occasionally overlapping ministry structures have a strength in dealing with diverse policy sectors but a weakness in determining organisational boundaries.

The greatest strength of Japan's ministerial structure is its responsiveness to diverse policy fields. As mentioned in Section 2.1, the organisational structure has been designed to promote the IIP across a wide range of fields, from nanomaterials to space exploration. In recent years, Japan's mission-oriented policymaking has focused on priority areas in these fields to address the country's main challenges and propose solutions (Organization for Economic Cooperation and Development (OECD), 2021).

Nevertheless, a weakness of the government structure is insufficient inter-organisational collaboration. Although cooperation between MEXT and METI is vital for linking basic research to applied research and the social application of research results, the insufficiency of cooperation has been noted by universities and the business community (MEXT & METI, Japan, 2016). In 2016, to address this issue, the two ministries established the Industry–Academia–Government Dialogue Conference on Innovation Promotion to deepen their collaboration (MEXT, Japan, 2016). Stakeholders such as the University of Tokyo and Toyota Motor Corporation participated in this conference (MEXT, Japan, n.d.), indicating their support of the industry–academia–government partnership.

# Processes

Japan's IIP policymaking takes place at two levels: the whole-government level and the individual ministry level. As illustrated in Figure 2, at the former level, the Council for Science, Technology and Innovation (CSTI) deliberates on IIP-related policies; at the latter level, the Council for Science and Technology (CST) for MEXT and the Industrial Structure Council (ISC) for METI are responsible for considering policies related to the IIP.

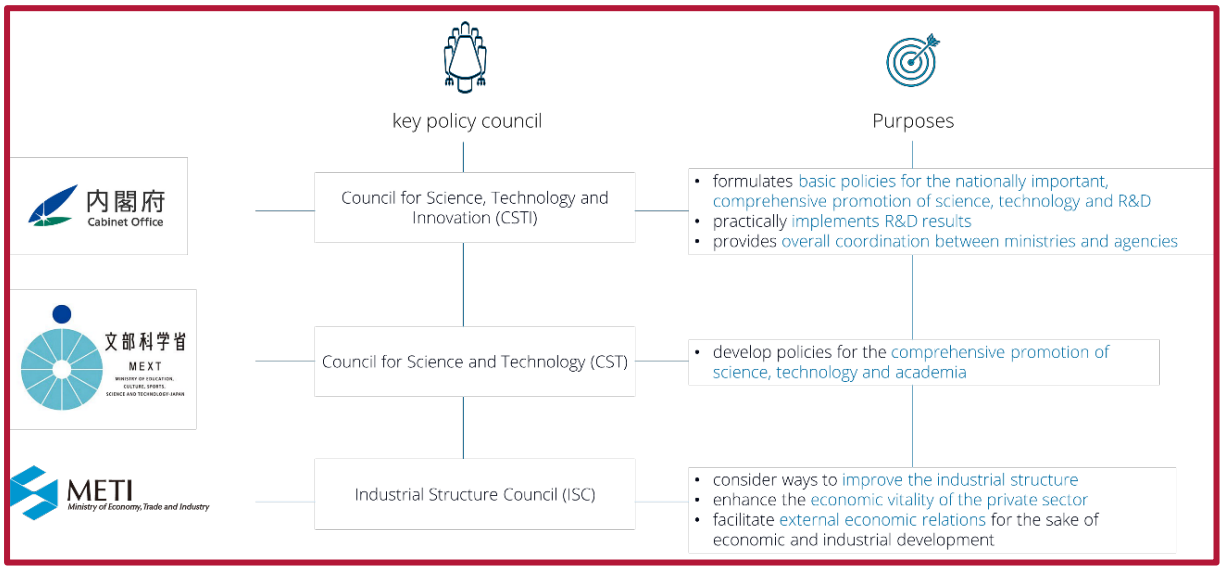


Figure 2. Policymaking Architecture of the Japanese Government[3]

CSTI[4] was established as a key policy council in the Cabinet Office when ministries and agencies were reorganised in 2001 (JST, Japan, 2022). CSTI, chaired by the prime minister, has 14 members, including the Chief Cabinet Secretary; the Minister of State for Science and Technology Policy; the Minister of Education, Culture, Sports, Science and Technology; the Minister of Economy, Trade and Industry; the President of the Science Council of Japan; the President of the University of Tokyo and other academic experts; and the Executive Officer of Fujitsu and other leading industry figures. CSTI's responsibility is to formulate basic policies for the nationally important, comprehensive promotion of science, technology, research and development (R&D); the practical application of R&D results; and overall coordination between ministries and agencies (JST, Japan, 2022). Its specific policies are discussed in the next section.

