Department for International Trade Tokyo

Japan Smart Cities

Public and private Smart City activity in Japan and opportunities for UK businesses

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Introduction

- In March 2022 the Department for International Trade Tokyo (DIT) commissioned Cambridge Consultants to produce a report on the state of Smart Cities in Japan.

- The aim of this work is to provide an overview of the current and future status of Smart Cities in Japan and the related application and technology trends, to identify potential opportunities for trade, investment and R&D between UK and Japan.

- This is to enable DIT to better connect British companies to key domestic players so that British companies can join and play an important role in the development of Japan's Smart Cities.

- This report consists of five main sections:

  1. Introduction and overview
     - Smart City definition, Domestic ecosystem, Smart City Reference Architecture, City OS

  2. Key drivers and barriers
     - Drivers, Barriers, Expectations for 2025

  3. Domestic Smart Cities
     - Smart Cities and Super Cities, Application and technology trends, Example cities: Osaka, Kyoto, Fukuoka

  4. Private sector activity
     - Activity by industry for construction, real estate and housing, digital connectivity, financial services and other service and equipment providers

  5. How could UK companies get involved
     - Why should UK companies get involved, Main types of Japan Smart Cities, Perceived benefits and barriers to overcome, Recommended approach and messaging

- This report is the result of primary research in the form of interviews with experts from Japanese local governments, public organisations and commercial entities, supported by secondary research and the viewpoints of experts from Cambridge Consultants. Much of this report is based on opinion and interpretation.

- We would like to thank all the contributors for their valuable insights.

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Executive summary

Current status of the Japan Smart City ecosystem

- Japan is making an investment and concerted push to advance its Smart Cities but it is still at the stage of exploring and testing services and technologies to identify and define which directions the efforts should be directed towards.

- There is no clear definition of a Smart City in Japan but most agree the main purpose of Smart City developments is to use technology to improve citizens' wellbeing and achieve sustainability development goals (SDGs) to help realise Society 5.0, although how this should be achieved varies on a case by case basis. This recent shift from a technology driven approach popularised in the early 2000's to a human centric approach has been led by the Kishida administration.

- Smart City activity in Japan today is fragmented. Most major cities and most large well-known domestic companies with digital technologies and major universities are already engaged in a number of projects. These cities are vertically integrated and mostly siloed. There are also a few industry and public associations working with industry partners and government to define new standards and policies, most notably the Smart City Institute Japan and the Smart City Shared Fab.

- However, the domestic ecosystem is strong with significant backing and support from national government. The Cabinet

| Entity type	Role in Smart City ecosystem
National government	- Sets the national tone and direction, providing the bigger picture - Defines policies and initiatives to drive innovation - Allocates budgets to local governments to help fund projects - Works with industry and the public towards standardisation
Municipal government / Area management E.g. town, city, prefectural government or district / private area management committee	- Responsible for their own Smart City, setting the framework, developing the future vision and driving principles for the area - Identifies the social issues to be solved for the area - Responsible for collecting and providing open city data to service providers - Work with other partners to develop and implement solutions - Promotes collaboration between citizens and corporations
Private companies and universities E.g. technology companies, utility providers	- Develop or customise (technology) solutions to address identified social issues - Find and manage the right partners for local government
Industry and public associations E.g. Smart City Implementation Consortium, Smart City Institute	- Works with industry partners and government to define new standards and policies - Promotes Smart Cities activities and provides a network for connecting potential partners

Office, MLIT, METI, MIC and Digital Agency (DA) are especially relevant. It is expected that the role of the DA in driving and developing standards for Smart Cities will increase in the next few years.

- The most wide reaching platform for collaboration is the Smart City Public-Private Partnership (PPP) platform, with nearly 1000 members to date. All known public-led domestic Smart Cities make use of this platform to engage the private sector for projects.

City OS and the Smart City Architecture

- A "City Operating System" (City OS) is seen as a common element needed in all Smart Cities. It is the data management and/or data linkage platform. The framework for what a City OS needs is provided by government as part of the Smart City Reference Architecture, a recently published guide on how domestic Smart Cities should be planned, run and managed.

- However, most Smart Cities have so far been developing independently of the City OS and Reference Architecture guidelines. While some intend to align its efforts with these guideline in the future, it is expected that only new efforts will adhere to these guidelines. Service providers will not benefit from scalability between domestic Smart Cities for quite some time.

