

# Riding the Wave of Digital Transformation: Insights from Japan's Journey



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## Abbreviations & Acronyms

APPI	Act On Protection of Personal Information
AEMS	Area Energy Management System
BRT	Bus Rapid Transit
BEMS	Building Energy Management Systems
CEMS	Community Energy Management Systems
CI	Critical Infrastructure
CIP	Critical Infrastructure Protection
CSV	Comma Separated Values
DIGIDEN	The Vision for a Digital Garden City Nation
DFFT	Data Free Flow with Trust
GPs	Gram Panchayats
HEMS	Home Energy Management Systems
ICT	Information and Communication Technology
IoT	Internet of Things
IPA	Information-Technology Promotion Agency
Keidanren	Japan Business Federation
LMICs	Low- and middle-income countries
LRT	Light Rail Transit
MaaS	Mobility as a Service
METI	Ministry of Economy, Trade and Industry
MIC	Ministry of Internal Affairs and Communication
MIS	Management Information System
MLIT	Ministry of Land, Infrastructure, Transport and Tourism
NISC	National Center of Incident Readiness and Strategy for Cybersecurity
NTT	Nippon Telegraph and Telephone Corporation
OECD	Organization for Economic Co-Operation and Development
PPP	Public-Private Partnership
QII	Quality Infrastructure Investment Partnership
Sler	System Integrators
SMES	Small and Medium-Sized Businesses
SRN	Strategic Road Network
WSPs	Water Security Plans

## Executive Summary



In the dawn of the new millennium, Japan found itself lagging in the global race to embrace information and communication technology (ICT). In 2000, its internet penetration was only at a modest rate of 30 percent, dwarfed by other peers of the advanced economies. Japan faced the urgency of advancing its digital development as acutely acknowledged by the government that the country lagged not only in internet usage but also in integrating ICT into businesses and public administration, and that the gap could further jeopardize the nation's competitive edge in an era of rapid digital revolution (Japan Prime Minister's Office, 2001).

By 2008, Japan had turned around its internet status completely. Japan's internet penetration surged to 75 percent, marking a significant leap that brought it on par with major comparators—Canada 77 percent, New Zealand 72 percent, US 74 percent, South Korea 81 percent. While the development of the broadband infrastructure and the penetration of the Internet into business and private practices saw significant progress during the first decade of the 21st Century, the implementation of applications for public sectors and the integrations of data separately developed and stored in public organizations were stranded due to the lack of clear and robust strategies and these have resulted in Japan's setback of digitalization and digital transformation behind other countries like Korea and Singapore. The transformative journey, nevertheless, continued, and in another eight years' time, Japan unveiled its visionary digital transformation initiative, Society 5.0, in 2016. This ambitious vision showcased Japan's determination to not only keep pace with but to take a lead in shaping a future where digital technologies will elevate residents' quality of life.

The infusion of digital technologies has not only streamlined traditional governance and management processes but has also introduced efficiency, responsiveness and innovation into infrastructure and service provision at the global stage. The transformative potential of digital technologies is rich for improving the quality of living. Many countries find themselves at various points of the digital transformation journey, eager to leverage digital technologies for great progress. Yet, they may be at a disadvantaged position as Japan once was and face various challenges. Can Japan's digital journey offer lessons to other countries in undertaking a similar journey?

This report analyzes the key components of digital transformation in Japan over time and across key sectors. In Japan's digital journey, importance of sound governance, solid infrastructure investment, and smart city development are intricately woven together with the challenges posed by a stagnating economy, an aging society, archaic business processes, and major disasters. The inclusion of smart city development perspectives is a key feature of this report as it provides critical insight into how social, economic, and environmental challenges in cities can be addressed through digital technologies. Four key components stand out as critical areas in Japan's digital transformation journey and would collectively pave the way for other societies to embark on their own.

## Data

Data are recognized as the lifeblood of digital societies, guiding decision making through predictive modeling and value creation. Many developing countries, however, are grappling with the challenges in collecting, managing, and sharing up-to-date, granular, and digitally accessible data across operations and services. This limits the ability of both the national and city governments to understand the conditions of the society and develop effective policies, thereby impacting a country's overall competitiveness.

Japan's experience in navigating data challenges, from the enactment of key legislations in promoting the acquisition, utilization, and sharing of data to protection and safeguarding of data provides a good reference for the actions that the government can take to reap the benefits of data. Supported by such measures, a wide range of applications have been developed by the public and private actors in Japan, utilizing various data to enhance residents' conveniences and improve the efficiency of public administrations.

## Digital infrastructure

Digital infrastructure encompasses a wide range of elements that support the digital systems including stable power supply, high speed internet connectivity, efficient telecommunication networks, scalable information technology systems, and secure data storage and management solutions. Availability and accessibility of digital infrastructure is often inadequate in developing countries, which is a key barrier for providing digital services to the wider society.

Japan's experience in this domain ranges from formulating national strategies for digital infrastructure development to providing affordable high-speed internet access, and to integrating and standardizing different systems. Such experience emphasizes the importance of sustaining robust infrastructure investment over a period of time and providing room for digital system scalability and flexibility.

Another key aspect of digital infrastructure in Japan is exemplified in the "My Number Card" initiative. This initiative provides a government-led common platform to authenticate and identify users in a broad spectrum of public and private services using a new form of identification cards. The concept of "My Number Card" was developed based on the lessons learnt from the "Residents Ledger Net ("Juki-Net")" in 2002. The "Juki-Net" failed to achieve its aims of sharing basic resident-related data among municipalities due to communication challenges arising from individually stored databases by local governments. Despite its renewed approaches, the penetration rate of My Number Cards remains low due to deep-rooted privacy concerns and their utilization for advanced applications is limited to a few smart city cases as illustrated in Appendix D. The report, therefore, provides the narrative on how the Japanese government faced these challenges and is attempting to overcome hurdles to promote digital integration.



## Institutional enablers

An enabling environment that fosters collaboration and innovation requires adequate policies and regulations, shared vision and strategy, and strong leadership and governance. To many developing countries, balancing the multifaceted needs for innovation, privacy protection, cybersecurity, and consumer rights is a complex task. Developing comprehensive policies and systems related to data privacy, security, and cyber threats is challenging and will be increasingly so as the digital ecosystem in a country becomes sophisticated.

In the context of Japan, legal framework and incentivizing mechanisms have been established to encourage collaboration between government agencies and the private sector. Based on the lessons-learned of the past challenges, new government bodies such as the Digital Agency have been set up to support digital transformation with guidelines, instructions, supporting programs, and best practices for the local government and private sector. Cities and local governments have established platforms, including data portals, to foster collaboration in addressing municipal challenges. These platforms invite solutions by enterprises, universities, and residents, reflecting a decentralized mode to innovation and problem solving in the digital era.

Furthermore, the report explores the evolution of Japanese policy making in digital transformation, in which a mechanism of how each ministry takes its own initiatives independently to establish relevant digital policies in its mandates, and then joins forces to establish effective collaborations and structures to achieve policy objectives. In addition, the important role that effective tax policies play, coupled with relevant subsidy programs, in promoting sound investments in digital infrastructure and systems will be highlighted.

## People and digital skills

The success of digital transformation initiatives also rests on the digital capabilities across the public, private, and civil sectors. Limited digital literacy and skills among the wider population can hinder the effective use of digital technologies in many developing countries.

Japan has embraced innovative approaches to enhancing people's digital skills. Some cities are training staff to use minimal coding tools and providing digital transformation training for different hierarchical levels. The government also recognizes citizens and residents as contributors and co-creators of the initiatives that directly impact their own lives and have also capitalized on digital technologies to expand platforms to seek their inputs on policies and programs, transforming users from recipients of services to empowered contributors in the digital development journey.

The lack in digital skills among municipality officials, a common issue across most of the cities and towns in Japan, is also faced by many cities in developing countries. A number of innovative approaches to build capacity of the municipality officials, in close collaboration with local residents, especially those who are elderly, are described in the case studies of smart cities in the Appendixes. It is hoped that such cases can be a source of inspiration for the cities and towns of the developing countries that wish to achieve a sustainable and inclusive society through digital transformation.

## Smart city development

The report also examined digital transformation in cities and towns—how the local governments have harnessed digital technologies to enhance and innovate service delivery, building on the country's recognized strength in urban infrastructure development. The national government's various programs

have facilitated digital transformation at the city level or development of smart cities, which demonstrates a significant manifestation of digital transformation in the urban and peri-urban context and as a whole-of-the society approach.

## Roles played by different stakeholders

One of the key takeaways is that digital transformation requires different stakeholders to play their role. The Japanese central government was instrumental in leading the nation's digital development. Various policies, initiatives, and regulatory frameworks deliberately crafted by the government have provided the impetus for digital transformation, underlining the importance of proactive governance in shaping a society's digital development trajectory. The local governments have effectively translated national policies into actionable initiatives and extended the benefits of digital solutions to the public. Beyond government efforts, Japan's digital transformation journey shows how the private sector's active participation and citizen engagement, and empowerment are facilitated by open regulatory environments. Public-private partnerships, combined with open and collaborative regulatory environments, would be key to unlocking the full potential of digital technologies and driving transformation.

# 1

## Introduction



### 1.1 Background

In an era of rapid technological advancement, digital technologies are key drivers of development for any country, by enabling countries to harness innovation that accelerates economic growth, connects citizens and residents to essential services and employment opportunities, and more effectively addresses complex development challenges. During times of crises, such as pandemics or natural disasters, digital technologies play a critical role in keeping governments, people, businesses, and the wider society connected, and facilitate the delivery of vital services.

The penetration of digital technologies has not only streamlined traditional governance and management processes but has also introduced efficiency, responsiveness, and innovation into infrastructure and service provision. Whether it is the adoption of smart technologies, data analytics, or the Internet of Things, these digital solutions are offering novel opportunities to optimize resource allocation and service delivery and enhance performance monitoring and feedback mechanism. The transformative potential of digital technologies is also rich for improving the quality of infrastructure investment, which is the main focus of this report.

For the quality aspects of infrastructure investments, the Quality Infrastructure Investment (QII) principles first emerged at G20 Osaka Summit in Japan in 2019 where its six principles were announced.<sup>1</sup> With an aim to maximize the positive impact of infrastructure development in developing countries, these multilaterally agreed standards are intended to guide infrastructure investments to meet high standards of sustainability, resilience, and long-term economic and social benefits.

<sup>1</sup> World Bank's Quality Infrastructure Investment webpage, <https://www.worldbank.org/en/programs/quality-infrastructure-investment-partnership/qii-principles>



- QII.1:** Maximizing the positive impact of infrastructure to achieve sustainable growth and development;
- QII.2:** Raising economic efficiency in view of life-cycle cost;
- QII.3:** Integrating environmental considerations in infrastructure;
- QII.4:** Building resilience against natural disasters;
- QII.5:** Integrating social considerations in infrastructure investment; and
- QII.6:** Strengthening infrastructure governance

The World Bank established the Quality Infrastructure Investment Partnership (QII)—a single-donor trust fund established in 2016 with financial support from the Government of Japan—dedicated to the mission of elevating awareness and prioritization of the quality dimensions of infrastructure investment and development. From its inception in 2016 to June 2023, QII has provided grant support of US\$64.1 million to World Bank projects aimed at improving governance arrangements, operation and maintenance processes, and capacity of municipal governments, and fostering innovation in infrastructure planning and design. Digital transformation has been an important crosscutting theme of the QII support. With an increasing number of countries embarking on their digital journeys, the QII is well positioned to provide stronger support to their digital transformation based on sound principles and lessons drawn from established countries. This report intends to contribute to that end by documenting and sharing practical insights from Japan's digital journey.

### 1.2 Objective and structure of the report

This report presents Japan's digital journey toward fostering a sustainable, resilient, and inclusive society as one of the compelling benchmarks for the countries interested in leveraging digital technologies for transformation. Japan—both as a developed country and a country that is actively advocating for digital transformation—has gone through an evolving journey with a fair share of trials and errors, in which elements of sound governance, solid infrastructure investment, and smart city development are intricately woven together with the challenges posed by a stagnating economy, an aging society, major disasters, and the impact of the COVID-19 pandemic.

The objective of this deep dive into Japan's digital transformation experience is to distill useful practices and valuable lessons and provide them as a reference for other countries through QII support and other World Bank engagements. The report analyzes Japan's digital journey over time and across key elements and sectors of digital development. Furthermore, it discusses the evolution of smart city development in Japan, which is a dominant manifestation of digital transformation in urban contexts. The report's primary audience are emerging markets and developing economies, with an aim to help them formulate and implement relevant, efficient, and effective digital transformation policies aligned with QII principles.

The structure of the report is as follows. First, Chapter 2 briefly examines the concept and foundational elements of digital transformation and discusses how QII principles can guide the process of digital transformation in infrastructure development and service delivery. Chapter 3 analyses the Japanese government policies and support programs that have been instrumental in promoting digital transformation since the 1990s. In Chapter 4, the report presents concrete examples and use cases in Japan regarding the use of data, digital infrastructure development, digital safeguards and governance, enhancement of human capital and skills. Chapter 5 describes the evolution of smart cities in Japan, with a focus on the government's incentivizing and supportive policies and case studies of four smart cities. The report concludes with the key takeaway from Japan's experience that can inspire other nations to embark on their own digital transformation journey.



Digital transformation is a crosscutting and multisectoral phenomenon, which takes place over time. This chapter briefly discusses the key stages of digital transformation and its fundamental elements as the conceptual framework for the analysis in subsequent chapters. The chapter also analyzes the common challenges encountered in digital transformation, especially by developing countries, and discusses how QII principles can effectively relate to and steer the initiatives geared toward digital transformation.

First, it describes the process of digital transformation by breaking it into three stages: digitization, digitalization, and digital transformation (or the 3Ds approach). While this elucidates digital transformation by the level of sophistication, the chapter also identifies foundational elements that enable the digital transformation process across all stages. Inspired by the existing framework developed by the Digital Development Practice Group at the World Bank (Appendix A), this chapter highlights four key building blocks—data, digital infrastructure, institutional enablers, and people and digital skills—as success factors to achieve sustainable, resilient, and inclusive development. These building blocks will serve as an organizing framework of the report.

This chapter contextualizes the building blocks of digital transformation in terms of common challenges that developing countries encounter. The chapter also demonstrates how the digital transformation process—or the 3D approach—relates to the actual technical assistance provided by the QII Partnership. The overview of the concept of digital transformation and the challenges of its application within developing countries, as outlined in this chapter, is a crucial precursor to understand better the value and relevance of the Japan's digital transformation experience that will be analyzed further in Chapters 2 through 5.

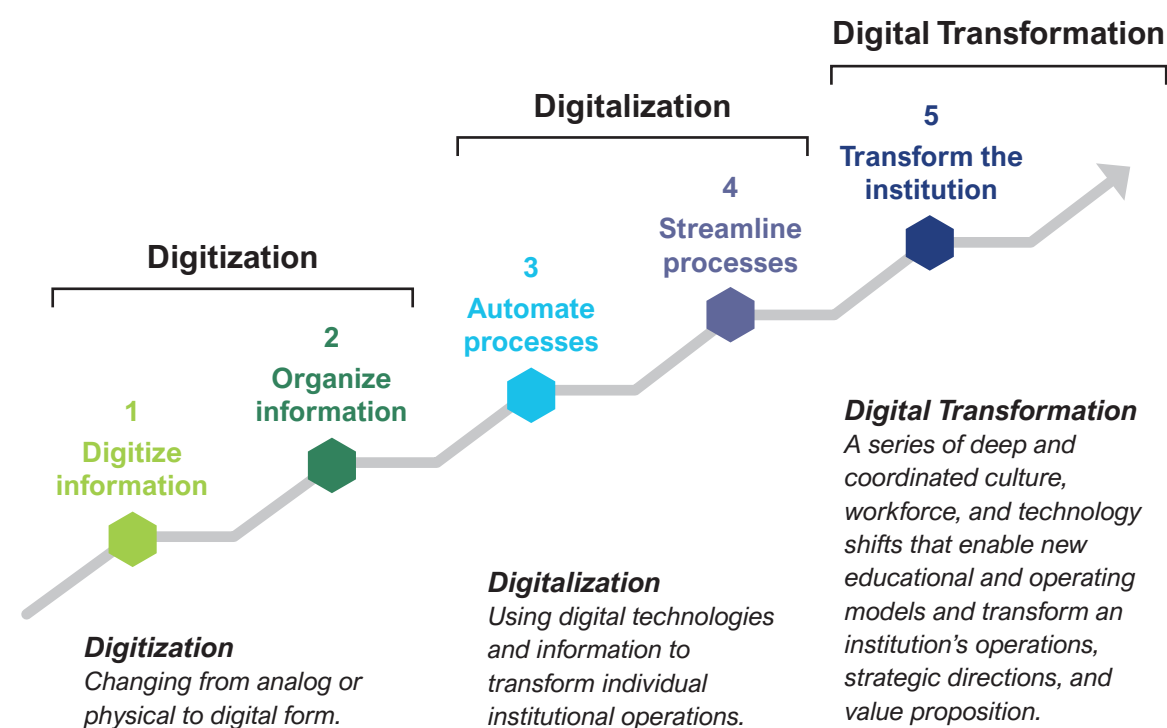
## 2.1 Digital transformation — Stages

Digital transformation is part of the process through which data are collected and managed in a digital format and processed by digital technologies to produce insightful analytics and insights that underpin

various digital services, thereby transforming how people live, work, and connect with each other and organize the society. The process involves three stages or 3Ds—digitization, digitalization and digital transformation (figure 2.1).

- Digitization: Encoding analog information into zeroes and ones for computers to store, process, and transmit as data.
- Digitalization: Process of employing digital technologies and information to transform business or governance operations and processes.
- Digital transformation: User-driven strategic business transformation that requires crosscutting organizational change toward interoperability and crosssectoral collaboration.

**FIGURE 2.1: DIGITIZATION, DIGITALIZATION, AND DIGITAL TRANSFORMATION**



Source: Betsy Reinitz (2020). Consider the Three Ds When Talking about Digital Transformation. <https://er.educause.edu/blogs/2020/6/consider-the-three-ds-when-talking-about-digital-transformation>

While digitization and digitalization are two critical steps, as Japan's digital journey will show in the next chapter, digital transformation marks a clear departure from these steps by going beyond improving operational efficiency and facilitating substantial changes in both public and private organizations and business processes. In the digital era, societies are compelled to review the entire governance or business operations on the premise that data are accessible throughout their ecosystem, without information silos. With enhanced data sharing and interoperability of digital systems, transformation can then take place by enabling different sectors to make decisions on the same evidence and facilitating new ideas and innovative processes.