CST is an important MEXT council consisting of 29 members from independent administrative agencies (e.g., JST), universities (e.g., Nagoya University) and various companies (MEXT, Japan, 2022b). The purpose of CST is to develop policies for the comprehensive promotion of science, technology and academia (MEXT, Japan, 2019). Six subcommittees have been established under this umbrella council, including the Research Planning and Evaluation Subcommittee, which assists in the formulation and evaluation of R&D plans, and the Academic Subcommittee, which assesses the promotion of academic research and education programmes (MEXT, Japan, 2019).

[3] Sources: JST (Japan, 2022); MEXT (Japan, 2019); METI (Japan, 2022d)

[4] Until 2014, CSTI was known as the Council for Science and Technology Policy (CSTP).

METI has an ISC that proposes industrial policy and comprises 21 members from a wide range of organisations, including the Japan Business Federation, leading universities, the Japan Foreign Trade Council and the Japanese Trade Union Confederation (METI, Japan, 2022b). The purpose of ISC is to consider ways to improve the industrial structure, enhance the economic vitality of the private sector and facilitate external economic relations for the sake of economic and industrial development (METI, Japan, 2022d). Under the ISC, there are 11 subcommittees, including the New Opportunities Subcommittee on Economic and Industrial Policy for the post-COVID-19 period and the Subcommittee on Industrial Technology and Environment for policies on R&D, innovation, standards, certifications and green transformation (METI, Japan, 2022d).

A distinctive feature of the IIP policymaking process in Japan is the close cooperation between industry, academia and the government. These three stakeholders are also involved in CSTI, which coordinates overall government decision-making.

To analyse the balance between industry, academia and the government, this paper applied the triple helix model proposed by Ranga & Etzkowitz (2013) to Japan. This model integrates the key features of the interaction between the three actors into an innovation system, defined by systems theory as a set of components, relationships and functions (Ranga & Etzkowitz, 2013). Ranga and Etzkowitz (2013) identified three types of balance, as shown in Figure 3: (a) a statist configuration in which the government plays a leading role and drives industry and academia, (b) a laissez-faire configuration characterised by limited state intervention in the economy, and (c) a balanced configuration in which industry and academia collaborate with government(Ranga & Etzkowitz, 2013).

Based on national projects, such as Impulsing Paradigm Change through Disruptive Technologies Program (ImPACT) and Cross-ministerial Strategic Innovation Promotion (SIP), which are discussed in Section 4, Japan is considered to typify the balanced (c) model. This configuration is ideal for innovation because it provides favourable environments for innovation at the intersections between spheres, where creative synergies are generated (Ranga & Etzkowitz, 2013).

