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The Cognitive Computing Continuum Policy Landscape: Japan

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Executive Summary

Japan is a major economic power and in the late twentieth century was a major producer of electronic equipment including design and manufacturing. Despite late adoption of Internet infrastructure, it leapfrogged into a solid advanced position in the early 2000s with the roll-out of fibre connectivity. However it has lagged behind in e-government development and while its large enterprises have already digitised much of their operations, its large small business sector lags behind. Recent drives to address these problems have led to adoption of US hyperscaler services such as Google Cloud and AWS. A push for the development of Data Spaces and Smart Cities is leading to growth in interest in interoperable, portable and digital sovereign solutions.

Cloud-Edge-IoT/AI policies are still in development, with attention being paid to developments in the EU (referencing the [NexusForum.EU R&I Roadmap](#)) which is in keeping with the successful years-long efforts to achieve EU Data Protection Adequacy, the signing of the EU-Japan Digital Partnership, Japan's negotiations to join the Horizon Europe Framework Program, and highlighting of the need for international cooperation on AI Safety.

BACKGROUND

1. Japan's Geopolitical Situation

Japan is the world's fourth or fifth largest economy (depending on the [source](#)). With a population of around 110 million people it also has a relatively high GDP per capita (around [40th](#) in the world). It is a fairly stable democracy (Pekkanen & Pekkanen, 2020), although the predominance of a single party in power for all but eight years of the 70 since 1955 leads some to suggest it is not fully democratic (Kasza, 2006). Despite being seen as primarily within the US' economic and security orbit from the post-war period to the early 2000s, it has recently been moving closer to the EU in geopolitical terms (Söderberg, 2020). This is particular true in some areas of information policy, with the 2003 introduction of a comprehensive set of data protection laws (covering commercial, government and other public sectors in similar but separate pieces of legislation) being a first attempt (Adams, Murata & Orito, 2012) at achieving Data Protection Adequacy, which was eventually granted in 2019 (European Commission, 2019), followed by the signing of the Japan-EU Digital Partnership Agreement in 2022. As of 2025 Japan is also negotiating possible accession to the Horizon Europe research framework funding program.

2. Japan's Digital Infrastructure

Japan has a robust general digital infrastructure, with a wide scale deployment of fibre to the corner and fibre to the building in urban areas since the national government's implementation of the e-Japan strategy in 2001. While adoption of ecommerce is high in both B2C and B2B sectors, government has been hampered by legacy digital systems in use in both local and national government, combined with a legal obligation to use physical stamps (inkan or hanko) for a variety of official purposes requiring paper documents to be generated, used and stored (Ono, 2022). A post-CoViD review of e-government in Japan finally promoted a removal of all but a tiny number of physical stamp requirements (the few remaining ones include issues such land ownership) as well as increasing both the pressure on, and resources available for, local government and national agencies to implement usable e-government facilities. A push towards a digital ID system using the MyNumber card and database (introduced in 2015 but the cards were updated to include NFC chips in 2021 and currently in the process of replacing the health insurance card system) is proceeding as part of this.

The uneven and somewhat limited advances by various ministries, agencies and local governments in digitisation between 2015 and 2023 led to an expansion of the role and powers of the Digital Agency (DA), giving it the power to effectively co-opt the finance and IT personnel of ministries which consistently fail to meet targets on the road to ensuring that all high volume (more than one million e-government operations per year) are smartphone-enabled by 2027. This rapid development/expansion of e-government services has necessitated a functionality focus by the DA which often relies on US hyperscaler support. However, the DA seeks to ensure such services are provided to user agencies via a somewhat portable approach to avoid too much vendor lock-in (Digital Agency, n.d.)

3. Japan's Digital Policy Organisations

The implementation of e-government (including semi-public areas such as health and education) is the primary responsibility of the DA, created in 2021, which is, alongside the Ministry of Economy, Trade and Industry (METI), the parent body of Japan's AI Safety Institute (AIS). It complements and works alongside the Information-technology Promotion Agency (IPA), created in 2004, which has the remit to promote private sector digitisation through standardisation and promotional activities.