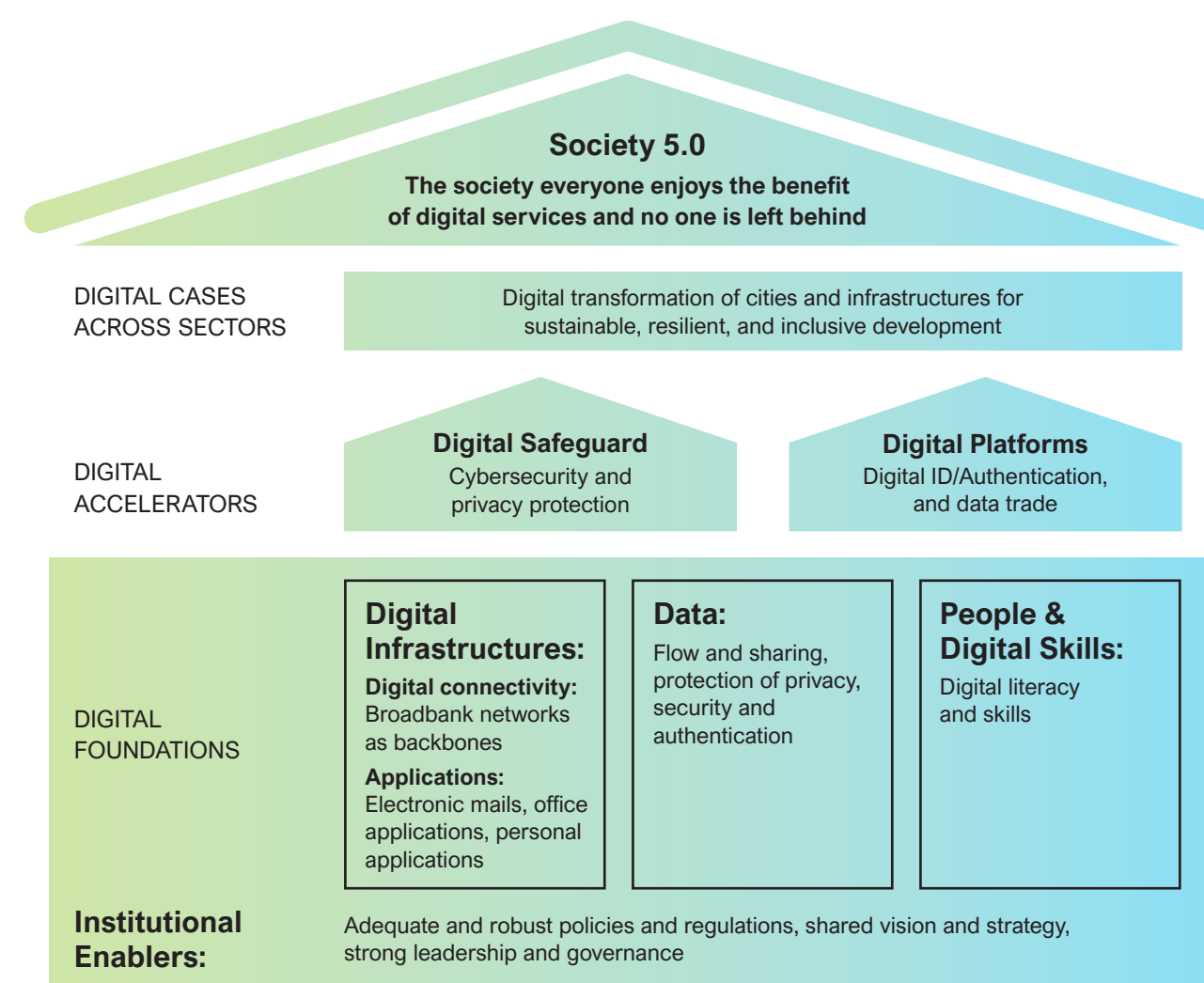
## 2.2 Digital transformation — Building blocks

This report utilizes a distinctive analytical framework to offer deep insights into the digital transformation process of Japan. This framework is an adaptation of the digital transformation framework developed by

the World Bank's Digital Development Practice (see Appendix A for details), tailored specifically for the purposes of this report.

This adapted framework (figure 2.2) analyzes Japan's journey, in four building blocks of digital transformation, namely data, digital infrastructure, institutional enablers, and people and digital skills. These elements have stood out as critical areas in Japan's digital transformation journey and would collectively help pave the way for other societies to embark on their own. Meanwhile, the common challenges encountered by developing countries on their paths toward digital transformation echo those confronted by Japan. As such, a brief overview of each element is presented below, while Chapter 4 of the report will provide a detailed analysis of Japan's experience in relation to these core elements.

**FIGURE 2.2: KEY ELEMENTS OF JAPAN'S DIGITAL TRANSFORMATION**



### 2.2.1 Data

Data have evolved from being a mere operational byproduct to the lifeblood of digital societies by underpinning decision making, predictive modeling, and value creation. In the digital age, data are constantly streamed from interconnected devices, business transactions, social interactions, and sensor networks. Deriving insights and patterns from this wealth of information has become a critical competitive advantage. Organizations leveraging data analytics can uncover hidden correlations, predict trends, and optimize operations with precision. Whether optimizing infrastructure, tailoring city services, or forecasting maintenance requirements, data are the key to



strategic innovation. However, collecting, processing, and managing data, with their granularity and integrity intact, are challenging. Breaking data silos and promoting data sharing, while protecting data privacy, requires collaborative ecosystems under robust regulatory governance—hence, the importance of strong institutions. Embracing data as a strategic asset and effectively navigating these challenges will be pivotal to realize fully the benefits of digital transformation.

### Challenges in developing countries

In many developing countries, however, a prominent challenge is the scarcity of up-to-date, granular, and digitally accessible data across various operations and services. Although seemingly basic, establishing an effective data collection and management system requires a political will to drive institutional coordination and financial resources and technical capabilities to develop and maintain a coherent and vibrant data ecosystem. This situation limits the ability of both the national and city governments to understand the prevailing conditions of various sectors and develop effective policies, thereby impacting a country's overall competitiveness. Limited data also affect the private sector in developing countries, undermining economic growth and innovation.



### 2.2.2 Digital infrastructure

Digital infrastructure in broader terms encompasses a wide range of elements that support the digital systems including stable power supply infrastructure, high speed internet connectivity, efficient telecommunication networks, scalable information technology systems, and secure data storage and management solutions. The quality

and robustness of this underlying infrastructure significantly impact a digital society's interoperability, scalability, and competitiveness. A well-designed and adaptable digital infrastructure empowers the society to efficiently deploy and scale digital solutions, whereas substandard infrastructure can hamper even the most well-conceived initiatives. That is, digital infrastructure's capacity to seamlessly integrate technologies determines the success of digital transformation.

### Challenges in developing countries

Meanwhile, the inadequate digital infrastructure—including limited access to reliable internet connectivity, power supply, telecommunications networks, and hardware and software for storing, processing, and distributing of data—is a key barrier for providing digital services to large populations in developing countries. According to the World Development Report 2021, modern data infrastructure is only available in less than 20 percent of the low and middle-income countries.<sup>2</sup> In particular, expansion of digital infrastructure to remote and underserved areas pose significant financial and technical challenges. Moreover, the cost of digital devices, internet services, and data plans can be prohibitively high for many people in developing countries, especially those living in poverty, preventing widespread adoption of internet and digital inclusion.



### 2.2.3 Institutional enablers

An enabling environment for fostering collaboration and innovation requires adequate policies and regulations, shared vision and strategy, and strong leadership and governance.<sup>2</sup>

Policies and regulations, such as data standards and privacy and security requirements, enable digital transformation while safeguarding against ethical lapses and risks. Shared vision and strategy create a culture of flexibility, adaptability, and resilience in the face of changes. Leadership and governance are instrumental in defining roles, responsibilities, and institutional frameworks, and cultivating operation models and businesses. Therefore, these institutional enablers, though nondigital in nature, transcend the boundaries of digital infrastructure and technology and play a pivotal role in shaping the culture essential for innovation and successful digital transformation.

To many developing countries, balancing the multifaceted needs for innovation, privacy protection, cybersecurity, and consumer rights is a complex task. Navigating such complex landscape requires certain enabling institutional functions, such as setting clear visions, strategies and policies, supporting internationally compliant rules and standards, enforcing compliance, and continually improving governance through learning and evaluation.<sup>3</sup> However, these institutional functions are often weak in developing countries, and their implementation can pose challenges to existing governance systems in those countries.

### Challenges in developing countries

As digital transformation advances, both organizations and individuals would face higher risks related to privacy and cybersecurity issues. Robust data protection laws, cybersecurity measures, and the capacity to handle threats are essential for fostering trust in a digital society. Developing comprehensive policies and systems related to data privacy, security, and cyber threats is challenging and will be increasingly so as the digital ecosystem in a country moves closer to maturity. Developing countries also face challenges in securing expertise in those domains. To date, only a small minority of low- and middle-income countries (LMICs) have adopted effective institutional frameworks for data protection.<sup>3</sup>



### 2.2.4 People and digital skills

The success of digital transformation initiatives also rests on the digital capabilities across the public, private, and civil sectors. People's digital literacy and proficiency impact the feasibility of developing and using digital products and services. Importantly, the vision of successful digital transformation now also emphasizes the involvement of citizens in the process and encourages their participation in cocreating solutions. These efforts not only empower individuals to access, understand, and utilize solutions in the digital world, but also support the uptake of digital jobs and the development of digital-oriented industries.

### Challenges in developing countries

On the other hand, a lack of digital literacy and skills among the population can hinder the effective use of digital technologies. Of people living in LMICs who do not access the internet, more than two-thirds stated in a survey that they do not know what the internet is or how to use it, indicating that digital literacy is a major issue.<sup>3</sup> Domestic disparities in access based on income, gender, and age further exacerbate the gap. Developing countries often face resource, expertise, and institutional constraints for such investment. While the private sector plays a significant role in digitalizing the society and economy, the ICT industries in many developing countries are often weak in capacity and capability requirements.

A multistakeholder approach involving governments, citizens and communities, private sector entities is critical in policy reforms, infrastructure development, investment in capability development, and a whole-of-society collaborative effort. These attributes are essential to capitalize on the potential brought by digital technologies and to address the challenges faced by many developing countries. This report aims to shed light on this multistakeholder and multidimensional nature of digital transformation by presenting how Japan has experienced and dealt with them in its digital transformation journey.

<sup>2</sup> World Bank's "World Development Report 2021" webpage, <https://www.worldbank.org/en/publication/wdr2021>

<sup>3</sup> World Bank's World Development Report 2021, <https://openknowledge.worldbank.org/bitstream/handle/10986/35218/9781464816000.pdf>

## 2.3 QII-supported projects with digital components



Digital transformation has been an important crosscutting theme of QII. From its inception in 2016 to June 2023, QII grant portfolio has grown with US\$64.1 million implemented or committed to 229 projects across all regions.<sup>4</sup> In 2022–23, a record shows that about 50 percent of QII standard grants had a digital component

and potential for digital transformation. Areas of QII support includes enabling government ministries and implementing agencies to acquire high quality data for conceptualization, design, procurement, and surveillance of infrastructure investments; empowering citizens and communities to participate in the planning and implementation process; and facilitating technology transfer through capacity building in the client countries. Selected examples of QII-supported projects with digital components are provided in Appendix E.

Selected examples of QII-supported projects with digital components have touched upon various stages of the 3Ds journey introduced earlier in this chapter. Transport projects in Mozambique and Nepal used big data or video surveillance data to produce useful analytics to inform transport investment planning, design, and implementation or digitization. Several cases have developed digital planning and management systems to improve the quality of key services such as water management in India and water supply and sanitation management in Côte d'Ivoire through digitalization. Similarly, in Dhaka, Bangladesh, mobile applications are developed to monitor and improve the quality and safety of public spaces.



This chapter explores the stages of Japan's digital transformation since 1990s,<sup>5</sup> focusing on the evolution of government's digital strategies, policies, and subsidy programs and highlighting the comprehensive whole-of-government approach implemented across various ministries and agencies. To achieve this, the chapter begins with a stakeholder analysis, providing insights into key government stakeholders and their roles in the digital transformation landscape. Then, the chapter provides a chronological account of policy development and impact, contextualizing them within Japan's shifting social, economic, and political landscapes.

### 3.1 Stakeholder analysis

The institutional enabler, such as government policies, laws, and regulations, forms the foundation for digital infrastructure, data, and people and digital skills among the four key elements of digital transformation. This section presents a brief overview on the roles played by governmental ministries. Figure 3.1 shows the current organization of the Government of Japan, highlighting key ministries and offices, which play an active role in digitalization and smart city initiatives.

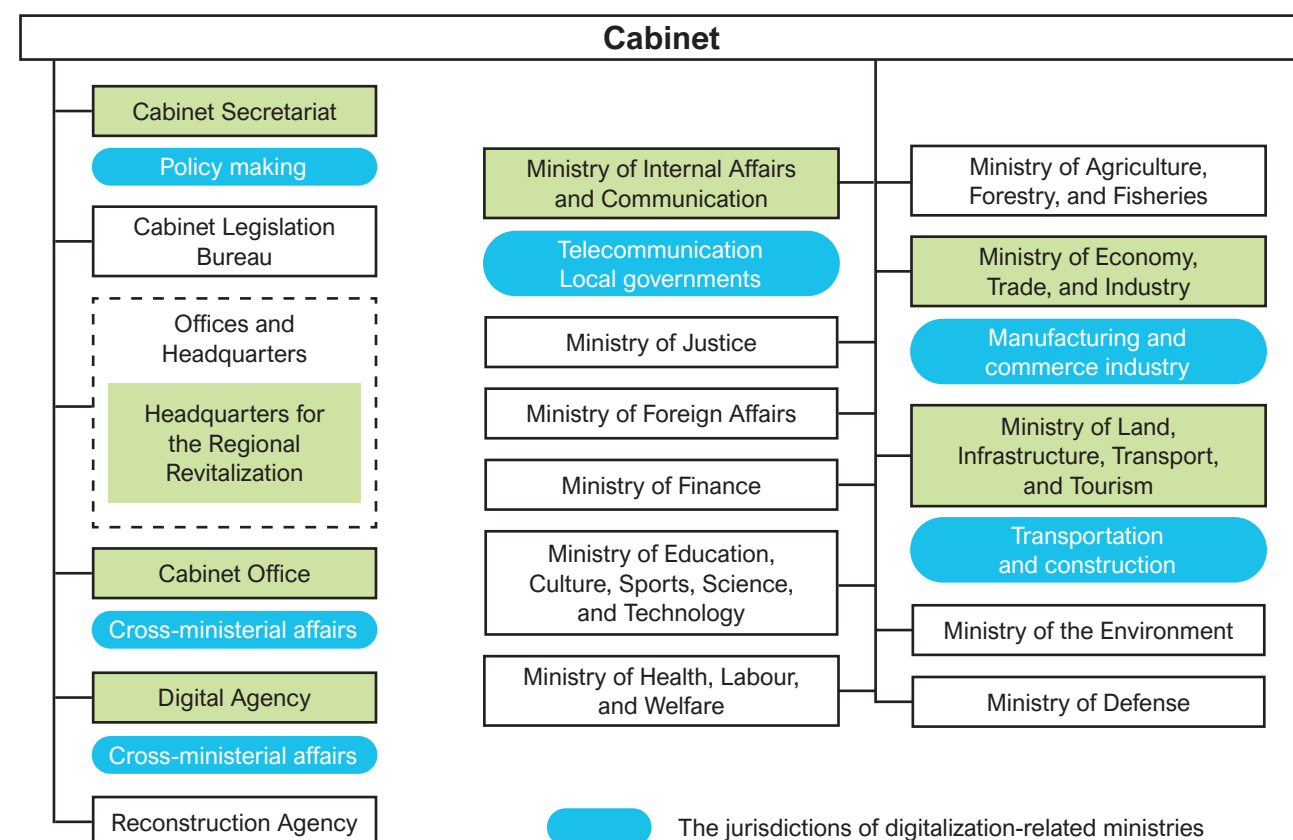
### 3.2 Evolution of Japanese government policies

The progress of Japan's digitalization efforts can be categorized into four distinct stages, as illustrated in figure 3.2. Each stage is characterized by distinctive policy objectives and priority areas that define the subsequent digital transformation trajectory, all against the backdrop of the rapidly evolving political,

4 Quality Infrastructure Investment Partnership — 2023 QII Annual Report.

5 In 1990s, the use of the Internet, personal computers, world wide web, and electronic mails rapidly penetrated into businesses, personal lives and public services. 1989: Invention of WWW, 1993: Rapid growth of web servers and early versions of web browsers, 1995: Release of Windows 95.

**FIGURE 3.1: ORGANIZATION AND JURISDICTIONS OF THE GOVERNMENT OF JAPAN**



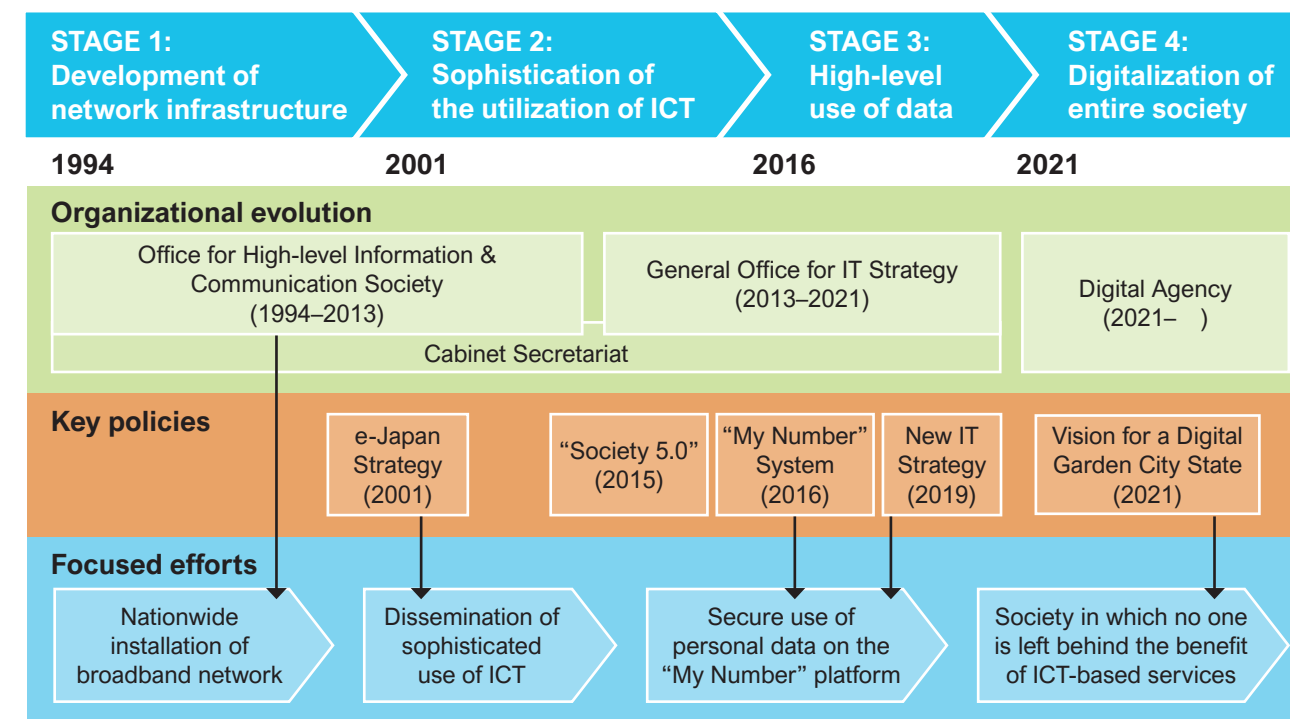
social, and economic context of Japan. Given the rapid evolution of the ICT industry and digital economy, it is important for governments to review iteratively and update policies related to digital transformation and build in flexibility for adjustment.