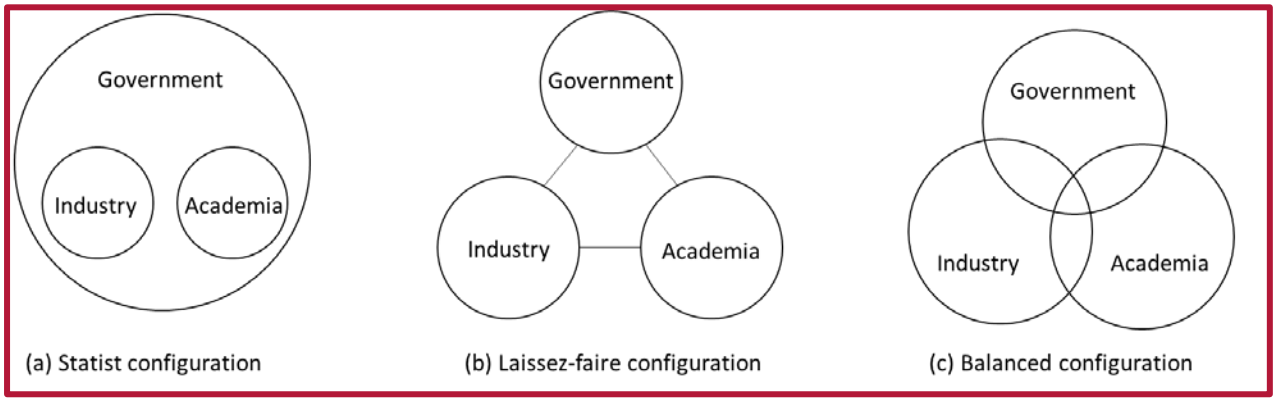


Figure 3. Triple helix configurations[5]

Furthermore, Japan's IIP policymaking architecture is excellent for policy evaluation. CSTI evaluates large-scale national R&D projects and administers a total national expenditure of at least 30 billion yen, according to Article 26, Paragraph 1, Item 3 of the *Act for the Establishment of a Cabinet Office* enacted in

[5] Source: Ranga & Etzkowitz (2013)

2001, which states that the Cabinet Office should evaluate large-scale R&D projects and other nationally important R&D initiatives (Cabinet Office, Japan, n.d.c). The evaluation results are made public and are used to improve project management and budget allocation (Cabinet Office, Japan, n.d.c), thus supporting the comprehensive and systematic promotion of the IIP policy in Japan.

A challenge of Japan's policymaking architecture is the disorganisation of headquarters, which affects individual policies. In recent years, the number of headquarters headed by the prime minister has increased to involve relevant ministers in issues that should be promoted comprehensively and intensively at the country-wide level (JST, Japan, 2022). In the science and technology fields alone, these include the Strategic Headquarters for Intellectual Property, the Strategic Headquarters for Space Development, and the Headquarters for Healthcare Policy (JST, Japan, 2022). These headquarters tend to be established in response to changes in government administration and society, but once established, they are rarely abolished. This may have led to a negative impact of an increased workload on government officials, and the consolidation of these headquarters into CSTIs could effectively integrate their operational aspects and streamline the government.

## Content

Based on the organisations and policymaking architecture described in Sections 2 and 3, the Japanese IIP again covers the whole-government level and the individual ministry level. The hierarchy of the Japanese Government's IIP consists of four tiers: law, plan, strategy and individual programme, as illustrated in Figure 4.

At the whole-government level, the *Basic Act on Science, Technology and Innovation* was established in 1995 as the *Basic Act on Science and Technology* and amended in 2020 to form the current act (JST, Japan, 2021). The most prominent amendment is that the law now covers innovation development, together with the improvement of science and technology, and includes both the natural and social sciences (JST, Japan, 2021).