The Japan Society for the Promotion of Science (JSPS), an incorporated administrative agency, is the primary research funding body in Japan for basic and applied research, including computing and information sciences. The Japan Science and Technology Agency (JST), a national research and development agency (a kind of incorporated administrative agency), is the primary innovation funding body, and also acts as the principle science and technology advisory body for the government of Japan. JST works closely with the DA and IPA in funding innovation activities aiming to support digitisation in the public and private sector. The New Energy and Industrial Technology Development Organisation (NEDO), a national research and development agency, is another innovation funding agency with a specific remit to support energy and industrial technologies in Japan. JST and NEDO both maintain offices in other countries to promote cooperation, including offices in Paris to support EU-related activities.

These agencies report to various ministries for different parts of their remits, as well as being directly responsible to one ministry for accountability and oversight. The various ministries which are relevant in this area are:

- Cabinet Office, which oversees the DA, is the bureau that supports the Prime Minister's Office in Japan, with theoretically a cross-ministerial coordination role, but which often takes on a more direct oversight role for some policies via control of agencies. This is the primary agency responsible for policy relating to the Society 5.0 agenda.
- Ministry of Internal Affairs and Communications (MIC), which is responsible for the physical infrastructure of postal and electronic communications. They are responsible for the allocation of wireless spectrum as well as the regulation of television, telephone and physical Internet connectivity.
- METI's Commerce and Information Policy Bureau shares responsibility with the Cabinet Office for the implementation of Society 5.0 in the industrial and commercial sectors, and with MIC for ensuring adequate provision of communications infrastructure for those sectors. METI is also the ministry responsible for NEDO and the IPA.
- Ministry of Education, Culture, Sports, Science and Technology (MEXT), is the parent ministry of JST and JSPS, but mostly acts in an oversight rather than directing role with respect to the operations of those agencies.

POLICY REVIEW

1. Overview

The Japanese government has issued/updated a new basic information technology policy platform every five years since 1996, as mandated by the Basic Act on Science and Technology (1995). The current (sixth) version runs from 2021 to 2026. The fifth and sixth version of this plan introduced and reinforced the Society 5.0 vision of a society in which human beings and human flourishing are central to the development, use and deployment of technology (particularly information technology). JSPS, JST and NEDO have all been tasked under the plans with supporting appropriate research and innovation activities to achieve this. Japan's central role as the host of the 2023 Hiroshima G7 Meeting in pushing for the creation and adoption of the Hiroshima Process on AI particularly Generative AI, was related to this viewpoint.

The Society 5.0 objective is part of the reason for the push for e-government noted above, and within this the Cabinet Office has been keen to promote the development of Smart City infrastructure as well as the development of Data Spaces (interoperable Vendor Relationship Management-style [VRM] (McKay, 2010) provision of data aggregation and services).

Committees and bureaus within the ministries MIC and METI have issued various policy declarations which discuss various aspects of the cognitive computing continuum, but which often focus on one segment (e.g. cloud infrastructure) or at most a combination of two elements (cloud support for running AI). JSPS, JST and NEDO have programs designed to support the research, innovation and deployment of various aspects of the cognitive computing continuum but again these are mostly focussed on a single aspect (e.g. JSPS' RIKEN AIP for AI) or a partial combination (NEDO's AI-edge innovation area). The IPA is the policy group most focussed on the continuum as a whole, with recent reports seeking to promote the Cloud-Edge-IoT aspect in particular. Discussions with representatives of the IPA indicate that they are working on adapting and expanding these to include both "Cloud-Edge-IoT running AI", and "AI supporting Cloud-Edge-IoT".