During the initial phase—stage 1—development of network infrastructure—Japan focused on the development of network infrastructure. As computers became increasingly used in various workplaces, the government recognized the importance of ICT and laid the groundwork for the computerization of businesses and services, with a concerted effort to build a robust network infrastructure, such as Asymmetric Digital Subscriber Line (ADSL), a technology to transfer digital data on metallic telephone lines, and installation of redundant dark fiber in the city centers of metropolitan areas.

Following the establishment of a strong network infrastructure, stage 2—sophistication of ICT utilization—paid attention to incentivizing the widespread adoption of ICT hardware and software across public and private organizations. This is in part a response to some of the unsuccessful experiences with e-services in the early 2000s. The New IT Transformation Strategy in 2006, for example, aimed to learn from the lessons from the previous stage. Notably, tax policies played a pivotal role in driving this adoption, fostering an environment conducive to technological advancement and innovation.

As technology continues to evolve, stage 3—advanced use of data—focused on providing a secure environment for advanced use of data. With the proliferation of computers and smartphones, secure handling of personal data became paramount. In response, the government amended the Individual Information Protection Law to ensure secure yet accessible management of personal information. Additionally, initiatives like My Number Card were introduced to provide a platform for identification and authentication in digital service usage.

**FIGURE 3.2: CHRONOLOGY OF GOVERNMENTAL EFFORTS ON DIGITALIZATION IN JAPAN**



Stage 4—digitalization of entire society—marks a significant turning point in Japan’s digital transformation journey. Prompted by the wake-up call of the COVID-19 pandemic, which highlighted the country’s digitalization gap compared to other advanced nations, the government launched an ambitious campaign with the “Vision for a Digital Garden City Nation.” This initiative, accompanied by unprecedented budget allocations and the establishment of the Digital Agency, signals a comprehensive drive to digitalize every aspect of Japanese society. It is a bold step toward ensuring Japan’s competitiveness on the global stage and embracing the digital future with confidence and resilience.

The following sections provide more details about each stage.

### 3.2.1 Stage 1: Development of network infrastructure

Stage 1 can be described as the period of establishing digital infrastructure, the digital connectivity in particular. In 1991, Japan saw the collapse of bubble economy and pursued the improvement of productivity through the use of ICT. In 1994, the then Cabinet established the Office for High-level Information and Communication Society within the Cabinet. This office’s mandate was primarily in the development of ICT infrastructure, especially broadband networks. The launch of the office was inspired by initiatives such as the National Information Infrastructure<sup>6</sup> and Information Superhighway<sup>7</sup> announced by the Clinton Administration in the United States during the same period.

The Office for High-level Information and Communication Society formulated the Basic Policy toward High-level Information and Communication Society and the Action Plan. These policies aimed at various objectives, including: (i) promoting e-commerce, (ii) digitalization of the public sector, (iii) enhancement of information literacy, and (iv) development of information and communication infrastructure. While these

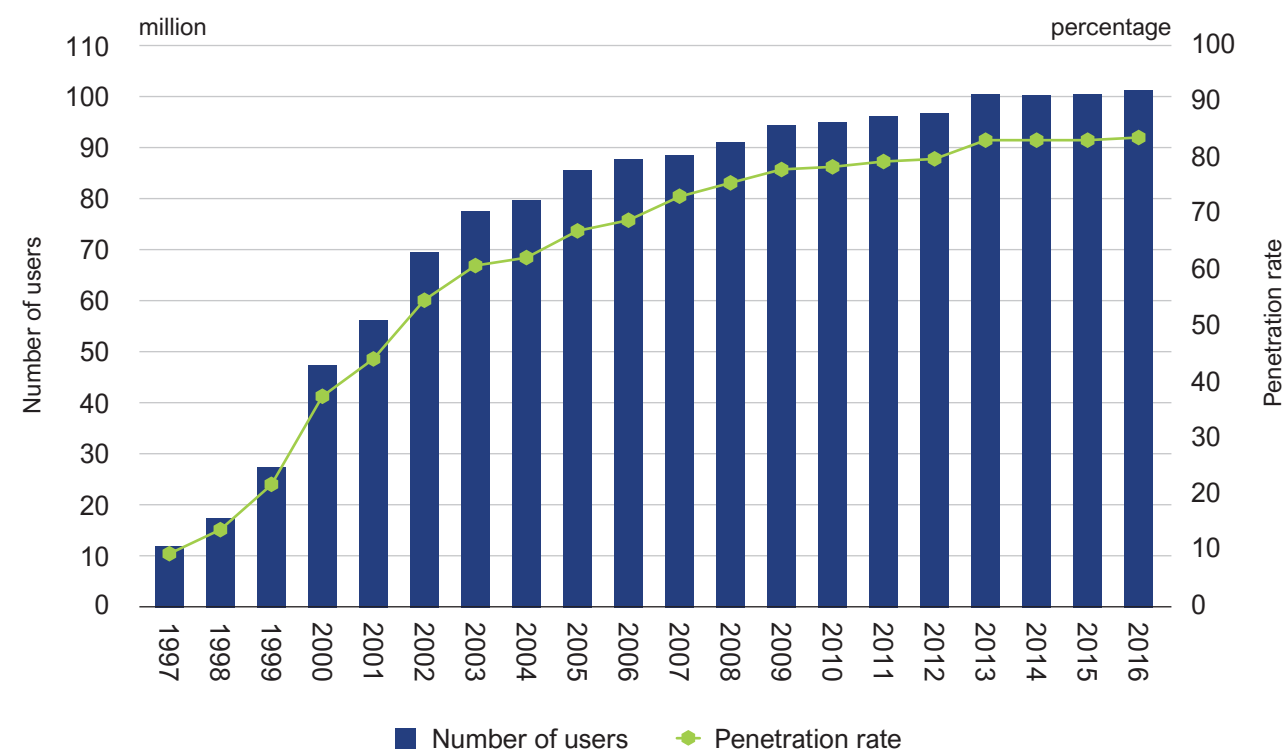
<sup>6</sup> The National Information Infrastructure (NII) was a vision proposed by the Clinton Administration in the 1990s to promote the widespread adoption and integration of advanced information technologies across the United States.

<sup>7</sup> The Information Superhighway was a term popularized during the Clinton Administration to describe the vision of a high-speed telecommunications network that would connect people, businesses, and institutions across the United States.



objectives covered a wide spectrum of digitalization of government administration and private business infrastructures, the primary focus was on development of information and communication infrastructure, particularly broadband networks. The actions by the government under these policies include: (i) direct investment on public facilities related to broadband networks, (ii) facilitation of investment by telecommunication carriers on broadband infrastructure through tax incentives, and (iii) de-regulating private networks implementation in areas where public authorities operate. This laid the groundwork for Japan's broader digitalization efforts that followed in the succeeding years.

**FIGURE 3.3: THE INCREASE OF INTERNET USERS AND ITS PENETRATION RATE IN JAPAN, 1997 TO 2016**



Source: Drafted by the authors based on the diagrams disclosed in the Information and Communication White Paper issued by Ministry of Internal Affairs and Communications (MIC), 2002, 2007, 2012, and 2017 editions.

### 3.2.2 Stage 2: Sophistication of the utilization of ICT

Japan's internet penetration rate only stood at a modest 30 percent in 1999, lagging behind other Organisation for Economic Co-operation and Development (OECD) countries at that time such as Canada 51 percent, New Zealand 47 percent, South Korea 45 percent, and the United States 43 percent.<sup>8</sup> In response, Japan aimed to position itself as a leading IT nation and the government formulated national strategies for developing ICT infrastructure. In 2000, the IT Basic Strategy was compiled, and the IT Basic Law was enacted. As a key outcome of these efforts, the Office for High-level Information and Communication Society launched the e-Japan Strategy in 2001, opening an era of sophisticated use of ICT. The strategy aimed to address various aspects of the digital landscape, including establishing the world's most advanced Internet networks within five years, providing high speed internet access at an affordable rate to 30 million households, promoting the use of IT in public services, and nurturing high quality human resources in IT domain.<sup>9</sup>

Remarkably, in about a decade's time, Japan's internet penetration surged to 88 percent in 2013 and has consistently maintained this high level since then (figure 3.5).<sup>10</sup> However, many initiatives outlined in various IT strategies, including "e-Japan Strategy", fell short of their intended outcomes. Inspired by US government's internet policies, the government set out the "e-Japan Strategy" in 2001. Yoshiro Mori, the then Prime Minister, resigned the following year, leading to a decrease in government enthusiasm for the strategy. This highlights the fact that merely developing Internet infrastructure is insufficient to prepare for the further advancements of digitalization and digital transformation.

Additionally, the bursting of ICT bubble economy following the Y2K problem in 1999-2000 severely impacted the ICT industry as well as information system divisions of public and private organizations. Consequently, there was an increase in the entire process of developing public systems for central and local governments, including specification, definition and architecture design, being subcontracted to ICT system integrators. This approach, to some extent, resulted in the prevalence of insulated and less-interoperable ICT systems both at the national and municipal levels.

Despite these challenges, the broadband network infrastructure was established under the vigorous efforts in budget and grants by the Ministry of Internal Affairs and Communication (MIC). Subsequent focus shifted naturally to facilitating widespread penetration of ICT facilities and applications among end-users in both the public and private sectors on a nationwide scale.

As indicated in Figure 3.1, once the governmental policies are established, each ministry enforces laws and regulations governing the segment they hold jurisdictions and submit budget for those segments. Since public budgets both in central and local governments operate on an annual basis, the emphasis of budget filing varies from year to year and across ministries. Among these budgeting and funding, the subsidy from MIC was directed toward introducing ICT facilities, especially personal computers, into public organizations. In the private sector, major companies equipped their employees with personal computers under the banner of "One PC for each" initiative, benefitting from the preferential tax policies set by the Ministry of Economy, Trade and Industry (METI) and Ministry of Finance. Industries, such as the banking sector, experienced the transition from legacy mainframe systems to distributed systems with servers and personal computers as the end-user terminals, a phenomenon known as downsizing<sup>11</sup>

During this period, e-mails became common among the public and the world wide web established its position as a common platform of information dissemination and sharing during this period. Internet connection from mobile phones also started in Japan, with the inauguration of i-Mode service, a data exchange service over the mobile telephone networks in 1999 by NTT (Nippon Telegraph and Telephone Corporation) DOCOMO, a market-dominant mobile communication company in Japan and a mobile branch of NTT Group, a descendant of the privatized formerly government-owned Telegraph and Telephone Public Corporation. Despite being an advanced system ahead of its time, "i-Mode" did not grow into a global standard. NTT, the provider, lacked initiative in globalizing its business, resulting in 'i-Mode' remaining confined to Japan and lacking roaming capabilities. This underscores the importance of putting a strategy for global standardization in place at the early stages of digitalization processes.

Along with the advancement of digitalization in private sectors, which was facilitated by policies and funding by METI, the digitalization of public sector also progressed to follow the "e-Japan Strategy". Although the employment of ICT in central and local governments continued, a few issues became a large impediment in promoting digital transformation during the following years. One was that ministries and municipalities introduced their systems from different suppliers under the different specifications, and as a result, the linkage between systems of different ministries became difficult. Another issue was that,

<sup>8</sup> World Bank's webpage of Individuals using the Internet, <https://data.worldbank.org/indicator/IT.NET.USER.ZS?end=2000&start=1960>

<sup>9</sup> Prime Minister's Office of Japan's webpage on e-Japan Strategy, [https://japan.kantei.go.jp/it/network/0122full\\_e.html](https://japan.kantei.go.jp/it/network/0122full_e.html)

<sup>10</sup> World Bank's webpage of Individuals using the Internet in Japan, <https://data.worldbank.org/indicator/IT.NET.USER.ZS?locations=JP>

<sup>11</sup> "Downsizing" refers to the strategic transition from large mainframe computers to a more decentralized and distributed infrastructure, typically involving the adoption of servers and personal computers (PCs). Downsizing enables organizations to streamline operations, improve scalability, and take advantage of advancements in computing technology, leading to a more responsive and adaptable IT environment.



while back-office processes had been digitalized, the interfaces between the municipality offices and the residents remained paper based.

In terms of the connectivity infrastructure, the broadband backbone network was well developed during the previous stage. The reach to end users—called “Last One Mile”—was developed during this period. Stage 2, therefore, can be characterized as the period of developing digital infrastructure including both digital connectivity and applications described in Chapter 2.

### 3.2.3 Stage 3: Advanced use of data

Despite Japan’s history and culture of data privacy, the mentality of risk aversion has become a significant barrier to data sharing. Organizations are often grappling with concerns that sharing data could precipitate legal or reputational risks if the data are mishandled or misused. In the mid-2010s, the government identified two obstacles in further penetration of digitalization in both public and private sectors. One was excessive protection of individual information, which resulted at that time in hiding almost every personal data and in impeding digital services. The other showed up as difficulties in linking applications of different ministries and municipalities due to their uncoordinated implementation of information systems.

In response to such challenges, in 2016 Japan introduced the Basic Act on Promotion of Public and Private Data Utilization,<sup>12</sup> which was first proposed by MIC. This landmark legislation provides a legal framework and incentives to encourage data sharing and collaboration between government agencies and the private sector. The act champions open data initiatives, mandating national level government agencies to release datasets to the public and encouraging the use of data stored in public and private organizations.

In 2017, the Act on the Protection of Personal Information—an act enacted in 2003 by MIC, applied only to certain business operators with databases containing large set of personal information—was amended to facilitate broader use of personal data. This amendment enabled public and private entities to handle individual information under the “opt-in”<sup>13</sup> principles and thus paved the way for proliferation of various applications utilizing personal data, enhancing users’ convenience and the efficiency of public administrations.

It should be mentioned that some of the forward-thinking city and municipal governments started implementing open data portals in their official sites. <sup>11</sup> During this period, the central government encouraged local governments to establish their data portal, and approximately 70 percent of all cities in Japan launched open data portals on their municipal official websites by the end of 2010s. To further support these efforts, the relevant national government agencies issued comprehensive guidelines, instructions, and best practices for local governments. However, the quality of the disclosed open data lagged that of more advanced cities in the US and Europe. Most disclosed data in Japanese cities were primarily in PDF format for presentation purposes. Approximately five percent of cities released their data in machine-processable forms such as spreadsheets and comma-separated values (CSV).

In summary, Stage 3 focused on preparing mechanisms and legal frameworks for the effective use of data, with a particular emphasis on personal data. The full-scale use of data is poised to bloom in the subsequent stage, marking a further transition in Japan’s digital transformation journey.

### 3.2.4 Stage 4: Digitalization of entire society

The deficiencies in the digitalization in governmental ICT systems in both central and local governments became increasingly evident in 2020, as the COVID-19 pandemic swept through Japan. Challenges included complications in disbursing governmental subsidies to individuals and small businesses, as well as difficulties in obtaining accurate data on COVID-19 patients at the local level. These issues stemmed from the fragmented development of public ICT systems and disjointed data storage practices.”

These challenges highlighted the perceived lag in the digitalization of the governmental administration compared to countries like Korea and Singapore. In response, Yoshihide Suga, who became Prime Minister in September 2020, prioritized digitalization as a critical policy and established a new ministerial position Digital Agency in September 2021. Digital Agency is exclusively dedicated to overseeing the complete digitalization of public and private activities that align with the digital age within five years. Their broader goal is to realize a society where the benefits of digitalization reach every citizen and resident by promoting digital transformation across the entire society, strategically using data, and creating services that meet people’s needs. This is spelled out in the “Vision for a Digital Garden City Nation” (abbreviated as “DIGIDEN” in Japan) that Fumio Kishida and his administration introduced after succeeding the Suga administration in early October 2021. The government outlined a thoroughly digitalized society where each user can choose services that meet their demands, fostering various forms of happiness through digital technology.

At this stage, the trajectory of digital transformation journey by the government merged with the trajectory of smart city initiatives. Under DIGIDEN schemes, the government is making efforts in penetrating the benefits of digital services to every corner of the country especially in supporting the existing efforts to attract new residents as the countermeasures against population drainage. The government endeavor in digital transformation has thus merged with its commitment on the revitalization of rural areas. The DIGIDEN schemes also include the efforts to employ My Number cards as the common platform to handle personal data, and to spearhead the leading models of Society 5.0. Due to the widely varied objectives under the features of DIGIDEN, the grants are classified into several types, and the number of grantees and the budget allocated to DIGIDEN are far greater than the previous initiatives in digital transformation and smart cities by the government. The types of grants and actual number of grantees are described in detail in Appendix C.

The objectives of the DIGIDEN grants include capacity building of professional personnel, extension of the digital connectivity to every corner of the country, and promotion of flow of personnel data through the My Number platform. The government measures in Stage 4, therefore, show an excellent example of embracing the four key elements of digital transformation stated in the previous chapter.



<sup>12</sup> The law was first under the jurisdiction of MIC, but transferred to the Committee on Protection of Personal Information in Cabinet Office in 2022.

<sup>13</sup> “Opt-in” refers to a privacy approach where individuals explicitly give their consent or agreement before their personal information is collected, processed, or used for specific purposes. In the context of data handling, opt-in mechanisms require users to take an affirmative action, such as checking a box or clicking a button, to indicate their willingness to share their information. This ensures that individuals have control over their data and are actively involved in decisions regarding its usage.

# 4

## Japan's Experience in Strengthening Foundations for Digital Transformation



Chapter 3 took a chronological look at Japan's dynamic journey through policy evolution toward digital transformation. The report will now take an in-depth review of the essential groundwork that sustains the various policy endeavors. This chapter explores the building blocks that are critical for the success of digital transformation, especially how the government initiatives and policies discussed in Chapter 3 have unfolded across data, digital infrastructure, institutional enablers, and digital capabilities. The chapter introduces specific use cases and initiatives that illustrate how they have contributed to Japan's digital transformation process.

### 4.1 Data: The cornerstone of digital transformation

As discussed in Chapter 2, data are critical for evidence-based decision making, effective policy formulation, and the nurturing of innovation in the digital era. Meanwhile, its availability faces multifaceted challenges and the absence of data governance policies and cross-sectoral collaboration can undermine systemic data collection and management.



In the Japanese context, the evolution of its legislations and enactment of key new legislations have played a catalyst role in promoting the acquisition, utilization, sharing, and collaboration of data. Amendments to the Electricity Business Act—against the backdrop of Act on the Promotion of Utilization of Public and Private Data and the Act on the Protection of Personal Information—were pivotal in deploying smart meter to acquire new data and subsequent innovations (case 1). Supported by such legislations, a wide range of applications has been developed, utilizing various data to enhance users' conveniences and improve the efficiency of public administrations.