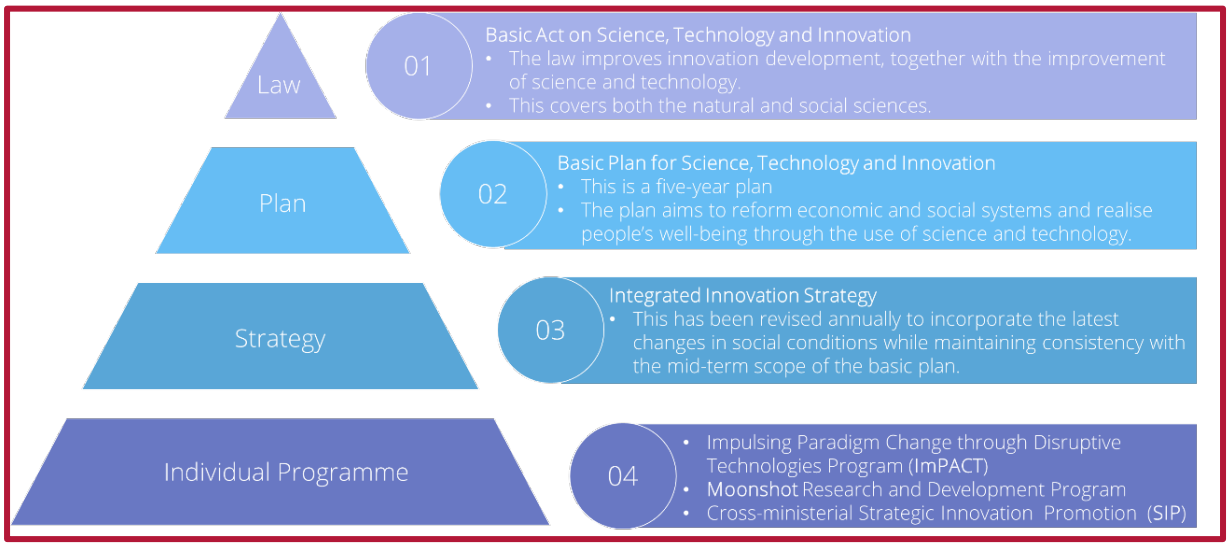


Figure 4. Japanese Government's Industrial Innovation Policy Hierarchy[6]

According to the Basic Act, CSTI has formulated the *Basic Plan for Science, Technology and Innovation* to promote these disciplines comprehensively and systematically. This is a five-year plan, and since the first phase of the plan was formulated in 1996, the sixth phase started in FY2021 (JST, Japan, 2022). This sixth plan, which is the first based on the revised Basic Law, differs significantly from the preceding plans. It has moved from promoting specific fields of science and technology to reforming economic and social systems and realising people's well-being through the use of science and technology (Cabinet Office, Japan, 2021b).

Furthermore, the *Integrated Innovation Strategy* has been revised annually to incorporate the latest changes in social conditions while maintaining consistency with the mid-term scope of the basic plan (JST, Japan, 2022). The strategy focuses heavily on integrating basic research, social implementation and international expansion policies simultaneously (Cabinet Office, Japan, n.d.a).

To integrate these strategies with practice, CSTI rolled them out across ministries and agencies. The primary policy is ImPACT from FY2013 to FY2018. The role of ImPACT is to promote high-risk, high-impact,

[6] Sources: JST (Japan, 2021); JST (Japan, 2022)

challenging R&D to develop scientific and technological innovations that, if realised, might revolutionise industry and society. The second policy is the Moonshot Research and Development Program, launched in FY2019 as a successor to ImPACT. It aims to foster R&D for discontinuous innovation in line with ambitious initiatives (moonshots) that could not previously be imagined (JST, Japan, n.d.b). The third major policy is SIP, which has been in place since FY2014. Its objectives are to comprehensively promote R&D through industry–academia–government collaboration, from basic research to practical application and possible commercialisation (Cabinet Office, Japan, 2022a).

MEXT formulates science and technology policies. For example, a *White Paper on Science, Technology and Innovation* has been published annually since 1958 to highlight Japan's research capabilities. Also, the *Comprehensive Strategy for Strengthening Basic Science* was formulated to strengthen Japan's science base (MEXT, Japan, 2009). Moreover, a designated national corporation university system was introduced in FY2017 to strengthen world-class research and education in universities (MEXT, Japan, 2022a).

In contrast, METI focuses on industrial policy. METI has published a *Monozukuri (Manufacturing) White Paper* every year since FY2001, analysed trends in Japan's manufacturing industry and provided guidelines for responding to changes in the business environment (METI, Japan, 2022a). Furthermore, METI has introduced a policy to reduce corporate tax as part of the *Tax Deduction System for Research and Development* and to promote companies' applied research (METI, Japan, 2022c). Additionally, METI has formulated policies on intellectual property and patents to indirectly support the IIP (METI, Japan, n.d.).