2. Cloud-Edge-IoT Policy

In March 2025 the IPA (2025a; 2025b; 2025c) released their initial policy plans/advice on the Cloud-Edge-IoT. These stress the potential advantage Japan's existing IT hardware and software producers have in the existing small device space as Edge and IoT innovations and deployments gather speed. They also stress the potential applications in Japanese manufacturing industry as the next stage beyond industrial robots (of which Japan was an early adopter, particularly in the automotive manufacturing sector as well as a major manufacturer), as well as in smart city development (see below), agriculture, energy, logistics, transport/mobility and retail (IPA, 2025c). The European focus on issues of digital sovereignty and environmental efficiency are also highlighted as issues to be given a similar focus in Japan. The existence of relevant Japanese initiatives such as the industry groups IoT Acceleration Consortium and Robot Revolution and Industrial IoT Initiative as well as the National Institute of Advanced Industrial Science and Technology's Digital Architecture Research Center, were also highlighted as signs of existing strength in parts of the cognitive computing continuum that could be built on for the development of Japanese provision and use of these technologies. (This initial policy document also highlights the NexusForum.EU project, and inclusion of Meiji University as a partner in the project to promote further commonality with EU developments.)

The IPA's (2025d) Software Modernisation Committee also issued a report in March aimed at presenting the software developments needed to create Society 5.0. Promoting utilisation of

AI and separately of Cloud-Edge-IoT are also highlighted in this report, although their combination in the cognitive computing continuum is not particularly discussed.

In the MIC (2024; 2025) annual White Papers on Information and Communications in Japan, separate sections discuss data centres, cloud services, edge computing and AI. While each of these are regarded as important areas for development/deployment in Japan and for MIC to support, the integrated Cloud-Edge-IoT or cognitive computing continuum are not discussed. The dominance of Amazon, Microsoft and Google in the Japanese cloud market is noted as a cause for concern, although there is no explicit mention of digital sovereignty.

Reports by various bureaus within METI (2023a; 2024; 2025) stress various portions of the cognitive computing continuum, but again do not refer to Cloud-Edge-IoT or the continuum by name or as an integrated concept.

METI (2023a) stressed the importance of supporting Japan's development of edge computing, and AI-integrated IoT for green computing. METI (2024) emphasised the development of a cloud technology ecosystem, including support for IoT device and AI applications. METI (2025) (a futurology report on possible scenarios for 2040) stressed the importance of the effective use of cloud computing by Japanese industry for economic advancement.

3. Artificial Intelligence Research, Innovation and Promotion Policy

AI is mentioned as a key technology for Smart City initiatives, alongside the Cloud-Edge-IoT computational infrastructure (see below) in Cabinet Office (2025).

RIKEN (one of Japan's national research institutes) runs the Centre for Advanced Intelligence Project (<https://www.riken.jp/en/research/labs/aip/>), funded directly by JSPS and employing around 50 full-time principal investigators. This centre is comprised of three major research groups, one on fundamental AI technologies, another on applications of AI, and a third on the social impact of AI.

As noted above, as the hosts of the Hiroshima G7 meeting in 2023, Japan's government pushed for consensus on addressing the potential social harms of AI across a broad spectrum of issues from bias in machine learning to deep fakes produced by LLMs. Unlike some other countries there is very little rhetoric from the Japanese government pushing LLMs as a replacement for knowledge workers or for LLMs or other AI systems as a significant driver of government efficiency gains.

MIC (2024, 2025) has short sections reporting on the economic trend of spending on AI by the private and public sector in Japan, but nothing regarding government policy to encourage this, nor to focus on the development of home-grown AI technology (beyond existing support via JSPS and JST mentioned above). METI (2025) does, however, mention the need for effective use of cloud computing, IoT, and generative AI in boosting productivity in the Japanese economy.

JST and NEDO both include the need for development of chip production in Japan to provide Edge-AI capabilities (see below). This ties in with METI (2023a) which stresses the need for Japan to leverage its existing strength in small device manufacture (particularly electronic devices in which Japan was a world leader from the 1970s and only recently lost or outsourced production to China) to become a world leader in the design and manufacture of Edge and IoT devices, particularly AI-integrated IoT sensor devices.