#### Case 1: Release the electricity data for public use

Japan offers an interesting case of how the release of electricity data collected from smart meters has facilitated the emergence of other smart solutions. Through the Electricity Business Act, enacted in 1964, the government initially placed restrictions on the use of electricity data. Starting in 2014, power suppliers began deploying smart meters nationwide in response to the amendments to the Act. The amendment aimed to encourage the adoption of smart meters to improve the overall efficiency of the energy sector and provide consumers with more detailed information about their electricity usage.

By 2021, approximately 70 million smart meters were installed, achieving complete coverage in Tokyo and nearly 86 percent coverage across the entire country. In 2022, another amendment to the Electricity Business Act made electricity data generated by smart meters accessible, removing partial restrictions on its use.

Accessibility of electricity data has stimulated the development of diverse applications, ranging from effective power supply and efficient transportation to preventive healthcare. For instance, in many Japanese municipalities, addressing preventive care for socially isolated elderly individuals living alone has been a significant challenge. In Toin, a small town with a population of 25,000 in Mie Prefecture, a collaborative public-private initiative by Chubu Electric Power, Necolico—a telecommunication service provider—and Japan Data Science Consortium emerged in 2022. This collaboration combines household electricity data usage patterns, AI analytics, and data from insurance companies, to detect the vulnerability risks of elderly citizens. Based on the predication in this initiative, local municipalities can further collaborate with local stakeholders and residents to provide early care or risk prevention measures to elderly individuals. As the initial effort proven to be effective, Necolico and Japan Data Science Consortium proceeded to roll out a service to municipalities in 2023, offering insights for preventative care for elderly people.<sup>a</sup>

a. <https://www.necolico.co.jp/mcas.ms/news/2023/02/27/release/post-2062>

In a thriving data sharing ecosystem, public and private entities collaborate, and innovation emerges by leveraging publicly available data. For instance, in Kyoto city, its open data portal<sup>14</sup> boasts approximately 650 datasets as of October 2023, covering categories such as tourism and industry, culture and arts, and safety, security, and disaster prevention. The platform has become a catalyst for addressing community issues, with a growing number of use cases showcasing solutions developed by enterprises, universities, and users. Therefore, by collecting data and facilitating data exchange, a wider range of stakeholders in the society can be empowered. Cities and organizations are able to amplify collective intelligence, fostering innovation that transcends individual entities.

While Japan has made considerable achievements in sharing and utilizing data, it is noteworthy that the standardization of data sets and their formats remain to be a major challenge, particularly across cities or between cities and the central government. Some cities operate with their own systems, data standards, and formats, hindering efficient data sharing and collaboration across administrations. This is a valuable lesson for developing countries that it is important to establish a framework for data standards and interoperability during the early stages of system and application development.

14 Kyoto city open data link. <https://data.city.kyoto.lg.jp/>



## 4.2 Digital infrastructure



Digital transformation is a dynamic and continuous process of innovation and adaptation, and digital infrastructure should accommodate changes and enable growth. Besides the provision of physical infrastructure (elaborated in chapter 3), digital platforms, scalability, and flexibility of digital infrastructure are indispensable attributes that empower the digital society.

### 4.2.1 Digital platforms

The presence of digital platforms plays a vital role in accelerating service delivery and transactions. These platforms include digital identity and trust services—such as e-signatures and verifiable credentials—digital payments, and data exchange.<sup>15</sup> Accessible through various digital channels such as smart phones, computers, and the internet, these platforms offer a wide range of products and services. In particular, digital platforms offered by the government have the potential to catalyze the emergence and widespread of services and application across various aspects of life, such as healthcare, education, government business or services, serving people, public agencies, and society at large.

One such example of digital platform is the “My Number” system in Japan. Introduced by the government as a personal identification system for all residents, it intends to enable the interoperability of different systems and application. The My Number System, coupled with associated cards, facilitates a wide range of services and applications (case 2).

Another example from the public sector is PLATEAU, a data sharing platform developed by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). Functioning as a 3D model of Japanese cities, PLATEAU integrates various building attributes, allowing its users to contribute data and simulate the impact from their building proposals or development solutions. In this manner, PLATEAU effectively serves as a digital twin of a city, providing a common platform for data sharing among the participants of an urban development project. Consequently, PLATEAU also facilitates collaborative discussions and proposal evolutions by offering shared models for various stakeholders’ analysis and decision making.

## 4.3 Enhancing system interoperability and managing legacy systems

In Japan, both national and local governments faced the challenge of independently developed and operated systems, resulting in disparities in specifications and data formats that led to a lack of interoperability. The Digital Agency, which was created in 2021 to promote digital transformation at both the national and local levels, implemented a solution to consolidate systems onto a single cloud-based IT infrastructure, fostering standardization and shared operation. The agency also facilitates efficient procurement for various government bodies by preselecting cloud services eligible for the government cloud and relaxing certain conditions to encourage the participation of local suppliers.

Building on the initiative of the Digital Agency, Kurashiki—a city located in the region known as the Seto Inland Sea—joined forces with Takamatsu and Matsuyama, two other cities in the region (map 4.1)<sup>16</sup>



Map 4.1. Three cities of the Setouchi municipal cloud council

<sup>15</sup> World Bank Group, Digital Development Global Practice

<sup>16</sup> Source: [japan-forward.com/find-500-years-of-history-in-okayamas-picturesque-kurashiki/](https://japan-forward.com/find-500-years-of-history-in-okayamas-picturesque-kurashiki/)

### Case 2: My Number Card

In early October in 2021, Japan’s newly inaugurated Prime Minister Fumio Kishida announced “The Vision for a Digital Garden City Nation” (DIGIDEN) as a key policy. This vision positioned the digitalization of the entire society as its core objective, aiming to create a society where citizens and residents can choose services that satisfy their needs and achieve satisfaction through digital technology.



Under this policy, the government advocated the use of “My Number Card” (see sample on the left<sup>a</sup>) as the primary means for the identification of citizens on various public applications. “My Number” is a commonly used nickname of a 12-digit individual identification number assigned by the government from 2015 to each resident of Japan, including foreigners with resident status. The system was envisaged to centralize personal information such as tax, social security, and disaster response

records, hence facilitating the efficiency and accuracy of public services. Over time, the government is expanding the application areas of the system, positioning it as a common platform for identification and authentication across a broad spectrum of public and private services.

“My Number Card”, a plastic card employing embedded IC chip, has been issued in association with My Number. By mid-2023, the penetration rate of the card reached about 70 percent of the entire Japanese population. The card can be used for personal identification for various applications, including online tax payments and issuance of resident registry. These tasks used to require personal submission of paper application at municipality offices before the introduction of the card. The government also plans to replace the conventional health insurance ID cards, used in hospitals, clinics and drug stores with the My Number Card. Subsidies have also been used to support the development of new applications and services employing My Number Card by the local governments.

Despite the expanding usage of the My Number Card, its application has encountered limitations and challenges. For instance, many institutions have existing applications and databases, requiring the linking of My Number to these institutions, which can be challenging due to different formats of existing IDs. Some ongoing linkage operations have revealed numerous errors, partly attributed to the wide variety of ways names can be written, necessitating manual operations in the linking process. These issues indicate the necessity in establishing the fundamental architecture of digital platforms like the My Number Card at an early stage, and factoring in the compatibility of future applications with existing systems.

a. <https://www.yomiuri.co.jp/pluralphoto/20221206-OYT1I50278/>

They established the Setouchi Three Cities Municipal Cloud Promotion Council. The collaborative initiative is dedicated to the comprehensive examination of the standardization and streamlining of business processes within the government, aiming to reduce customization efforts and optimize system efficiency. In 2023, Kurashiki City initiated a pilot migration to the government cloud, demonstrating a commitment to scalability, flexibility, and the potential of streamlined digital workflows.

For governments and companies, embarking on digital transformation also involves navigating the challenges posed by legacy systems. These legacy systems, often built on outdated technologies,

characterized by complexity and lack of flexibility, pose obstacles to the adoption of the latest technologies. They tend to require high maintenance costs, are prone to frequent failures, and hinder the introduction of innovative solutions. According to a survey by the Japan Users Association of Information Systems in 2017, nearly 80 percent of companies in Japan were burdened by legacy systems, with approximately 70 percent reporting that those systems impeded their digitalization efforts.<sup>17</sup>

Integrating new digital solutions with legacy systems can lead to inefficiencies, data silos, and compatibility issues. Organizations will need to formulate migration strategies that minimize disruptions while ensuring the seamless integration of existing data and processes into the new digital ecosystem. The transformation also involves evaluating whether migrating or building new systems from scratch is more cost effective. Case 3 illustrates how Hokkoku Bank, a regional bank in Japan, embarked on an infrastructure shift to the public cloud. This move not only positioned the bank as a pioneer in redefining the traditional banking landscape in Japan but allowed a fundamental transformation touching decision-making processes and organizational culture.

In the public sector, the Digital Agency plays a pivotal role in managing the Government Cloud—a public cloud system aimed at fostering interoperability between central and local governments. Collaborating closely with designated ICT vendors, the Digital Agency oversees systems integration efforts, facilitating the migration of pertinent local systems to the central cloud infrastructure. Simultaneously, the Agency advocates for local governments to centralize their data onto unified integration platforms tailored for each prefecture

### Case 3: Hokkoku Bank—Pioneering digital transformation in Japan’s banking sector

The banking sector in Japan offers compelling lessons in this regard. Hokkoku Bank, a regional bank established in 1943 and headquartered in Kanazawa City, has long been committed to a business strategy driven by system improvements and IT investments. The aim is to build an ecosystem extending beyond traditional banking systems, involving the customers, and creating highly convenient new services through the provision of Banking as a Service (BaaS). Hokkoku Bank defines digital transformation not merely as the use of technology but as a fundamental digital transformation of the bank itself, encompassing decision-making processes, authorities, decision criteria, and organizational culture.

Since establishing the Systems Department in 2007, Hokkoku Bank’s investments in strategic systems continued, with a major overhaul of groupware—a type of computer software that helps members of a group work together—in 2011 and the rebuilding of IT infrastructure in 2013 by the deployment of Microsoft’s Surface—a series of touchscreen based personal computers and tablets. In a bold move, the bank also updated its account management system in 2015, acknowledging the significant changes to the core operations of the bank, which could impact customer transactions, data security, and financial processes.

In 2019, Hokkoku Bank decided to adopt Azure—a cloud service provided by Microsoft—as the company’s system infrastructure. Executing a cloud-first policy, Hokkoku Bank achieved the status of Japan’s first banking operator with a full banking system in the public cloud. Today, Hokkoku Bank stands as one of the most advanced regional banks, earning recognition as a “DX-certified operator” in 2021 by the Ministry of Economy, Trade, and Industry.

17 <https://medium.com/tokyo-fintech/japans-2025-digital-cliff-48dbb838fb27>

## 4.4 Institutional enablers



The advancement of the digital development agenda can be significantly hastened by establishing key institutional enablers. Robust digital safeguards enhance the trust and security of digital applications, while effective policies and incentives offer crucial support in navigating challenges during digital transformation. Timely visioning plays a pivotal role in aligning digital development initiatives with the latest trends and technological changes, allowing societies to leverage these advancements for greater benefit.

### 4.4.1 Digital safeguards: Data privacy, protection, and cybersecurity

As data become a strategic asset, the ethical and legal dimensions of data privacy and protection take center stage. Japan, alongside countries like Singapore, Canada, and the Netherlands, stands out as one of the few economies that has successfully embraced a model where secure and seamless digital experiences lead to engaged consumers and nurture an active digital ecosystem, while generating more data and enabling a virtuous cycle of growth.<sup>18</sup> In 2019, Japan proposed its visionary concept of Data Free Flow with Trust (DFFT) at the G20 Summit. The concept advocates for a harmonious combination of open data flows and robust privacy protections and has been well received by the international community. The DFFT concept has been operationalized at the G7 summit in 2023 with the establishment of Institutional Arrangement for Partnership.<sup>19</sup>

Japan’s data protection journey started some 20 years ago. The original Act on Protection of Personal Information (APPI) in Japan, enacted in 2003, applied only to business operators with databases containing personal information of at least 5,000 identifiable individuals. Recognizing the evolving landscape of privacy concerns, the government took a proactive step to update the regulation. In 2021, amendments were made to extend the Act’s scope to cover not only businesses but also government agencies, nonprofits, and individuals. Entities and individuals who want to collect personal information will need to obtain consent from individuals prior to collecting, using, or sharing it if the information is sensitive or is to be transferred to a third party or outside of Japan. The amended APPI now covers a range of personal data, including names, addresses, emails, and health information, reinforcing the robust data privacy and protection practices.

The private sector often faces challenges in setting up data governance structure. In response to such challenges, the METI published a Privacy Governance Guidebook<sup>20</sup> for the private sector, offering insights to navigate the complex terrain of data governance, security protocols, and privacy regulations.<sup>21</sup> Leading companies, such as KDDI Corporation, a major Japanese telecommunications operator, have responded by establishing a data governance office. Such a centralized unit integrates functions related to the preparation and operation of personal data utilization within their organizations, following the principles outlined in METI’s guidebook. For small and medium-sized businesses (SMEs), the METI acknowledged their constraints and took proactive steps by publishing the Digital Governance Code.<sup>22</sup> The code offers hands-on guidance and documentation tailored to SMEs, aiming to provide practical support for enterprises that may have struggled with the initial steps of their digital transformation. In addition to the code, METI also organized a series of workshops, further empowering SMEs with the knowledge and tools needed to navigate the complexities of data governance, risk management, and ethical considerations.

18 Harvard Business Review’s webpage of Which Economies Showed the Most Digital Progress in 2020?

19 Japan Digital Agency’s webpage of Data Free Flow with Trust, <https://www.digital.go.jp/en/dfft-en>

20 Japan’s Ministry of Economy, Trade and Industry Guidebook for Corporate Privacy Governance in the Digital Transformation (DX) Era, [https://www.meti.go.jp/policy/it\\_policy/privacy/guidebook\\_ver1.3\\_english.pdf](https://www.meti.go.jp/policy/it_policy/privacy/guidebook_ver1.3_english.pdf)

21 Japan’s Ministry of Economy, Trade and Industry webpage on Privacy Governance, [https://www.meti.go.jp/policy/it\\_policy/privacy/privacy.html](https://www.meti.go.jp/policy/it_policy/privacy/privacy.html)

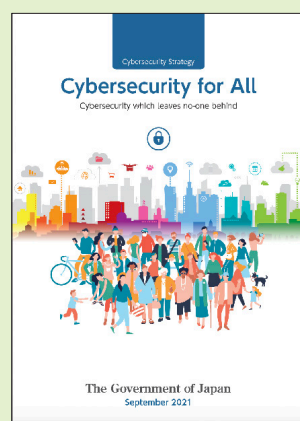
22 Digital Governance Code published by Japan’s Ministry of Economy, Trade and Industry, [https://www.meti.go.jp/shingikai/mono\\_info\\_service/dgs5/pdf/20201109\\_e01.pdf](https://www.meti.go.jp/shingikai/mono_info_service/dgs5/pdf/20201109_e01.pdf)



The interconnected nature of modern digital infrastructure increasingly exposes it to cybersecurity risks. As digital solutions become integral to operations, the threat for cyberattacks expands, ranging from data breaches to ransomware attacks with severe consequences. Societies and organizations will need to implement robust cybersecurity measures to safeguard digital assets, which involve strategies like firewalls, intrusion detection systems, and encryption protocols. Additionally, fostering a culture of cybersecurity awareness is crucial for preventing and mitigating potential threats. Case 4 provides some of the detailed initiatives.

#### Case 4: Evolving cybersecurity measures for critical infrastructure protection

Since 2005, the Cybersecurity Policy for Critical Infrastructure Protection (CIP) in Japan has served as a common action plan for the government and critical infrastructure operators. The government bears responsibility for promoting independent measures by critical infrastructure operators related to cybersecurity and implementing other necessary measures. The National Center of Incident Readiness and Strategy for Cybersecurity (NISC), established in 2015—formerly the National Information Security Center since 2005—operates as the secretariat of the Cybersecurity Strategy Headquarters.



With the backbone of the cybersecurity law enacted by the Japanese government in 2014, the NISC has functioned as a focal point in coordinating intra-government initiatives and wider partnerships with other stakeholders to create a “free, fair, and secure cyberspace”. Its key policy strategies have three priorities: (i) Enhancing socio-economic vitality and sustainable development including advancing digital security literacy; (ii) Realizing a digital society where people can live safely and securely including preparation and measures to respond to massive cyberattacks; and (iii) Contributing to the peace and stability of the international community and Japan’s national security including measures to strengthen capabilities for defense, deterrence, and situational awareness.<sup>a</sup>

Responding to the dynamic cybersecurity landscape and fast changing regulatory environment, a new edition of the CIP was published in 2022.<sup>b</sup> The updated version identifies 14 sectors as critical infrastructure, including information and communication, financial services, aviation, and electric power. The updated CIP expects stakeholders to undertake five specific measures, including the enhancement of incident response capability, maintenance and promotion of safety principles, enhancement of information sharing systems, utilization of risk management, and enhancement of the basis for CIP.

a. A set of policies and guidelines published by Japan’s National Center for Incident Readiness and Strategy for Cybersecurity through its website, <https://www.nisc.go.jp/eng/index.html>  
b. Overview of cybersecurity policies for critical infrastructure protection, published by Japan’s National Center for Incident Readiness and Strategy for Cybersecurity, [https://www.nisc.go.jp/eng/pdf/cip\\_policy\\_abst\\_2022\\_eng.pdf](https://www.nisc.go.jp/eng/pdf/cip_policy_abst_2022_eng.pdf)

Japan has established a robust foundation for cybersecurity building on policies and measures accumulated over the past two decades. According to the Global Cybersecurity Index 2020, released by the International Telecommunication Union, Japan ranks seventh in the world for a safe and secure cyberspace.

## 4.5 Society 5.0 — Leveraging technologies to enhance the well-being of citizens

The Japanese government introduced the concept of Society 5.0 in 2016, envisioning a society where both the economy grows, and social problems are resolved in a balanced manner through advanced use of technologies. Rooted in the evolution of human societies from 1.0 (hunting), 2.0 (agricultural), 3.0 (industrial), and 4.0 (information), Society 5.0 would be a human-centric society where cyber and physical spheres mutually interact, fostering collaboration across the society to enhance citizens’ well-being.<sup>23</sup>

In Japan’s digital transformation journey, it is timely and necessary to have a vision like Society 5.0. Given that Japan’s economy is more conventional industry based, a shift toward sectors related to data, artificial intelligence (AI), robotics will have greater potential to drive economic growth and job creation. Moreover, Japan has been grappling with societal challenges, including an aging population, declining workforce, and stagnant life quality. A human-centric approach in digital transformation, as proposed by Society 5.0, is well positioned to address those challenges with the transformative impact of digital technology (case 5).

#### Case 5: Society 5.0

Society 5.0 is a vision launched by the Japanese government for the future society in 2030 and beyond. The concept was first advocated by Japan Business Federation (Keidanren) and was adopted in the 5th Science and Technology Basic Plan as a future society that Japan should aspire to.