As discussed above, the Japanese IIP is well-developed in terms of organisations, processes and contents. Nonetheless, a capability that is perceived to be lacking among policymakers is the ability to utilise digital technologies and data for policymaking to enhance evidence-based policymaking (EIBM; Cabinet Office, Japan, 2022b). EBPM is important for making effective use of limited resources and improving the public's trust in public administration in the context of rapidly changing economic and social situations. However, MIC has pointed out that although policymakers in ministries and agencies understand the significance of promoting EBPM, they lack the capacity for concrete implementation in terms of what data to collect and how to analyse it (MIC, Japan, 2018). Against this backdrop, MIC commissioned an empirical joint study with relevant ministries and academics on methods for understanding and analysing policy effectiveness to promote EBPM throughout the Japanese government (MIC, Japan, n.d.).

The new Kishida administration, which came to power in October 2021, is committed to a *new capitalism* that will open up the future (Prime Minister's Office of Japan, n.d.a). The new capitalism is conceived as a virtuous circle of growth and distribution: growth increases corporate profits and government revenue, and distribution stimulates consumption and investment (Prime Minister's Office of Japan, n.d.a). This virtuous cycle is intended to lead Japan to the next stage of national development, based on a growth strategy that is related to the IIP and includes university reform, start-ups, carbon neutrality, digital garden cities and car electrification (Prime Minister's Office of Japan, n.d.b).

As part of university reform, a 10 trillion JPY (60.6 billion GBP)[7] government fund will be established to strengthen long-term, stable support for university research infrastructure (Prime Minister's Office of Japan, n.d.b). Research funding from the profits of this initiative is expected to lead to the formation of world-class research universities.

Furthermore, the Kishida administration has dramatically strengthened its policy to promote start-up innovation. This serious commitment was reflected in the appointment of a Minister of State for Start-ups in August 2022 (Prime Minister's Office of Japan, 2022), which is seen as the first year of start-up support, and a five-year plan will be developed to create large-scale start-ups by the end of 2022 (Prime Minister's Office of Japan, n.d.b). These start-ups will be expected to involve collaboration with major manufacturing companies, universities and other relevant organisations to generate a 'second wind' of IIP promotion.

In the environmental field, the new administration has stated that it will achieve carbon neutrality by 2050. To realise this goal, it has declared that it will not only reform the energy supply structure but also undertake a major transformation of the entire economy and society, including the industrial structure and people's lives (Prime Minister's Office of Japan, n.d.b). In terms of policies, it formulated the *Green Growth Strategy* for reaching carbon neutrality by 2050 and allocated an unprecedented 2 trillion JPY (12.1 billion GBP) from the *Green Innovation Fund* established at NEDO (NEDO, Japan, n.d.).

Furthermore, the Kishida administration intends to revitalise rural areas through the use of digital technology and the founding of *digital garden cities* (Prime Minister's Office of Japan, n.d.b). The reason for this is that Japanese cities suffer from depopulation, falling birth rates, and an ageing population (Prime Minister's Office of Japan, n.d.b). The solution to these problems is seen as attracting young people from urban to rural areas by making the countryside more convenient and expanding fibre-optic networks, 5G and mobility as a service (MaaS; Prime Minister's Office of Japan, n.d.b).

In individual industry sectors, the government is promoting electrified vehicles to achieve 100% new car sales of electrified vehicles by 2035 (Prime Minister's Office of Japan, n.d.b). METI defines electrified vehicles as electric vehicles, fuel cell vehicles, plug-in hybrid vehicles and hybrid vehicles (METI, Japan, 2021). Policies have also been established to support the restructuring of the component supply chain and transform the industrial structure to support the electrification of vehicles (Prime Minister's Office of Japan, n.d.b).

At the overall government level, the Kishida administration has a clear strategy. However, individual ministries, agencies and government bureaus often have their strategies. Although these may be connected to the overall government strategy at the root, the possibility cannot be ruled out that they have diverged in their aims. Beyond the boundaries of ministries and individual policy areas, a systematic consolidation of overall and individual strategies is urgently required.

[7] Calculated on an exchange rate of 1 GBP = 165 JPY.

# Good Practices

This section presents the aforementioned ImPACT and SIP in detail as good examples of Japanese IIP implementation, although it does not cover Moonshot because it is at an embryonic stage.