Japan was one of the first countries to set up its AISI following the G7 Hiroshima meeting, and their work proceeds apace in promoting socially acceptable AI development and deployment, within the work of the Digital Agency, and in cooperation with their sister institutes in other countries such as the US and UK.

4. Semiconductor Design/Production Policy

As noted above, the METI (2023a) policy includes revitalising Japan's small device manufacturing sector for Edge and IoT design and production, particularly including Edge/IoT-embedded AI. For example in 2024 METI announced a major development grant to Rapidus Inc. for semiconductor development aimed at edge AI. JST funds a long term program on "Next-Generation Edge AI Semiconductor Research and Development" (<https://www.jst.go.jp/program/edge-ai-semicon/overview/index.html>)

NEDO also focusses on Edge AI, including chip design, for example NEDO's (2022) Web Magazine included a focus on Edge AI, and their ongoing AI-chip technology development project (高効率・高速処理を可能とするAIチップ・次世代コンピューティングの技術開発 : https://www.nedo.go.jp/activities/ZZJP_100123.html).

No policies regarding self-sufficiency in general chip design and/or fabrication were found during the documentary research. In particular, there appears to be no attention being paid to the RISC V open hardware design that is being considered as a major element of European digital sovereignty activity in chip design. There seems to be little attention paid to the reinvigoration of Japanese-owned fabrication facilities, although Taiwanese chip fabrication giant TSMC opened its first plant in Japan in 2024 (Kageyama, 2024).

5. Data Spaces Policy

The concept of Data Spaces, an interoperable data sharing platform where data providers (owners of commercial data and legitimate processors of personally identifiable data [PII] about individuals) and data subjects (individuals by or about whom PII is shared) may engage in the controlled sharing of data, is seen as one of the key technical developments needed for the achievement of Society 5.0.

The IPA, via its Digital Infrastructure Center, promotes the development and eventual deployment and use of data spaces by commercial organisations (<https://www.ipa.go.jp/en/digital/data/data-spaces.html>). The non-profit group Data Spaces Alliance (DSA: comprised of academic, commercial and government partners) is dedicated to building the DATA-EX platform to create this facility (Koshizuka and Mano, 2022). The DSA is engaged in international collaborations to ensure that Japan's Data Spaces implementation is compatible and interoperable with those developed elsewhere, particular in Europe, through engagement with Gaia-X and the Simpl programme.

Plans for wide-ranging use of data-spaces for public-private collaboration in realising the Society 5.0 goals have been developed by METI (2023b), IPA and NEDO under the name "Ouranos Ecosystem".

The architecture developed by the DSA is intended to be based on open protocols and have Free, Libre and Open Source Software (FLOSS) implementations available for deployment in all parts of the data space stack, although allowing proprietary implementations of the protocols to be used. As noted by the IPA, the data spaces concept promotes "data sovereignty", where the owner (or data subject for PII) retains legal control over the data and allows processing under contractual terms (often embodied in automated contracts embedded in the data space). Although a separate concept to national digital sovereignty, data sovereignty shares a reliance on open protocols, interoperability and federatability. This provides a solid grounding for Japan's engagement in pooled digital sovereignty where governments, corporations and individuals can reasonably exert sufficient control over the use of their data to avoid monopoly capture and vendor lock-in. The contractual nature of the Data Spaces approach, however, has a weakness in the face of national security laws, as seen in the repeated striking down of EU-US personal data transfer agreements "Safe Harbour" and "Privacy Shield" and the continuing concerns about the current Trans-Atlantic Data Sharing Framework. Such concerns

can be mitigated by limiting access to shared data spaces to entities bound by suitable rule-of-law, but which also requires investment in sufficient cognitive computing continuum infrastructure to support all data space activity being carried out in sufficiently protected jurisdictions.