In the preceding information society (Society 4.0), the mere cross-sectional sharing of knowledge and information is not sufficient, and cooperation is limited. Factors such as age and education level further limit the abilities to make full use of data and information. In addition, societal challenges like the declining birth-rate, an ageing population, and local depopulation make it challenging to respond to emerging issues adequately.

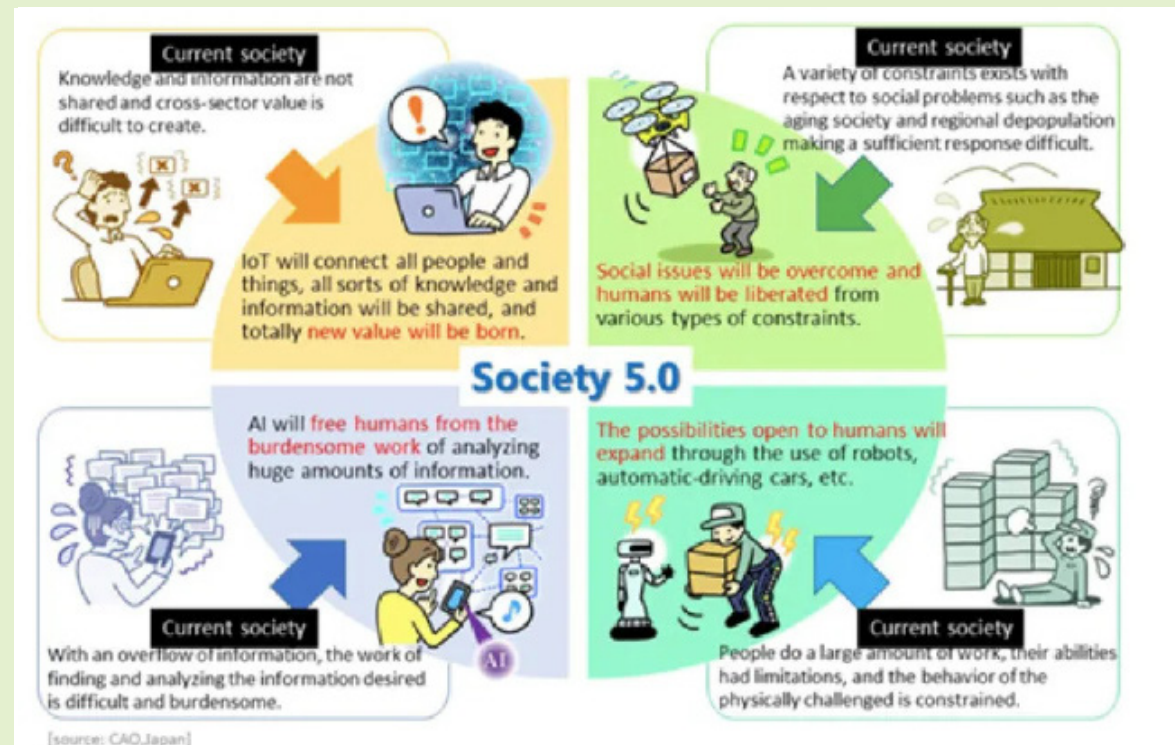
Society 5.0 aims to achieve a forward-looking society that breaks through the existing stagnation, and foster a society characterized by mutual respect among all members, transcending generation gaps. Another characteristic of Society 5.0 lies in the convergence of cyberspace and physical space. For example, sensors in physical space generate large amounts of data, which can then be accumulated and analyzed in cyberspace with digital tools like AI. The insights from the analysis can be provided back to individuals via various means.

Diverging from the conventional practice of data collection through sensors and networks and having humans analyze it, Society 5.0 would integrate people, objects, and systems in cyberspace. The optimal results obtained by integrated analysis and AI would surpass human capabilities, and then be translated to tangible actions in the physical space. This process would bring unprecedented new value to industry and society.

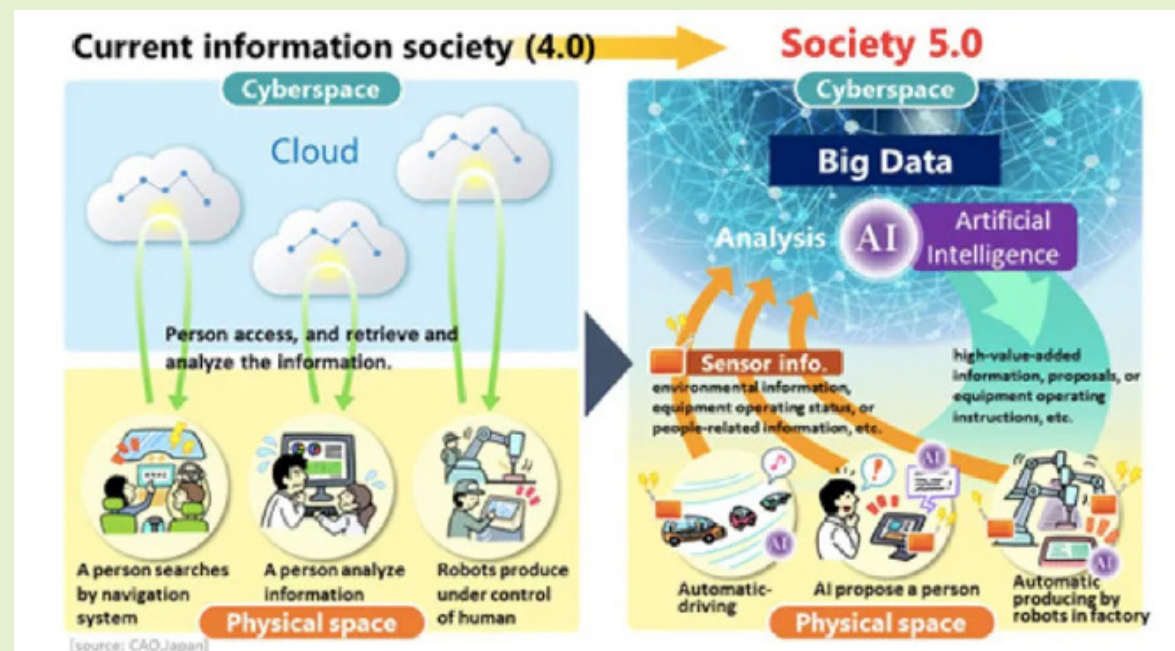
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23 Japanese Cabinet Office’s webpage of Society 5.0, [https://www8.cao.go.jp/cstp/english/society5\\_0/index.html](https://www8.cao.go.jp/cstp/english/society5_0/index.html)

## Case 5: Society 5.0, continued



The vision of Society 5.0 necessitates widespread acceptance and shared understanding among stakeholders, including central and local governments, industry players, academic institutions, and residents. As the world undergoes significant changes propelled by technologies such as IoT, robotics, AI, and big data, Japan's pursuing of Society 5.0 seeks to incorporate these new technologies in all industries and social activities, aiming to achieve economic development and address social problems at the same time. Society 5.0 stands not only as a national initiative but also as a model that other countries can consider as they envision their own digital future.



## 4.6 People and digital skills — Competence across public, private, and citizen spheres



The success of any digital transformation initiative also relies on the capabilities and skills possessed by individuals across the different sectors of a society. Organizations and governments should invest in cultivating a digitally competent and engaged workforce, while citizens actively shape the digital landscape with a focus on social considerations. Such efforts will not only support technological success but also empower individuals to cocreate solutions and manage change in an increasingly digital world.

In the digital era, organizations can gain a competitive edge by investing in nurturing digital skills within their workforce and acquiring talent. Upskilling involves equipping existing staff with the necessary expertise to excel in the digital age through training programs, workshops, and online courses covering emerging technologies, data analytics, AI, and more. Simultaneously, attracting new digital talents requires offering appealing career opportunities aligned with the aspirations of tech-savvy individuals.

In Japan many companies heavily rely on external vendors, particularly system integrators (SIs), for their internal IT engineering. According to Japan's Information-technology Promotion Agency (IPA), countries like the United States have nearly 70 percent of IT engineers employed by user companies, while Japan has the opposite situation, with fewer than 30 percent of IT engineers employed directly under user companies. Consequently, companies often encounter a shortage of in-house digital talent to drive initiatives. Moreover, traditional Japanese companies have relatively low mobility for external talent. With many employees being long-time staff in the organization, a prevailing tendency strongly emphasizes past company achievements instead of exploring innovative possibilities. In order to solve the situation, a new digital talent development initiative has started. Basic steps like training personnel at different hierarchical levels and partner with skills to become solution providers to create in-house technical solutions was introduced, as demonstrated by Kitakyushu City government (case 6).

### Case 6: Kitakyushu City, digital transformation with talent development

Kitakyushu, a city located in Fukuoka Prefecture with a million citizens, recognized the above challenges and took proactive measures. It established the Digital City Hall Promotion Headquarter in 2020, followed by the Digital City Hall Promotion Office in 2021. The Kitakyushu City Digital Transformation Promotion Plan aims to realize "a happy town made convenient and enjoyable through digital means". It prioritizes securing and developing digital talent. The city has systematically advanced digital talent development across both the public and private sectors, encompassing initiatives such as training staff to use low code tools—software that require minimal coding to build applications—providing digital transformation training for different hierarchical levels, and fostering a remote work friendly environment through training for all managers.

Furthermore, Kitakyushu City developed a partnership with Cybozu, a software company, conducting hands-on training on their cloud solution platform. This partnership enabled government staff to develop in-house systems for processing improvement within their respective workplaces. Kitakyushu City's achievements in digital talent development have won the first Nikkei Municipal DX Award Grand Prize in 2022 and the Prime Minister's Prize at the Summer DIGIDEN Koshien—Summer National Championship for Achieving a Digital Garden City Nation—held in the same year.



Citizens and users could become active contributors and cocreators in the digital transformation journey, transcending their traditional role as recipients of services. Citizen engagement in the digital era thus goes beyond increasing digital literacy; it is about empowering people to actively contribute to initiatives that directly impact their own lives. Digital technologies provide and expand platforms for citizen engagement, facilitating direct communication among governments, organizations, and citizens. Governments can utilize these digital channels to seek input on policies and programs. Similarly, the private sector involves customers in the design of products and services, resulting in solutions closely aligned with their needs. Case 7 below illustrates such an example, where the government facilitates collaborations among private sector solution provider, the academia, and local residents to co-create solutions.

### Case 7: Matsuyama City, empower citizens to cocreate solutions

Matsuyama City initiated the ‘Habitat Innovation’ project,<sup>a</sup> a test-bed that leverages various data, including human flow, traffic volumes, and purchase behaviors, to enhance its amenities and infrastructure. Analyzing citizens’ behavioral data from multiple dimensions creates a comprehensive view of the city’s challenges and potential solutions. This citizen-oriented approach to city development actively involves residents, local authorities, universities, and businesses in the planning process, fostering a sense of shared responsibility and ownership in the city’s development.

Hitachi also collaborates with Matsuyama city as a member of the city’s Smart City Promotion Consortium. They have created a simulation tool ‘Cyber-PoC (Proof of Concept) for cities that can model the impact of potential urban solutions and visualize the outcomes of different scenarios, such as how the introduction of new public transportation modes, rental bicycle stations or parking facilities could expand the range of movement of tourists. Citizens would be explained and trained to understand the results from the modeling and visualization tool. This contribute to discussions between the urban professionals and the general public, forging urban development plans and policies with feedback from better informed citizens.

a. Japanese technology company Hitachi’s webpage with detailed introduction of the Habitat Innovation project, [https://social-innovation.hitachi/ja-jp/case\\_studies/hitachi\\_todai\\_labo/](https://social-innovation.hitachi/ja-jp/case_studies/hitachi_todai_labo/)

The chapter has examined the four building blocks that are critical to Japan’s digital transformation journey, which has relied on integrated data and digital infrastructure, institutional enablers for data protection and system interoperability, and active participation and empowerment of people. With these core elements in place, numerous services ranging from infrastructure to essential utilities supporting people’s daily lives can be greatly strengthened and supported, which will be elaborated in the next chapter.



So far, the report has covered various aspects of digital transformation in Japan, providing a chronological account of its evolution over the past 30 years (chapter 3). This was then complemented by an in-depth analysis of the key building blocks that have played a critical role in driving digital transformation processes in Japan, namely data, digital infrastructure, institutional enablers, and people and digital skills (chapter 4). Taken together, this Chapter 5 explores how the central government works with local governments in implementing digital policies and strategies. Specifically, it aims to provide critical insights into the application of digital transformation in urban planning or development—or more appropriately, smart city approaches. To this end, central government policies and cases of smart city development in Japan will be presented as a concrete manifestation of digital transformation. This chapter also focuses on how Japanese towns and cities have harnessed digital technologies to enhance and innovate service delivery and infrastructure development. Finally, attention is also given to government support programs and partnerships that are pioneering smart city approaches in a coordinated manner across the country. More details on the specific examples of smart city approaches can also be found in Appendix D.

Japan’s journey in smart city development is compelling for multiple reasons. First, it has been fueled by the urgent need to tackle critical issues like climate change, aging populations, and bolstering community resilience in the wake of natural disasters. Through its evolving governmental policies and programs, Japan provides valuable insights into the application of digital solutions within urban settings. Second, Japan’s experience offers a rich and robust case study on how digital technologies can significantly enhance urban problem solving and resident well-being. This is exemplified by numerous instances where digital innovations have revamped infrastructure and services in energy, mobility, health-care, and payment systems. Lastly, Japan’s smart city approach resonates with global trends, shifting from a mere technological focus to prioritizing people-centric urban development. This makes Japan a pertinent benchmark for other nations seeking to navigate similar challenges.

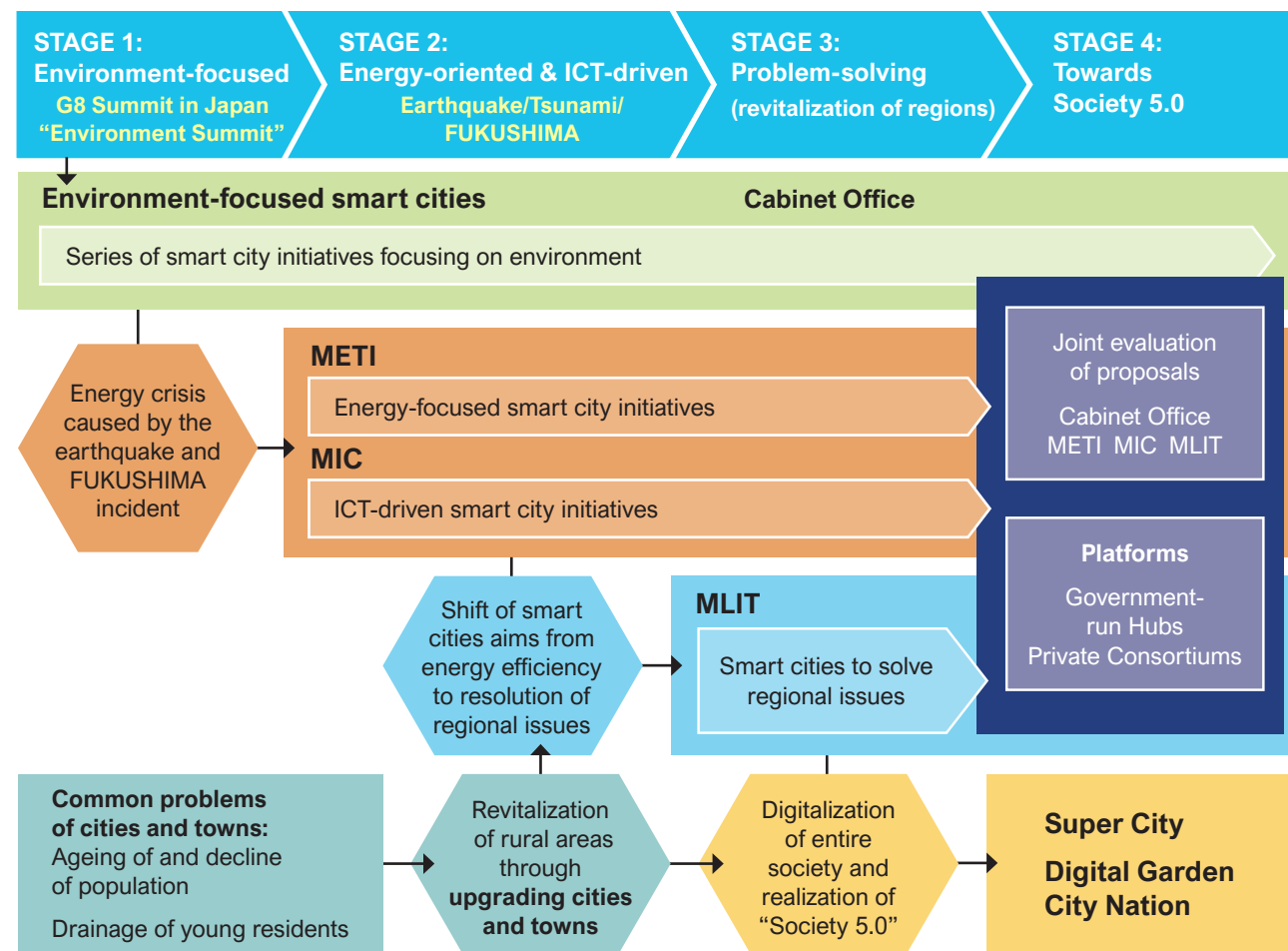
## 5.1 Evolution of government policies on smart cities

This subchapter presents the four stages of Japan's smart city evolution, tracing its trajectory from environment focused initiatives to service oriented initiatives and, ultimately, to a vision of a digitally transformed society.

The initiatives arose in response to two key challenges: global warming and a declining, aging population in stage 1. Initially rooted in environmental concerns, the concept gained momentum after the 2008 G8 Summit, leading to the "Environment Model City" initiative. Concurrently, efforts to revitalize rural areas underscored the need for smart city strategies to attract residents and industries. Stage 2, catalyzed by the 2011 East Japan Great Earthquake, prioritized community resilience and decentralized energy solutions. After a dip in enthusiasm, Stage 3 witnessed a shift toward problem solving focused initiatives, with municipalities partnering with industries for sustained operation. Stage 4 marked significant political shifts toward digitalization, with initiatives like the Super City Initiative and Vision for a Digital Garden City Nation aiming for societal transformation. Joint evaluation processes streamlined smart city applications across ministries.

The figure below provides an overview of government policies related to smart city development, in reference to the digitalization policies in Chapter 3.