## ImPACT

ImPACT is a policy to create disruptive innovations that will revolutionise future industries and society and overturn conventional wisdom (CSTI, Japan, 2020). To achieve this goal, an innovation R&D fund of 55 billion JPY (100 million GBP) was provided from FY 2013 to FY 2018 to ensure medium- and long-term research funding (CSTI, Japan, 2020)

CSTI has broken down the previously described abstract goals into five more concrete initiatives, one of which is Monozukuri (Manufacturing) Innovation for New Japanese Value Creation (JST, Japan, n.d.a). This initiative exemplifies a bold spirit of innovation that builds on Japan's manufacturing strengths.

However, previously, Japan had no policy to enhance discontinuous innovation through the promotion of high-risk research (CSTI, Japan, 2020). To address this challenge, the design of ImPACT was adapted from the United States Defence Advanced Research Projects Agency (DARPA), which has successfully introduced such policies, and a programme manager (PM) has been appointed for each ImPACT programme (CSTI, Japan, 2020), giving individual programmes greater planning and execution autonomy.

One of the successful individual programmes has developed lightweight, toughened polymers. Polymers are one of the most versatile materials invented by mankind, and this programme broke through the limits of polymers (thin polymers are fragile; thick polymers are brittle) to successfully create thinner and tougher polymers (CSTI, Japan, 2020). An EV concept car designed using this polymer had a positive impact and spill over effects on various other industries (CSTI, Japan, 2020). One possible reason for the success of this programme is the collaboration between industry, academia and the government. The project was led by a professor from the University of Tokyo and represented a powerful alliance of automobile R&D stakeholders, including Nagoya University, Tohoku University, RIKEN and companies such as Nissan Motors, Toray, and Sumitomo Chemical.

## SIP

SIP is a policy that allows CSTI to allocate its budget across ministry and sectoral boundaries to support everything from basic research to industrialisation. It has been in place since FY 2014, and the total budget is 300 billion JPY (1.8 billion GBP) until FY 2022 (Cabinet Office, Japan, 2022a).

SIP covers 11 socioeconomic issues in the first phase (FY2014–FY2018) and 12 in the second phase (FY2018–FY2022; Cabinet Office, Japan, 2021a). These issues include big data, artificial intelligence, cyber security, automated driving, and power electronics (Cabinet Office, Japan, 2021a).

SIP incorporates ImPACT's project management approach, as described previously (Cabinet Office, Japan, 2021a). Chronologically, ImPACT started a year earlier than SIP, so the latter can be viewed as an effective transfer of the best aspects of past institutional design.

SIP is an ongoing national project, but it includes a successful individual programme—*Automated Driving for Universal Services* (SIP-adus). The first and second phases of this programme ran for about 10 consecutive years. SIP-adus focused on automated vehicles in the first phase and extended the theme in the second phase to automated driving systems and services (Cabinet Office, Japan, n.d.d). This covers not only the development of automated vehicles but also solutions to economic and social problems (e.g., logistics and mobility problems) through the use of such vehicles.

Furthermore, SIP-adus has achieved strong industry–academia–government collaboration. Although Toyota Motor Corporation's Fellow is the PM, companies such as Denso and Panasonic and academic

institutes such as Keio University and the University of Tsukuba are jointly conducting R&D (Cabinet Office, Japan, n.d.d). To provide support for automated driving in terms of legislation, ministries and agencies, such as the National Police Agency, which has jurisdiction over the Road Traffic Act enacted in 1960, and the MLIT, which has jurisdiction over the Road Transport Vehicle Act enacted in 1951, are fully involved (Cabinet Office, Japan, n.d.d). Solving today's economic and social problems is not merely a matter of 'making good products, which was Japan's forte in the past, but of achieving essential collaboration between industry, academia and the government from an institutional perspective.

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## About us

Cambridge Industrial Innovation Policy (CIIP) is a global, not-for-profit policy group based at the Institute for Manufacturing (IfM), University of Cambridge. CIIP works with governments and global organisations to promote industrial competitiveness and technological innovation. We offer new evidence, insights and tools based on the latest academic thinking and international best practices.

This report was delivered through the Babbage Forum.17 Charles Babbage Road, Cambridge, CB3 0FS, United Kingdom ciip.group.cam.ac.uk