6. Smart City Policy

The Cabinet Office, as part of the Society 5.0 implementation plans, has been pushing the development of Smart Cities in Japan, alongside the push to augment existing government services with egovernment options (see above). This includes the publication of a smart city reference architecture (Cabinet Office, 2025) for the Cloud-Edge-IoT infrastructure necessary to process Smart City sensor data. The earlier roadmap on Smart Cities from the Cabinet Office (2024) stressed the need for standardisation of IoT and edge computing platforms for smart city operation, in particular the implementation of NGSI-LD interfaces in all such devices to allow for multi-vendor installations without needing to define a new interface for each type of device to be deployed. This represents a clear preference towards interoperability, portability and vendor-independence for Smart City development and deployment.

AI is regarded as another key technology for Smart City deployments, as noted above particularly in the development of Edge-deployable AI for urban infrastructure, such as that supported by the JST project on chip development for Edge-AI mentioned above.

CONCLUSIONS

Japan's policy on research, innovation and deployment of cognitive computing continuum remains somewhat fragmented. A focus on delivering quick wins in egovernment has led to the adoption of overseas cloud providers Google and AWS for initial contract, although the Japanese cloud provider Fujitsu was also later awarded contracts. None of these contracts have focussed on avoiding vendor lock-in, a concern that the IPA have raised in discussions with the authors, and which are addressed in their current policy proposals/advice. The public sector adoption of cognitive computing continuum is the primary responsibility of the DA, which has recently been brought much closer to the IPA in operational terms, which may lead to a shifting of future priorities in the public sector to interoperable and potentially digitally sovereign approaches. According to discussions with IPA representatives, they are keen to ensure compatibility in both technical and policy approaches with EU developments and are engaged with the NexusForum.EU project via the Japan Working Group (having attended the March 2025 NexusForum.EU event).

The Data Spaces approach, supported by JST but industry led in development, is designed around interoperability, data portability and allows for digital sovereign requirements in contracts.

The Coordination roles played by the IPA and DA, and the influence their policies hold on developments at not just their parent ministries but on the other ministries and agencies, suggest that this is a pivotal moment in the development of the cognitive computing continuum in Japan and that the NexusForum.EU project, the IPCEI-CIS, and the European Commission should seek close engagement with the agencies as well as the ministries and other agencies, to ensure that this possibility of convergent and interoperable cognitive computing continuum platforms and policies support and help to fulfil the goals of the EU-Japan Digital Partnership.

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GLOSSARY

AISI: Artificial Intelligence Safety Institute

Cabinet Office: The agency (pseudo-ministry) supporting the Prime Minister of Japan (JP: 内閣府)

Cognitive Computing Continuum: Cloud-Edg-IoT/AI technology area.

DA: Digital Agency (JP: デジタル庁)

FLOSS: Free, Libre and Open Source Software.

IPA: Information-technology Promotion Agency (JP: 情報処理推進機構)

JSPS: The Japan Society for the Promotion of Science (JP: 日本学術振興会)

JST: Japan Science and Technology Agency (JP: 科学技術振興機構)

LLM: Large Language Model, a form of AI used for generation of text, images, video and audio based on prior training and user prompts.

METI: Ministry of Economy, Trade and Industry (JP: 経済産業省)

MEXT: Ministry of Education, Culture, Sports, Science and Technology (JP: 文部科学省)

MIC: Ministry of Internal Affairs and Communications (JP: 総務省)

NEDO: New Energy and Industrial Technology Development Organisation (JP: 新エネルギー・産業技術総合開発機構)

NGSI-LD: A device-independent interface definition and discovery protocol maintained by the non-profit FIWARE organisation to ensure architectural consistency and simple deployment of heterogeneous hardware and software devices in a distributed system.

PII: Personally Identifiable Information. Information about individuals, subject to restrictions under data protection law.