**FIGURE 5.1 MACROSCOPIC VIEW OF TRAJECTORY OF SMART CITY INITIATIVES**



### 5.1.1 Stage 1: Dawn of smart cities in Japan — Environment-focused smart cities

Japan's smart city policies and initiatives emerged in response to two distinct challenges—namely the impact of global warming and the decreasing and ageing population. In response to the global challenge

of climate change, the concept of environment-friendly cities took shape in the Japanese government policies. The G8 Summit Toyako Summit held in 2008 in Hokkaido, Japan, focused on environment issues and influenced the inauguration of the "Environment Model City" initiative by the Cabinet Office in Japan, which was the origin of the smart city endeavors by the Japanese government. This initiative granted governmental subsidies to cities who are tackling environmental issues such as energy saving and treatment and recycling of solid waste and wastewater, regardless of the application of ICT. This approach focused on specific efforts and activities undertaken by various municipalities, rather than urban scale programs that are typically associated with the term smart cities. In the early initiative, smart activities were understood more as climate smart or environmentally friendly.



The second impetus for smart city policies in Japan emerged from efforts to revitalize rural areas. The total population of Japan started to decline in 2008, and the ageing population also posed a big challenge to the future of the country. The issue of declining and ageing population is particularly acute in rural areas. In 2005, the Government issued the first alert on the population decline and adopted "Basic Policy on Regional Rehabilitation" as a Cabinet Decision. The Office for Regional Rehabilitation was established in the Cabinet Office at the same time. Since then, the smart city initiatives have been positioned as part of efforts by municipalities to attract people and industry to move to their cities and to retain young generation to maintain the economy and liveliness of the cities, and this stance persists till today

### 5.1.2 Stage 2: Post Great Earthquake — Energy-oriented and ICT-driven smart cities



On March 11, 2011, Japan experienced the East Japan Great Earthquake, Tsunami, and Fukushima Incident, killing more than 20,000 people, forcing 470,000 people to evacuate from their homes, and completely destroying 120,000 buildings. This massive tragedy called for more a more advanced form of smart city approaches, which is thought to be the Stage 2 of Japan's smart cities development with a deeper attention to the sustainability and resilience of communities. The serious incident at the Fukushima Nuclear Power Plant caused the stoppage of all nuclear power plants in Japan for safety inspection against extreme natural hazards, and the consequent energy shortage affected not only the devastated areas but all over Japan. Prior to the disaster, energy supply in Japan was regarded as highly reliable, characterized by

stability in voltage and frequencies and rare blackouts. Such reliability and high quality service was possible because nine major electricity companies were responsible for distributing the electricity generated by huge power plants including nuclear ones to the very remote sectors of rural areas. However, the disaster brought to light the vulnerability of relying on limited number of power sources and complicated, extensive energy network.

From these experiences arose the catchphrase "local production and local consumption of energy", in which electricity is produced by small scale energy generators employing renewable energy sources such as photovoltaics and small hydro generators and batteries and distributed within a community through simple network. This method became a major concept for smart cities. In the Tohoku region, where the damage by the earthquake was the worst, newly developed towns for disaster refugees incorporated such a concept into their masterplans.

During this period of the disaster, the Kashiwanoha Smart City project (Appendix D), owned and run by the private real estate company Mitsui Fudosan, was undergoing development. The Chairman of the company decided to halt the construction and instructed the project team to redesign the neighborhood, strengthening the disaster resilience aspects of the city while including emergency shelters for



the residents in the surrounding areas with a mechanism to run the core functions of the infrastructure self-sufficiently.

### 5.1.3 Stage 3: Problem-solving smart cities for the revitalization of regions

The mid-2010s saw a renewed interest in smart cities emerge in the United States and Europe, exemplified by a number of relevant initiatives in the US such as the Horizon 2020 initiative and President Obama's Smart City of 2015 or the European Smart Cities and Communities Lighthouse Projects of 2014. These initiatives were widely viewed as a promising approach to addressing the unique challenges of individual cities and towns through active resident participation. In contrast, in Japan, the concept of smart cities stalled, due largely to the general public and the mass media having reportedly become less enthusiastic about it, seeing it as nothing more than just another buzzword created by technologically savvy experts. This is likely to stem from residents' fatigue with the ongoing energy-saving efforts in their daily lives, compounded by the challenges of establishing sustainable business models for newly introduced services in smart cities once governmental subsidies expire.

However, one publication, written by Hiroya Masuda, a former Governor of Iwate Prefecture, resuscitated the need for digital transformation. The publication entitled "Demise of Regions", delivered a stark warning about the ongoing issue of a declining and ageing population in Japan, pointing out that 896 cities, or 49.8 per cent of all of the cities in Japan as being under threat of demise on the back of an increasing concentration of population in Tokyo. The publication triggered municipality leaders to pay attention to the improvement of the quality of life of their cities and towns to attract new residents and retain current residents, and the smart city approaches came to be seen as a potentially viable solution to the problems of their own cities.

Such a sense of urgency was shared with the central government. In 2013, the MIC initiated "Promotion of ICT-driven Urban Development" marking the first governmental effort targeting the resolution of urban issues through information and communication technologies. On the other hand, MLIT, which is the ministry in charge of urban development, placed little emphasis on smart cities until 2018 when it published "Interim Report on the Realization of Smart Cities", the first governmental document bearing "smart cities" in its title. Subsequently, MLIT initiated programs with governmental subsidies for smart city projects. Then, METI launched new pilots, combining succeeding and on-going initiatives with new ones. Under these initiatives, local governments actively applied for subsidies for their projects.

However, the results of these pilots were not always positive. A post-project survey on the continuity of the smart city projects with governmental subsidies showed that over 70 percent of the projects granted in mid-2010s had been abandoned after the termination of subsidies, without achieving the initially aimed objectives. The survey concluded that common challenges preventing the local government from fully implementing the intended smart city approaches: (i) insufficient capability of municipality officials, especially in the field of ICT, and (ii) the fact that their proposals were often prepared by major consultancy firms based in Tokyo, disconnected from the real problems faced by the applying cities and regions.

On the basis of these results and observations, suggestions were provided that ministries encourage municipalities to tie up with industry at the early stage of applications for the grants, so that the public-private partnership would continue work for operation of the new systems after the development phase under governmental subsidy is over. Ministries also facilitated the establishment of mechanisms where municipalities can match up with suitable industry that meet the local needs through government-assisted platforms discussed in this chapter.

While widely varied aspects can be found in the activities of both central and local governments during this period, the general trends in stage 3 can be summarized as the time of transition from environment focused and technology driven smart cities to problem solving-focused with the common objectives to revitalize the cities and towns by upgrading them.

### 5.1.4 Stage 4: Toward Society 5.0

Significant shifts in politics and governmental efforts toward digitalization and smart cities characterize the onset of Stage 4, particularly observed in the years 2020 and 2021.



The Super City Initiative, envisioned as the model of future society described in Society 5.0 (see case 5) accompanying ambitious deregulation, was announced in 2018 under the leadership of the then Prime Minister Shinzo Abe to restore and activate the National Strategic Special Zone System, the reputation of which had been marred by political scandals. The call for proposals commenced in December 2020, with selected cities announced in April 2022.

The Kishida Administration, which followed, adopted a new policy on urban and regional development called "Vision for a Digital Garden City Nation (DIGIDEN)". The significance of this initiative is that its goal is set to digitally transform the entire society. The grants under this initiative are diverse, aligning with the aims of Society 5.0 and focusing on regional revitalization, while also integrating My Number Card. Some types of the subsidies are granted as digital boosters, supporting the ongoing programs local governments are undertaking as measures to revitalize the regions. Because of the nature of DIGIDEN—unlike other smart city initiatives including Super City Initiative, which are mostly city-wide and comprehensive projects—many small scale proposals are being granted with subsidies. This indicates the firm intention of the government to penetrate digital transformation in the most secluded areas and not to leave anybody behind.

Another distinctive action taken by the government during Stage 4 is the joint evaluation of smart city applications submitted to different ministries. While both the DIGIDEN and Super City initiatives were led and coordinated by the Cabinet Secretariat and Cabinet Office, other ministries such as MIC, MLIT and METI have been running individual initiatives. Since 2021, the evaluation and selection of grantees are carried out collectively by a joint committee of Cabinet Office and the ministries, although the filing of budget and call for proposals are separately done by individual ministries. The new process of joint evaluation has facilitated effective coordination of different smart city initiatives for each fiscal year among the ministries..

## 5.2 Government subsidy programs and partnerships

As demonstrated in the evolution of smart cities in Japan outlined in previous chapters, the subsidies by central ministries play important roles in promoting smart city development. Under this financial framework, local governments and industry take coordinated efforts to obtain the grants and to implement smart city strategies. This chapter aims to dissect these somewhat complex yet impactful programs. To this end, this section elaborates the processes of how local governments obtain subsidy from the central government as a benchmark model for other countries interested in devising a similar support program. Furthermore, an analysis is provided to shed light on factors driving effective and impactful partnerships with the private sector, civil society, and local governments in implementing the smart city approaches in Japan.

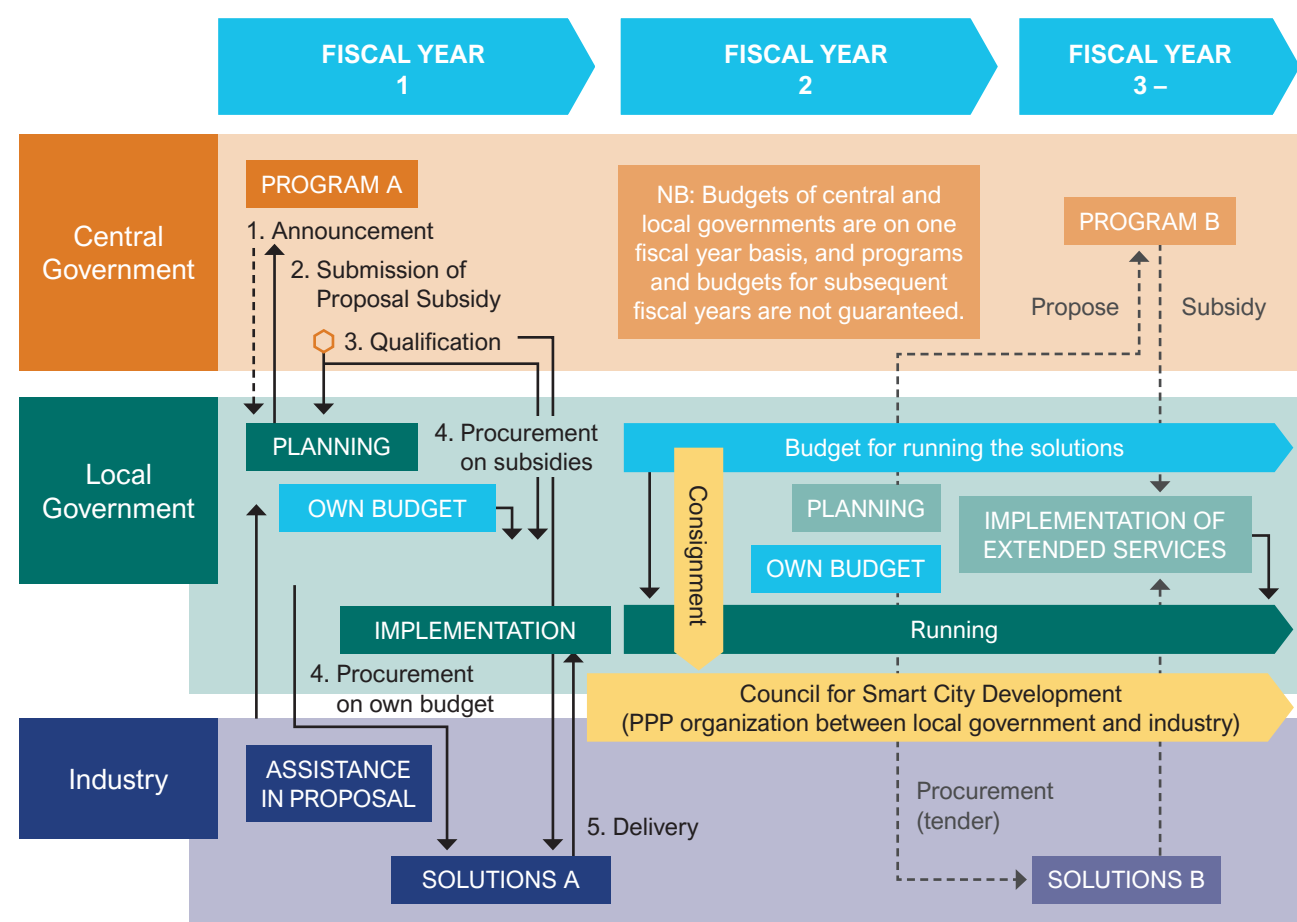
### 5.2.1 Governmental subsidy program

The central government offers various types of subsidy programs for local governments to implement smart city approaches. Figure 5.2 shows a common flow of the funding processes in smart city initiatives. It should be noted that the policies and programs are established by the ministries of the central government, which local governments then leverage to develop their infrastructure and smart cities. Meanwhile, central ministries gather input and needs from local governments as they prepare these programs.

First, one of the ministries at the central government announces a call for application for a given fiscal year, as shown in upper left of the diagram. The local government responds to the call and prepares a proposal. Companies in the private sector, who will become partners of the local government in the formation of a council of public-private partnership (PPP), assist the local government in preparing the proposal. The proposal will be submitted to the ministry, and once the proposal is qualified, subsidy is given to the local government. The subsidy is spent to implement the smart solutions described in the proposal, while, in many cases, the local government has to spend additional funding from their own budget for implementation. Private companies in the joint organization with the local government are expected to cover some part of the expenses for implementation.

It is also worth mentioning that central ministries recently tend to ask local governments to submit proposals as a PPP together with partnering organizations. Such an approach is gaining momentum to ensure uninterrupted implementation once the proposal is approved, and to encourage subsequent applications for later phases of the projects.

**FIGURE 5.2 SCHEMATIC DESCRIPTION OF FLOWS IN APPLICATION AND FUNDING OF SMART CITIES**



*Note: It is worth noting that the process depicted here should be seen as one typical example of funding flows from the initial proposal to the continuation of applications for governmental funding. The actual flow may vary based on specific guidelines and requirements.*

Specifically, once a new subsidy program (program A in figure 5.2) is launched by a ministry, local governments begin preparing their proposals. At this stage, local governments and industry work together in most of the cases; either the local government seeks for partners or industry stakeholders brings their ideas and draft proposals to local governments. These collaborative steps are shown in figure 5.2 where the sequential flow of actions is delineated through arrows labeled 1 to 4. Subsequently, either the

local government independently or in conjunction with the PPP organization prepares an application for governmental initiatives, either in the same series or those by a different ministry, to enhance the impact of the smart solutions and upgrade them. The caveat, however, is that since both the central and local governments operate on a single-year budget cycle, rather than multi-year, the sustainability of the initiatives beyond one fiscal year is not guaranteed. In the same vein, a great deal of uncertainty prevails about how much budget will be available in subsequent years even if the program continues.

### 5.2.2 Private sector, civil society, local government partnership

In tandem with the coordinated initiatives of various ministries, the establishment and operations of platforms and consortiums also played an important role in moving forward the smart city agenda in Japan. Partly based on the reflections from the previous experiences that many of earlier projects had been abandoned when the governmental subsidies were over, the ministries jointly established platforms on which municipalities can get in contact with a broader range of private companies, who have necessary technologies and solutions for different cities.

One example of such a platform is the public-private partnership platform,<sup>24</sup> established in August 2018 by the Cabinet Office. It subsequently expanded its reach to more participating ministries, and now the platform's secretariat is jointly supported by Cabinet Office, MIC, METI, MLIT and Digital Agency. Comprising 457 companies, universities and research organizations, and 187 local governments, the platform carries out matching events and establishes interest groups for pursuit of possible common solutions. Another example worth mentioning is the "Super City Open Lab", established by the Cabinet Office in 2018. This platform now includes over 250 companies classified into six layers—namely, overall design, integration, service applications, urban OS, communication network, and infrastructure. Both of the consortiums, the PPP platform and the Super City Open Lab offer, in principle, similar services of matching between local governments and industry.

In the private sector, two consortiums have been established, namely Smart City Institute–Japan, and Smart City Social Implementation Consortium. Both consortiums comprise public enterprises and local governments, providing opportunities for the local governments to connect with companies who offer suitable solutions for the cities. Smart City Institute–Japan offers knowledge sharing through webinars to officials of local governments and industry, and it also offers a capacity-building program for municipality officials to acquire knowledge and skills in managing smart city projects as the master planner. Smart City Social Implementation Consortium, on the other hand, carries out its activities in more cohesive manner in such a way that they organize working groups by participating members based on the common interests such as resilience, and the member bodies are entitled to join those working groups.

Apart from these platform and consortium activities supporting the local governments in project implementation, an evolving trend is collaborative execution of projects between local governments, often coming with technical assistance from a local government with advanced experience in smart city approaches to one that is less equipped with the necessary skills or capacity. Acknowledging the significant challenge of human resource shortages, particularly capable officials for smart city projects, collaborative efforts have increased between cities and towns. The new trend involves higher level local governments, namely prefectures, extending support to lower level municipalities. One common approach on the rise in recent years is that a number of cities and towns work together to share their staff equipped with relevant knowledge and skills to carry out project implementation. Saitama prefecture and Aichi prefecture, for example, offer opportunities of collective learning and exchange of experiences among cities and towns within their prefectures. Digital Agency has recently announced that each prefecture must establish a singular data integration platform. This measure aims to facilitate collaboration among the municipal officials within the same prefecture.

<sup>24</sup> Japanese Ministry of Land, Infrastructure, Transport and Tourism's webpage of public-private collaborating platform, <https://www.mlit.go.jp/scpf/>



# 6

## Conclusion



Digital technology plays a pivotal role in transforming the present and future of societies. Meanwhile, digital transformation is not a mere adoption of technologies but a holistic paradigm shift, impacting governments, enterprises, citizens, users and the details of how services are conceptualized and delivered. Through the digital transformation journey and different cases in Japan, we observe valuable insights for countries worldwide. The key takeaways from Japan's experiences are on four fronts, highlighting the role of key stakeholders behind digital transformation.

The pivotal role of the central government in shaping strategic directions and policy frameworks cannot be overstated, as demonstrated by the Government of Japan's consistent efforts over the years. However, despite these efforts, there have been instances where desired outcomes in digital policy fell short, as evidenced by examples such as the Office for High-level Information and Communication Society and the e-Japan Strategy, discussed in earlier chapters. Several factors contribute to these outcomes. Firstly, the frequent changes in Japanese prime ministers and accompanying shifts in government administrations often lead to changes in policy emphasis. While the overall commitment to promoting digital transformation and smart cities remains, these initiatives are not immune to shifts in administration. Secondly, the rapidly evolving nature of ICT and emerging technologies contrasts with the time-consuming and consultative decision-making processes inherent in Japan's democratic system. This dynamic presents challenges in keeping pace with technological advancements. Lastly, the difficulty in accurately envisioning the future societal landscape during the planning stages poses a challenge. Planning appropriate policies around digital transformation elements such as data, digital infrastructure, digital enablers, and people and digital skills, outlined in this report, may have been challenging 20 years ago due to uncertainties in technology. This predicament is evident in the My Number Initiative, which faces opposition despite its potential societal benefits. It is important to note that in 1994, digital technology was not perceived as an indispensable part of infrastructure when the Office for High-level Information and Communication Society was established. Today, however, the importance of digital technology is undeniable. Readers of this report, regardless of their location, are encouraged to envision a future society transformed by digitalization and to adopt a long-term vision.