Overall picture of Smart City Reference Architecture: Components for Smart Cities
Source: Adapted from link
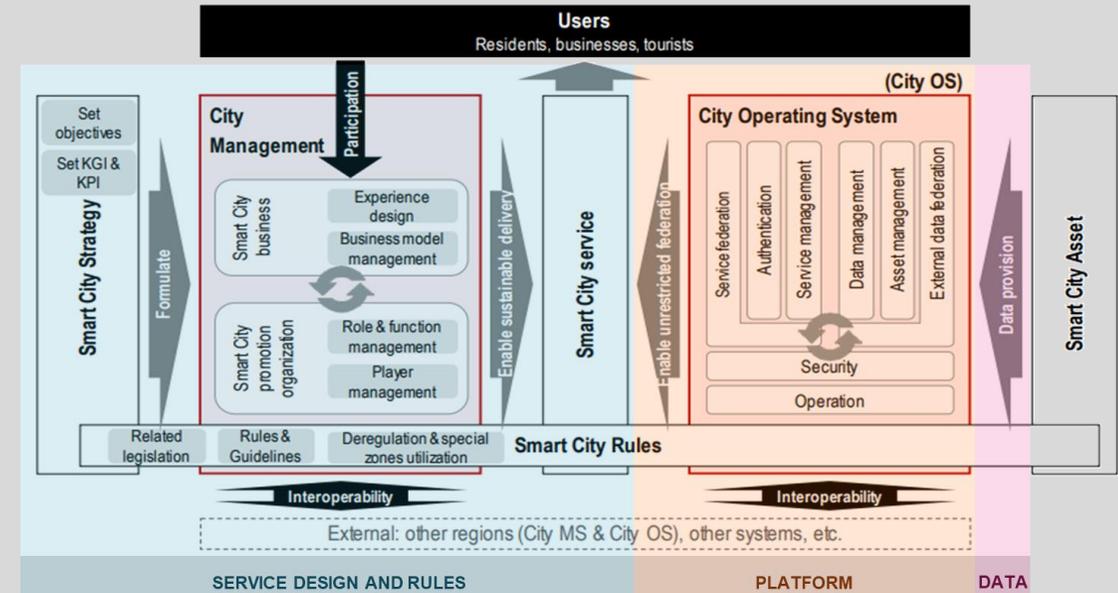
Types of Smart Cities

PUBLIC-LED / ADMINISTRATION-LED SMART CITIES

Activities are initiated by municipal governments who will be responsible for creating or overseeing the development plan.

Uses the public-private partnership model.

Takes the government-promoted human-centric approach by first identifying the social agenda/issue, then identifying the technology solution from anywhere in the world.

PRIVATE-LED / AREA-MANAGEMENT TYPE SMART CITIES AND SMART AREAS

Activities are initiated by one of:
1. Private company
2. Real estate company

These frame their activities in the same human-centric approach as public-led Smart Cities but the activity is also often driven by the desire to add value to a property development. Technologies and smart solutions are developed and implemented on a project-by-project basis.

Key drivers and barriers

- Japanese government has been a major driver for today's Smart City activity. Some prominent government initiatives include the Smart City Reference Architecture and the City OS. These provide a conceptual framework for all domestic activities. They focus on fundamental principles for how to set up a vision and organise for success, and what needs to be in place for a digital platform to enable city services and brokering of data.

- Another key public-sector driver is the Super City initiative. Among the 100 or so "Smart Cities" in Japan, there are around 20 that can be considered to be leading Smart Cities, with Osaka and Tsukuba being appointed Japan's first "Super Cities" in 2022. These Super Cities are undertaking or plan to undertake a much greater range and depth of developments than other Smart Cities. They are also intended to act as a test bed for deregulation policies that enable Smart City applications. In the case of Osaka, there is a strong focus on digital transformation (DX) related

developments, including the country's first wide area data integration platform for data integration across the prefecture, ORDEN.

- COVID-19, an aging population, sustainability and SDGs are major macro drivers. Other key drivers and barriers can be found on the next page, with more details in Section 2.

- The biggest fundamental barrier to progress across private and public sectors is that there is as yet no clear understanding of what applications and services should be developed. Many ideas are currently being tested, mostly at proof of concept (PoC) or demonstration stage. Commercially sustainable and truly valuable Smart City solutions that address real societal needs have yet to be identified, although pockets of success do exist for specific solutions, especially natural disaster-related solutions.