Second, local governments play a crucial role in translating national policies into actionable initiatives. The examples of Matsuyama City's citizen-centric digital projects and Asahimachi Town's mobility services showcase how local governments can bring the benefits of digital solutions to the general public, and foster innovation and community engagement in digital transformation. The implementation of smart city initiatives as demonstrated in the report's four cases, also suggests the necessity of collaborative efforts between central and local governments. Such alignment and collaboration are fundamental in providing policy support, funding, and sharing of lessons-learned and best practices to the local administrations. The deregulation of laws often opens the way to more effective use of ICT for the benefit of residents, in which the local governments play the leading role under the collaboration with the central government, who has jurisdictions over the laws and regulations in question. The sources of funding for projects can vary significantly from country to country. Some countries may rely on grants provided by the central government to support local projects, while in others, local companies may serve as key investors. It is important for readers to consider their own context when interpreting the findings of this report.

Third, the private sector's participation is inherent to driving innovation, investment, and technological solutions in digital transformation. Initiatives like Hokkoku Bank's digital initiatives and Hitachi's urban solutions' simulation highlight the private sector's role in shaping industry practices and fostering cross-sector innovation. Public-private partnerships, combined with open and collaborative regulatory environments, would be key to unlocking the full potential of digital technologies and driving transformation.

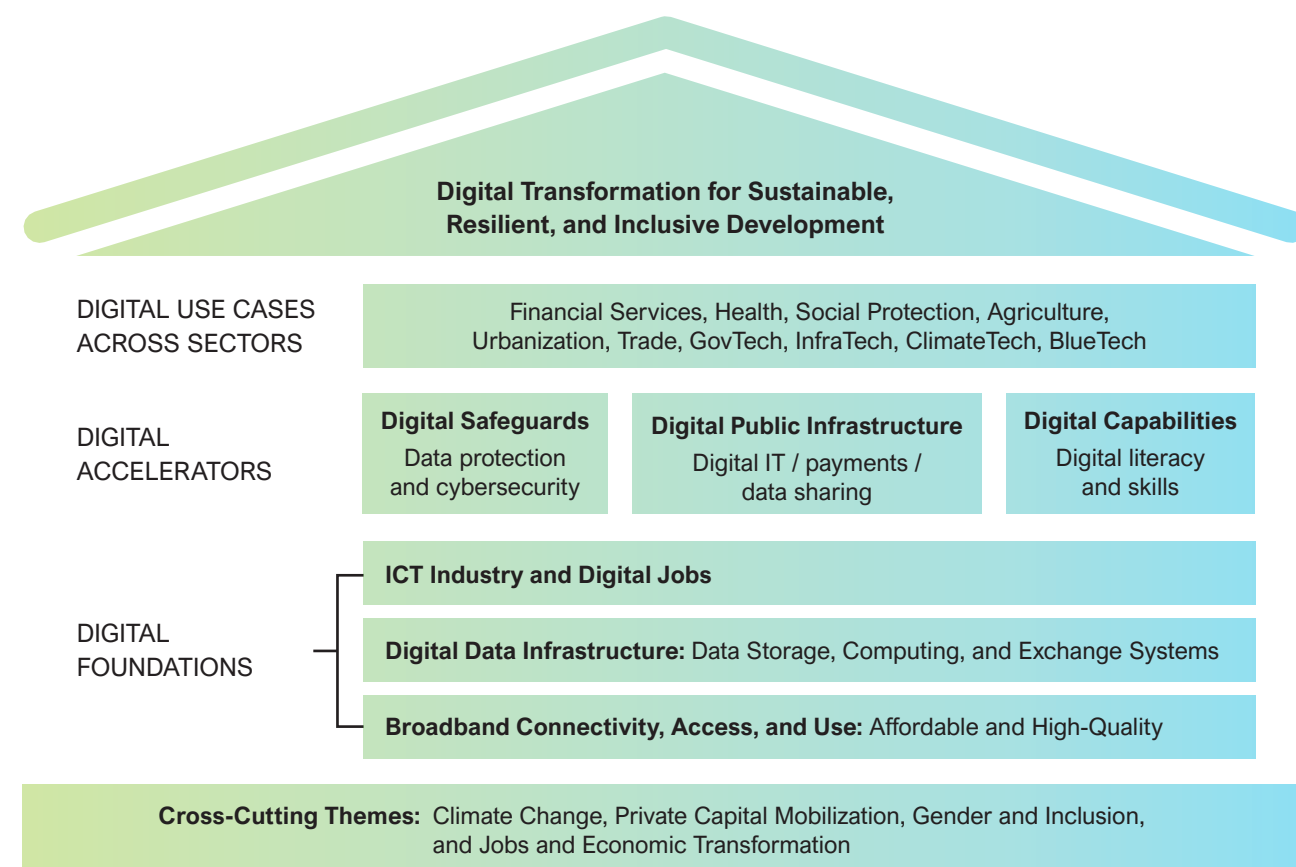
Lastly, citizens' engagement and empowerment are foundational to digital transformation. Japan's experience highlights the importance of citizen-centric initiatives and participatory approaches in the digital transformation process. For instance, Matsuyama city's Habitat Innovation project involves citizens in the design and evaluation of various urban planning projects, fostering a sense of ownership from the community in planning their own city. Toin's data and AI analytic initiative detects the vulnerability risks of elderly citizens, suggesting a great potential of digital technology in addressing societal challenges. By prioritizing citizen-centric approaches and incorporating citizen feedback into decision-making processes, these projects demonstrate that digital transformations benefit all segments of society and contribute to inclusive outcomes.

Japan's approach to digital transformation with robust infrastructure policies, dynamic governance, collaborative regulatory environment, and a whole-of-society effort exemplifies a holistic approach. This aligns seamlessly with the six QII principles for infrastructure development, emphasizing infrastructure's impact, economic efficiency, environmental considerations, resilience, social considerations, and governance. Japan's experiences indicate how digital transformation can serve as a catalyst for robust infrastructure development, ensuring efficient, sustainable, resilience, inclusive, and well-formulated government projects. Embracing these lessons can empower societies to leverage the full potential of digital transformation and enhance the well-being of all citizens.

# Appendix A: Digital Transformation Framework

The World Bank's Digital Development Practice presents a framework for digital transformation that built around a set of digital foundations including broadband connectivity, digital data infrastructure, and establishment of local ICT industries and jobs. Building on these foundations, digital development can accelerate through establishment of digital safeguards to improve trust and security, development of digital infrastructure to support digital public service delivery and access, and development of essential capabilities including digital literacy and skills. These foundations and accelerators can facilitate digital use cases across a range of sectors, to drive further sustainable, resilient, and inclusive development.

**FIGURE A.1: DIGITAL TRANSFORMATION FRAMEWORK**



Source: World Bank Group, *Digital Development Global Practice* (2023).

# Appendix B: Key Stakeholders and Responsibilities

## Cabinet Secretariat

The Cabinet Secretariat, central to the government's policy-making structure, houses temporary offices and headquarters for promoting critical policies. Historically, entities like the IT Strategy Office and General Office for IT Strategy, and currently the Secretariat of the Council for the Realization of the "Vision for a Digital Garden City Nation" from 2021 to the present, has been under the Cabinet Secretariat, and budget filing and practical operations are carried out by corresponding divisions of the Cabinet Office.

## Cabinet Office

Established in 2001, the Cabinet Office oversees crossministerial issues and policies under the Prime Minister's special orders and has the function of coordinating policies and practices which stretch over ministries. The Secretariat of the Local Revitalization Promotion Office with the National Strategic Special Zone Division manages the Super City initiatives that will be discussed further in chapter 5. While the Secretariat of the "Vision for a Digital Garden City Nation" is under the Cabinet Secretariat, the budget for the initiative is filed by Cabinet Office as one of the operational ministries.

## Ministry of Internal Affairs and Communication (MIC)

Formed in 2001 from the merger of the Ministry of Home Affairs and the Ministry of Posts and Telecommunications, MIC has dual functions of overseeing local autonomy and jurisdiction on telecommunication and posts. Because of this background of two distinctive ministries, MIC's roles in digital transformation can be found in two separate areas, one being the promotion of local governments' digitalization, and the other being the enhancement of the use of ICT for public and private service improvements. MIC, as the descendant of Ministry of Posts and Telecommunications, has been driving a series of initiatives related to ICT-driven Urban Development and Data-driven Smart Cities from an early stage of application of ICT to communities for the resolution of regional problems.

## Ministry of Land, Infrastructure, Transport and Tourism (MLIT)

Established in 2001 from the merger of the Ministry of Construction, Ministry of Transportation, and National Land Agency, MLIT takes a central role in urban, transportation, and construction policies. As the central ministry overseeing urban development and transportation encompassing rail, road, marine, and air sectors, all of which are intertwined with smart city initiatives, MLIT primarily focuses on facilitating the redevelopment of cities and towns from a policy standpoint rather than executing specific initiatives with predefined objectives and subsidies. Until 2018, MLIT primarily concentrated on digitalization efforts within the construction sector. In recent years, MLIT has also been promoting platforms for data sharing, a 3D model of actual cities called PLATEAU, which can be used by city planners, developers as well as start-ups with ideas on smart city solutions, to support the digital transformation of the planning and architectural processes in urban development.



## Ministry of Economy, Trade and Industry (METI)

Formed in 2001 from the merger of the Ministry of International Trade and Industry and Economic Planning Agency, METI focuses on energy, industry, and international trade. In the digital transformation context, METI leads initiatives to promote digital transformation in the private sector, providing guidance and reference materials for their progress. During the energy crisis following the East-Japan Great Earthquake and the Fukushima incident, METI led nationwide energy-saving efforts and executed programs focused on energy efficiency. This included the Demonstration of Next-generation Energy and Social Systems, in which four cities, Yokohama, Toyoda, Keihanna, and Kitakyushu, were selected as model cities to demonstrate the technological and societal impacts of the townwide use of renewable energy sources, large scale batteries, and energy management systems such as demand-response control, and this marked an early case of smart cities in Japan. In recent years, METI is promoting initiatives of Mobility as a Service (MaaS) as a part of its efforts in smart city initiatives.

## Digital Agency

Digital Agency is a new ministry established in September 2021 as a result of COVID-19 pandemics, and it aimed at boosting Japan's digitalization at par with more digitally advanced countries like Singapore and South Korea. A considerable portion of its staff members are recruited from the private sector while some others are from MIC and METI. Due to its short history, the agency has not shown remarkable accomplishments and has been involved in the challenges of integration of the My Number with existing data repositories. It is gradually being recognized as the center of digital transformation of the society and government's contact of accepting and handling the complaints on negative impacts of digitalization and the links of My Number systems with other systems.

## Appendix C: Details of Grants under DIGIDEN Schemes

Top layer	Types		Maximum grant per project	Subsidy proportion	Results of FY 2022	
	Middle layer	Bottom layer			# projects granted	Sum of subsidies
Regional revitalization type	Advanced models	Head runners	USD 2 million	1/2	30	USD 32 million
		Employment of existing solutions	USD 0.7 million	1/2	1573	USD 337 million
		Society 5.0	USD 2 million	1/2	26	USD 8.7 million
	Professional personnel			1/2	43	USD 8.7 million
	Promotion of relocation of residents and start-ups			1/2	110	USD 29 million
	Development of bases for regional revitalization			1/2	250	USD 262 million
Digital implementation type	Type 1: Embracing good model practices		USD 0.7 million	1/2	1687	USD 152 million
	Type 2: Utilization of data integration platform		USD 1.4 million	1/2	24	USD 17 million
	Type 3: Sophisticated use of My Number cards		USD 4 million	2/3	8	USD 12 million
	Creation of example for deployment in use of My Number cards		USD 2 million	10/10	52	USD 58 million
	Teleworker attraction for regional revitalization			3/4	63	USD 14 million
Development of footage for regional revitalization			USD 10 million	1/2	119	USD 143 million
TOTAL						USD 1,075 million

# Appendix D: Case Studies of Smart Cities in Japan

Four cities are selected out of many smart cities in Japan, as cases that correspond to different stages of Japan's smart city initiatives and that address particular social issues that Japan has been facing. (i) Kashiwanoha stands out as a pioneer in energy-oriented smart city development, highlighting the importance of urban resilience in the face of natural disasters or disruptions. (ii) Toyama City implementation of the "Compact City" policy addresses prevalent issues such as aging populations and diminishing public transportation services that are common across Japanese cities. (iii) Kibichuo Town's innovative use of personal information in emergency medical services showcases the benefits of data sharing and integration in building smart cities. (iv) Asahimachi's initiative of mobility services for elderly residents emphasizes the importance of involving a wide range of stakeholders, including the private sector and the communities, in the development of a smart city.

FIGURE D.1: LOCATIONS OF CASE CITIES



## Case 1: Kashiwanoha, Chiba Prefecture

City	Initiative	Scale	Project area	Project area population	Sector	Launch year
Kashiwa City	Private sector-led	Neighborhood	300 hectares	26,000 (Planned population) 11,600 (Actual in 2021)	Energy	2009

<b>Issues</b>	An urgent need for stable and minimum supply of electricity during disaster or in the event of a main grid failure.
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<b>Project concept</b>	<p>This project stands as a pioneering model for smart cities, with a rich developmental history and a comprehensive approach encompassing various aspects over its decade long journey. In its early stages, it endured the East Japan Great Earthquake and the subsequent energy crisis, leading the way in establishing an energy sustainable smart city equipped with self-contained energy systems and an early adoption of area energy management systems. This served as a blueprint for disaster resilient cities and neighborhoods.</p> <p>Following the establishment of its energy-oriented infrastructure, Kashiwanoha embraced the concepts of becoming a startup hub and fostering health-conscious neighborhoods, leveraging personal health data, wearable devices, and healthcare facilities. However, in this case study, emphasis is placed on the energy-oriented aspects to underscore its position as a leading model in this segment of smart cities.</p>
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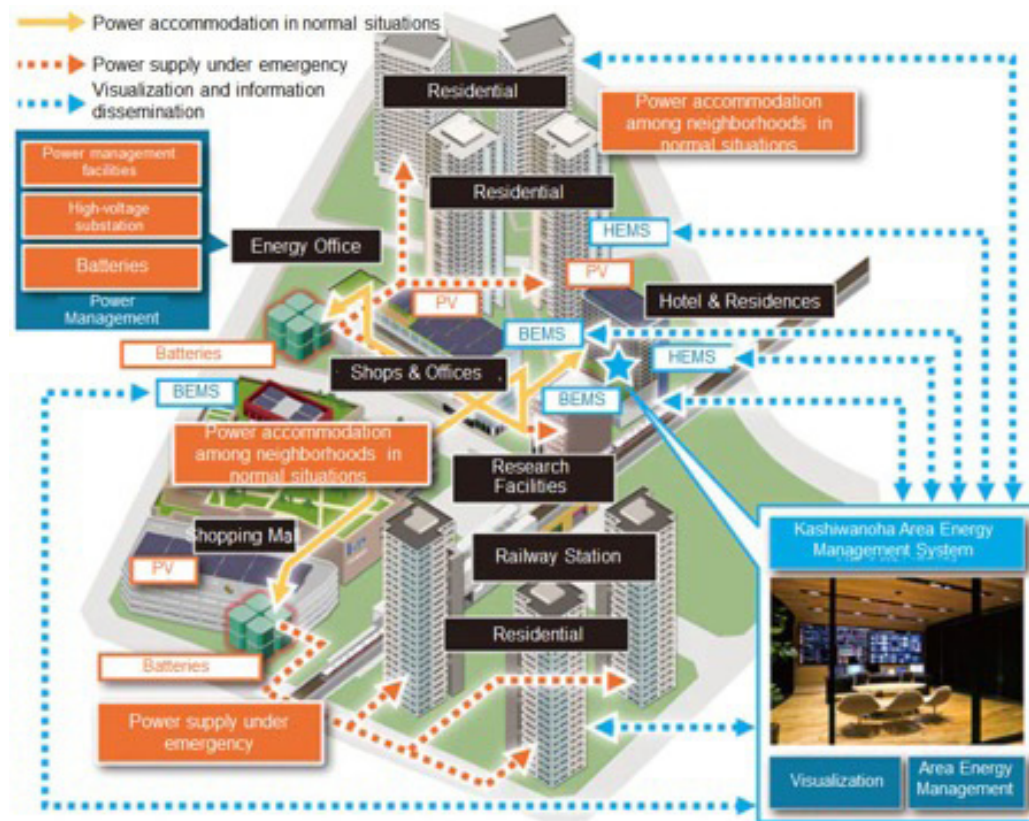
## Case 1: Kashiwanoha, Chiba Prefecture, continued

<b>Project concept, continued</b>	<p>Kashiwanoha is renowned for its area management organization known as the Urban Design Center Kashiwanoha (UDCK). This center serves both as an organization and a physical facility, comprising representatives from Mitsui Fudosan, Tokyo University (which has its Kashiwa Campus nearby), Kashiwa City, and local industries. UDCK functions as a permanent entity for deliberating and determining the direction of community development, guided by professional input from university space design professors.</p> <p>Similar Urban Design Centers, numbering over twenty, have been established across Japan. These centers foster collaboration among public entities, academia, industry, and residents, aiming to further enhance community development</p>
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<b>Description</b>	<p>The Kashiwanoha area, situated on the north-western edge of Kashiwa City, emerged as a model of innovation in sustainable urban development. Owned and financed by Mitsui Fudosan, a major real estate company, Kashiwanoha represents a private-owned greenfield project that transformed a former golf course into a thriving urban community. It stands as a testament to the successful fusion of private enterprise, municipal collaboration, and cutting-edge technology.</p> <p>"Local Production and Local Consumption" of energy: The defining feature of Kashiwanoha's sustainability model is its commitment to "local production and local consumption" of energy. Kashiwanoha pioneered a self-sustained energy supply system. Renewable energy sources, including photovoltaics, fuel cells, and batteries, were employed to ensure a continuous and reliable power supply. The area's energy infrastructure is connected to the main grid under normal conditions, but it would seamlessly transition into an independent system during grid blackouts.</p> <p><b>Regulatory and technological innovations:</b> The implementation of a self-contained private grid and its connection to the wider grid required ground-breaking changes in regulatory frameworks. Deregulation of the Electricity Business Act was essential for the project's success. Moreover, cutting-edge technologies deployed in the private grid underwent rigorous testing to ensure safety and stability, establishing a new benchmark in urban energy management.</p> <p>At the heart of Kashiwanoha's energy management is the Area Energy Management System (AEMS) (figure D.2). The central area—featuring a diverse mix of amenities such as shopping malls, high rise residential condos, hotels, commercial buildings, and academic facilities—is seamlessly connected through a private grid. In normal conditions, power generated by rooftop PVs serves the area's energy needs. When emergencies like external power supply disruptions happen, stored energy in batteries would be efficiently distributed through the closed private grid. A Smart Center, being Kashiwanoha's operational and coordination center, visually displays the real-time status of the AEMS, ensuring effective energy management and resilience during unforeseen events.</p> <p>The home energy management system (HEMS) was installed in most of the dwelling units of the newly built high-rise condominiums. A key feature of the HEMS was to display energy consumption by households, sensitizing residents about their energy use and encouraging them to adopt energy saving behaviors. This ahead-of-its-time initiative signifies the importance of leveraging data and digital infrastructure, two of the four building blocks of digital transformation discussed in Chapter 2.</p>
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FIGURE D.2: STRUCTURE OF KASHIWANOHA AREA ENERGY MANAGEMENT SYSTEM



Case 2: Toyama City, Toyama Prefecture

City	Initiative	Scale	Project area	Project area population	Sector	Launch year
Toyama City	Municipality-led	Suburban area of the city	12,000 km <sup>2</sup>	410,000	Transport	2005

**Issues** The dispersed population in the suburban areas has resulted in difficulties in maintaining public transportation due to insufficient ridership.

**Project concept** Toyama City is chosen due to its remarkable success in promoting the “Compact City” concept and policy. While the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) advocated for the compact city policy and selected several model cities, the tangible realization of this concept is most evident in Toyama City. This achievement stems from the implementation of clear and robust policies from the outset, coupled with the persistent continuation of these policies under the strong leadership of the mayor.

The challenge of aging population and declining population is a pervasive issue faced by cities and towns of all sizes. Despite being the largest city in Toyama Prefecture, Toyama City has not been immune to this phenomenon. One of the primary challenges associated with an aging and dwindling population is the shutdown of public transportation services due to declining ridership. However, Toyama City has succeeded in consolidating scattered residents into designated hub areas, addressing this issue effectively.

The case is a demonstration of smart planning strategies in responding to the city’s evolving conditions, complemented by technological solutions.

Case 2: Toyama City, Toyama Prefecture, continued

**Description**

As the capital city of its prefecture, Toyama stands as a testament to the transformative power of smart urban development strategies.

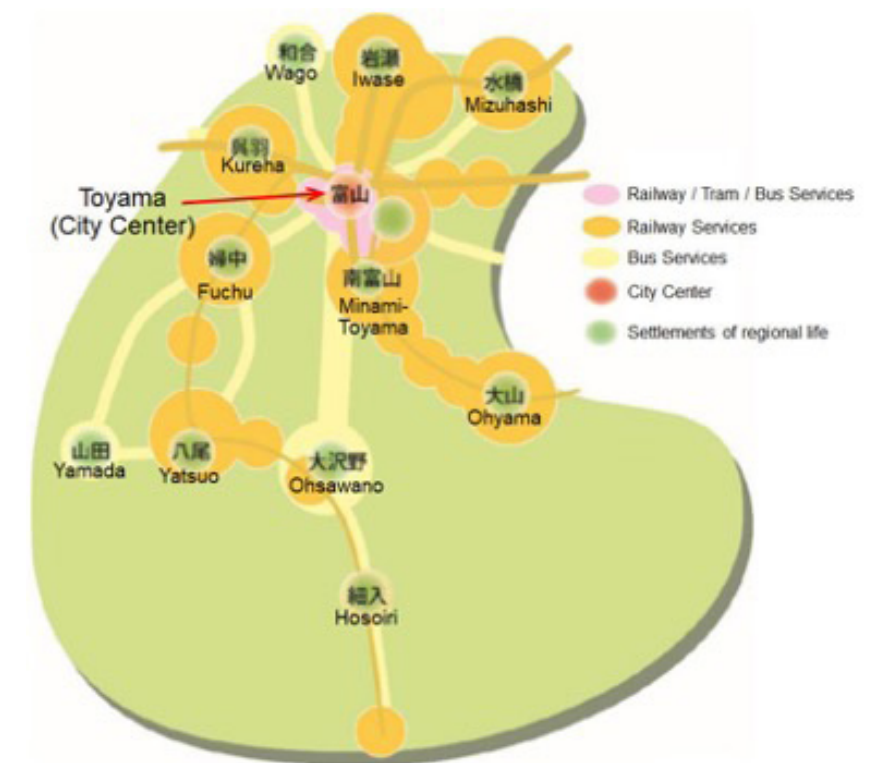
**Smart squeezing of urban sprawl:** With a history of remarkable growth, the city underwent a six-fold expansion, expanding from 210 square kilometers to a sprawling 1,240 square kilometers by 2005. In response to the city’s expansion during the economic growth era, Toyama adopted the “Smart Squeezing” approach. Public facilities were strategically relocated to designated “Inhabitation Promotion Areas,” incentivizing residents to relocate from rural regions. This initiative saw the proportion of the whole city’s population living in those promotion areas rise from 28% in 2005 to a 38.8% in 2019. It successfully curtailed urban sprawl while fostering sustainable community growth.

**Public transport network and “dumpling and sticks”:** Recognizing the importance of connectivity, Toyama invested in a public transportation network linking core areas (see Figure D3). Under the leadership of former Mayor Mr. Mori, the city embarked on the “Dumpling and Sticks” initiative. This initiative aimed to concentrate the regional population and enhance connectivity through an improved public transportation network, encouraging elderly citizens to explore outdoor spaces. It also encouraged elderly citizens to explore outdoor spaces by introducing elderly friendly coaches with low floors. These efforts not only improved the convenience of living for residents in core areas but also aligned with the national policy of “Compact plus Network,” utilizing financial support programs from the MLIT.

In 2014, Toyama City was selected as one of the 100 Resilient Cities by the Rockefeller Foundation. That same year, the city hosted OECD’s International Roundtable for Cities titled “Resilient Cities in Ageing Societies.” These recognitions demonstrated Toyama’s commitment to addressing urban challenges. Toyama embodies key characteristic of Japanese smart city development under Stage 3 (chapter 5), where it significantly focused on using data to enhance municipal efficiency and address societal issues.

After Toyama City accomplished its success in the compact city policy, the city continued its smart city efforts, focusing on the utilization of personal data with distributed sensors and wireless network. While this approach is common in many of smart city projects in Japan and abroad, Toyama City’s case serves to showcase how smart planning policies can effectively resolve specific urban challenges without excessive reliance on technological.

FIGURE D.3: THE CONCEPT OF “DUMPLINGS AND STICKS” IN TOYAMA CITY



### Case 3: Kibichuo Town, Okayama prefecture

City	Initiative	Scale	Project area	Project area population	Sector	Launch year
Kibichuo Town	Super City Nomination	Town	270 km <sup>2</sup>	12,000	Health	2022

**Issues** Difficulty in providing emergency medical care due to limited use of ICT and prohibitive regulations.

**Project concept** This is an example of the evolution toward a future society, where the utilization of personal information has paved the way for a new paradigm in emergency medical services, an achievement not attainable under the current regulations. Furthermore, it illustrates the effects and advantages of personal information sharing within the medical services network, an idea that may seem straightforward in theory but proves challenging in practice due to the complex laws and regulations, especially in this field. The case study demonstrates the efficacy of seamlessly integrating stakeholders from diverse domains and establishing a platform for data sharing.

**Description** In the realm of smart city initiatives, it is frequently noted that existing regulations pose significant challenges. Spearheaded by the Secretariat for National Strategic Special Zone in the Cabinet Office, the Super City Initiative<sup>a</sup> is dedicated to overcoming these obstacles by streamlining regulations and modernizing norms. Among the chosen Super Cities, one particularly innovative proposal stands out, uniting the efforts of multiple municipalities, including Kibichuo Town, Kaga City, and Chino City, to focus on enhancing healthcare services through a number of measures.

**Digitization of medical records:** Kibichuo Town's Super City Initiative started with the digitization of medical records, a shift from traditional paper-based systems to cutting-edge ICT solutions. The digitization lays the foundation for a seamless, data-driven approach to handling medical records, ensuring efficiency and accessibility in emergency situations. For example, ambulance crews can swiftly identify patients and share critical medical information with the designated hospital or clinic. This allows medical professionals to prepare for the incoming patient, potentially saving crucial moments in life-threatening situations (figure D.4. and Table D.1.).

**Collaborative stakeholder engagement:** Engaging a diverse range of stakeholders is a key feature of Kibichuo Town's Super City Initiative. Such collaborative effort involves ambulance crews, who are integral parts of fire stations in Japan, medical professionals from hospitals and clinics, local doctors' organizations, and ICT solution providers. Overcoming the traditions where doctors are not always willing to share medical records, Kibichuo's initiative prioritizes the cooperation necessary for a unified and efficient emergency healthcare system.

**Safeguarding personal data:** Medical data is sensitive and handling of it highlights the paramount importance of data privacy and security. Robust systems have been implemented to ensure that personal data remains confidential and will not be accessed by unauthorized entities. The initiative's emphasis on complying with privacy regulations helps it to gain public trust in the healthcare system.

**A sandbox environment:** The Super City Initiative strategically uses the framework of the National Strategic Special Zone laws, which provides a sandbox environment allowing regulatory adjustments on a pilot basis within designated areas. This enables Kibichuo to test new methodologies and implement innovative changes in emergency healthcare.

**Use of My Number Card:** In this system illustrated below, the My Number Card of the patient plays key role in identifying the patient, retrieving the medical data and other personal data needed from databases differently located. The use of My Number Card has further been enhanced with the subsidy of DIGIDEN "Digital Implementation Type — Type 3: Sophisticated use of My Number Card" granted in April 2023.

These cases exemplify dynamic governance in the digital era and sophisticated use of data, highlighting the key elements of digital transformation as described in Chapter 2.

a. According to the Cabinet Office of Japan, the Super City Initiative aims to realize 2030 future society from citizen's perspectives and with citizen participation by: (i) providing cutting-edge services with data analysis technologies in a wide range of sectors covering all aspects of citizen life (government services, mobility, healthcare, education); (ii) developing urban data platforms that allows multi-sectoral data connection and data sharing; and (iii) promoting comprehensive regulatory reform to enable cutting-edge services. <https://www.chisou.go.jp/tiiki/kokusentoc/english/super-city/index.html>

FIGURE D.4: INFORMATION SHARING SCHEME FOR EMERGENCY MEDICAL CARE



TABLE D.1: HOW THE SYSTEM WORKS

Steps	Actions	Notes
1	Upon arrival, emergency crews check "My Number" card of the patient and identify him/her.	[Deregulation] Access to the card and data by emergency crews.
2	Emergency crews share information on the patient with his or her primary care doctor.	[Significance] Online communication between emergency crews and primary care doctor on the medical data and current status of the patient.
3	Primary doctor instructs specific treatment on the patient to the emergency crews.	[Deregulation] Medical treatment by emergency crews.
4	The primary care doctor shares the medical records of the patient with the doctors of the destination hospital.	[Significance] Doctors of destination hospital are able to learn all the medical records in the past along with the current status of the patient.
5	The doctors of the destination hospital prepare for the acceptance and treatment of the patient.	[Significance] Preparation for the treatment of the patient can be made prior to the arrival of the patient.
6	Carriage of the patient to the destination hospital	

### Case 4: Asahimachi Town, Toyama prefecture

City	Initiative	Scale	Project area	Project area population	Sector	Launch year
Asahimachi Town	DIGIDEN Grantee	Town	227 km <sup>2</sup>	10,500	Transport	2022

**Issues** Unreliable public transportation due to declined ridership and ageing population. People's reduced movement also pose challenges in maintaining lively community, especially with a predominately elderly population.

**Project concept** The case of Asahimachi presents a solution involving personal vehicles and a taxi company. The restoration of mobility services for elderly residents has not only improved their quality of life but has also injected vitality into the community as a whole. This success story should serve as a valuable lesson for readers.



## Case 4: Asahimachi Town, Toyama prefecture, continued

Description	<p>Asahimachi, a town in the east of the Toyama prefecture, has a relatively small population of 10,500 (2022), yet covers a large area along the border with the neighboring Niigata Prefecture. In other words, the town's low population density was considered an obstacle to providing quality public services. In an attempt to address such challenges faced by local communities, Asahi Town has taken various measures to enhance connectivity and revitalize communities through smart city approaches (see an overview in figure D.5.).</p>
	<p><b>System integrator engagement:</b> As a small town, Asahimachi had to grapple with a shortage of ICT expertise. In response, the town has partnered with Hakuodo Inc., a leading advertising agency and event organizer in Japan. Leveraging this collaboration, Hakuodo Inc. provides skilled IT professionals who design user-friendly interfaces for various online services, catering to digitally inexperienced residents. Additionally, the company oversees maintenance to ensure service stability. This partnership with a system integrator has enabled the town to navigate the complexities of technology application in the “Nokkal Asahimachi” project. Tailored digital solutions have been developed for different stakeholders, including a web-based operation management system, a smartphone app for drivers, and a LINE-based reservation function, optimizing accessibility and convenience for users.</p> <p><b>Collaboration with taxi company for mobility services:</b> Typically, taxi companies tend to resist embracing ride-sharing modes. However, Asahi has defied this trend and successfully involved its sole taxi company as a coordinator for mobility services. The town municipality equipped the taxi company with a vehicle allocation system, entrusting it with assigning cars and drivers based on rider requests. In return, the company receives a management fee, fostering a mutually beneficial relationship that supports both community residents and the local taxi service.</p> <p>That is how the “Nokkal Asahimachi” initiative works in practice. Launched in 2019, this initiative synchronizes taxi drivers’ travel plans with residents’ transportation needs. Following a successful 14-month pilot program, the service integrated into Asahi Town’s public transportation network in October 2021, complementing existing community buses. This mobility service has garnered community interest, with 828 individuals utilizing the service between October 2021 and March 2022. This initiative contributes to the vibrancy and community revitalization of Asahi Town.</p> <p><b>Community revitalization:</b> Acknowledging that mobility options alone may not fully encourage elderly residents to venture out, the Nokkal project initiates bilateral support and knowledge sharing between elderly residents and the town’s youth. Younger community members teach the elderly how to use smartphones, while the elderly reciprocate by sharing expertise in agriculture, hand-crafted furniture, environmental issues, and health activities. This intergenerational exchange cultivates a sense of vibrancy and belonging within the community.</p> <p>The Nokkal project in Asahimachi received support through a DIGIDEN Digital Implementation Type 3 grant (see Appendix C) in April 2022, showcasing the government’s proactive approach to leveraging digital transformation benefits for revitalizing small rural towns like Asahimachi. This represents government’s effort under the Stage 4 of Chapter 3, where digital transformation initiatives led by the government are merged with the trajectory of smart city development.</p>

FIGURE D.5: NOKKAL AND PERIPHERAL ACTIVITIES AND SERVICES IN ASAHIMACHI TOWN



## Appendix E: Examples of QII Supported Projects with Digital Components

### Digitization



In Mozambique, the challenges posed by rapid urbanization and a burgeoning population have significantly strained the road corridors in the country’s cities, particularly in the capital city of Maputo. Complex institutional structure, coupled with a deficiency in government capacity, expertise, and resources, created a bottleneck for effort aimed at enhancing the transport infrastructure in Maputo. To address these issues, the QII grant supported the Mozambique Maputo Metropolitan Area Urban Mobility (MAUM) project—P175322, 2022–2027, USD250 million. Focused on improving accessibility for the economically disadvantaged residents of the Maputo Metropolitan Area, MAUM analyzed prevailing road traffic levels, developed a bus rapid transit (BRT) solution, and provided the necessary information to identify congestion and improve accessibility to Maputo’s central business district. Experts from the University of Tokyo also played a technical role in the project by analyzing large amount Call Detail Record (CDR) data from Mozambique’s telecom operator. This big data analysis helped identify bottlenecks along key transport corridors in Maputo.



In Nepal, the Strategic Road Network (SRN) is critical for the mobility of people and goods, providing essential links to neighboring countries amid challenging terrain and climate-related risks. To improve road safety and efficiency, a QII-funded grant supports the World Bank’s Nepal Strategic Road Connectivity and Trade Improvement Project—P170409, 2020–2027, USD450 million—in enhancing the efficiency of planning and managing SRN’s performance and filling crucial information gaps for better management of road corridors. This includes implementing video surveillance for road safety assessments to pinpoint high risk areas and formulating investment plans and maintenance schedules. Furthermore, the initiative pilots an innovative modeling tool for a comprehensive vulnerability assessment of the highway network, making informed and evidence-based investment decisions. The findings from these initiatives will be integrated into Nepal’s evolving Road Asset Management System, laying a foundation for safer and more reliable transport routes.

### Digitization



In India, the QII grant has enhanced World Bank’s National Groundwater Management Improvement Program—P158119, 2019–2025, USD450 million—focusing at reducing rampant overuse of groundwater in the country through participatory groundwater management and the development of a management information system (MIS). In India, significant powers are delegated to local communities, gram panchayats), to plan and implement investments in water resources management. The MIS supports the GPs and key stakeholders in developing data-driven and community-led water security plans (WSPs) by providing templates for local water budgeting and tools and user manuals detailing procedures for the WSPs. Now fully operational across seven partner states, MIS has become critical at various administrative levels, enabling the standardization and systematization of water management plans in digital forms, and advancing sustainable groundwater use throughout the country.



In Côte d'Ivoire, years of political turmoil had severely degraded the country's water supply and sanitation services. The QII grant has supported the Urban Water Supply and Sanitation Project—P156739 and P170502, 2017–2024, USD200 million—which aims to improve the water system's reliability and quality. Key initiatives include:

(i) developing a web-based platform to monitor and evaluate, (ii) formulating a comprehensive water and sanitation strategy, and (iii) training for regulatory staff. The web-based platform integrates features to control the flow of information generated from planning to execution of project activities, provides dashboards to generate greater visibility on the progress of project activities, and allows for better engagement with citizens and beneficiaries. These measures, now integral to a pilot scheme in the country's South Abidjan region, are instrumental in modernizing water management, increasing community involvement, and promoting sustainable hygiene practices through enhanced information flow and visibility of infrastructure projects.



Dhaka, Bangladesh, is one of the fastest growing megacities in the world. However, its rapid growth outstrips the urban infrastructure and services, presenting huge economic and social inclusion challenges. The QII grant for the Dhaka Public Space Sustainability initiative has helped the World Bank's Dhaka City Neighborhood Upgrading Project—P165477, 2019-2024, USD100 million—supporting asset

management and the integration of technology in infrastructure design. Leveraging digital technologies to enhance urban spaces, the project developed several public space audit applications. One mobile application is for real-time monitoring of public space quality and safety, informed by direct user feedback. Another application uses nighttime street level photography to assess public spaces, focusing on design elements like lighting and layout, which influence the public's sense of safety and space usability. These technology-based solutions represent a significant step toward planning and designing the city in an evidence-driven way.

## Digital transformation

These project examples—while mainly anchored in the first two steps of the 3Ds journey of digitization and digitalization—contribute to the evolution toward digital transformation by integrating data, planning, and decision making to reshape the existing way of governance or administration. These initiatives show that the potential of digital technologies and solutions cut across sectors in developing countries. Furthermore, as digital transformation encompasses a broad and evolving range of considerations, the principles advocated by QII—as outlined in Chapter 1—can also be an important guide for effectively steer various digital initiatives toward digital transformation.

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