Application and technology trends in government-led Smart Cities

- Smart Cities are applications driven, not technology driven. They focus on solving societal problems. All projects and activities are linked back to improving citizens' quality of life (QoL), although there are some specific manifestations of this which is provided below.

- The most popular technology focus areas according to interviewees are also provided below. However, these are all quite high level with no specific technology focus within each technology area.

- The lack of specific technology focus is in part due to the fact Japan Smart Cities are at the demo / PoC stage, so efforts are wide ranging. No set of technologies have been identified as being key to successes in Smart Cities, other than those relating to DX and the "City OS", and autonomous vehicles / robotics to a lesser degree.

Key drivers and barriers to Smart City developments
(See Section 2 for more details)

DRIVERS

PUBLIC SECTOR DRIVERS
National government
- Society 5.0
- Digital Garden City
- PPP platform
- Super City initiatives
- General drive for standardisation

Local government
- Local government (mostly drive all local developments themselves)
- Aggregation of local services to reduce costs

PRIVATE SECTOR DRIVERS
- Potential for new business generation
- Opportunity to help society (Corporate Social Responsibility)
- Professional consortiums
- FIWARE development

SOCIETAL AND OTHER DRIVERS
- COVID-19 pandemic
- Users
- Aging population
- Rural regeneration
- Sustainability and SDG targets 2030
- Osaka World Expo 2025

BARRIERS

PUBLIC SECTOR BARRIERS
National government
- No clear direction
- Bureaucratic red tape and silos
- Hard to deregulate data privacy

Local government
- Difficult to know what to invest in
- Difficult to get citizen buy-in, participation and social acceptance

PRIVATE SECTOR BARRIERS
Commercial challenges
- Not a profitable market
- Limited funds from municipal governments
- Difficult to monetize small PoCs and single solutions
- Hard to move past PoC
- Unclear what application will succeed

Practical challenges
- Hard to penetrate small-scale municipalities and area management groups
- Data availability
- Data privacy
- Application specific deregulation
- Inefficient technology development
- Few IoT platform providers

Top Smart City application and technology focus areas
(See Section 3 for more details)

Top applications

The most prominent application area uniformly mentioned in all Smart Cities is Quality of Life (QoL) applications, especially:

Wellbeing and health	Mobility and MaaS*	Elderly QoL

Disaster management / resilience	Digital transformation (DX)	Sustainability / decarbonisation

Most common societal issues being addressed:

Decrease in working population	Regional rejuvenation / attracting visitors and MICE** events

*Mobility as a service ** Meetings, Incentives, Conferences and Exhibitions

TOP SMART CITY FOCUS AREAS

Top technologies

The focus of Smart Cities in Japan today is on solving societal problems to improve the wellbeing and QoL of citizens, and not on any specific technology. They are application driven and not technology driven, and any technology can be used. That being said, a few important technology foci common to many Japan's Smart Cities and most commonly cited are:

Digital platform and cloud technology	DX operational technologies, including 5G/6G	Data collection, including IoT, sensing

Data analytics and AI, including digital twins	Autonomous vehicles and robotics

Expectations for 2025

- By 2025 many expect data privacy regulations to loosen, there to be more digital standards and more cities with City OS. A convergence in applications and technologies is expected but which ones will become most relevant to Japan's Smart Cities will depend on how the various PoC and Super City projects progress.

- Digital platform and cloud related operational technologies like servers and data storage, including 5G / 6G, are expected to become more important as more Smart Cities move from PoC to implementation and deployment of new services (see Section 2 for more details).

Expectations for 2025

- Data privacy regulations will loosen

- More standards

- Few projects, fewer applications, more deployments and larger scale implementations

- More cities with City OS

- More interest in DX implementation related technologies

- 5G to become more widespread with a race to 6G technology well underway

- More widespread use of advanced technologies

- No real change for small local governments or how they operate, other than some incremental advances in digitising systems and data

Surveyed Smart Cities and industry sectors

- The following pages provide a brief overview of the key insights and opportunities for UK for the

  – Three Japan Smart Cities:

Fukuoka Directive Council (FDC)	**Kyoto Prefecture**	**Osaka Prefecture**

  – And five industry sectors:
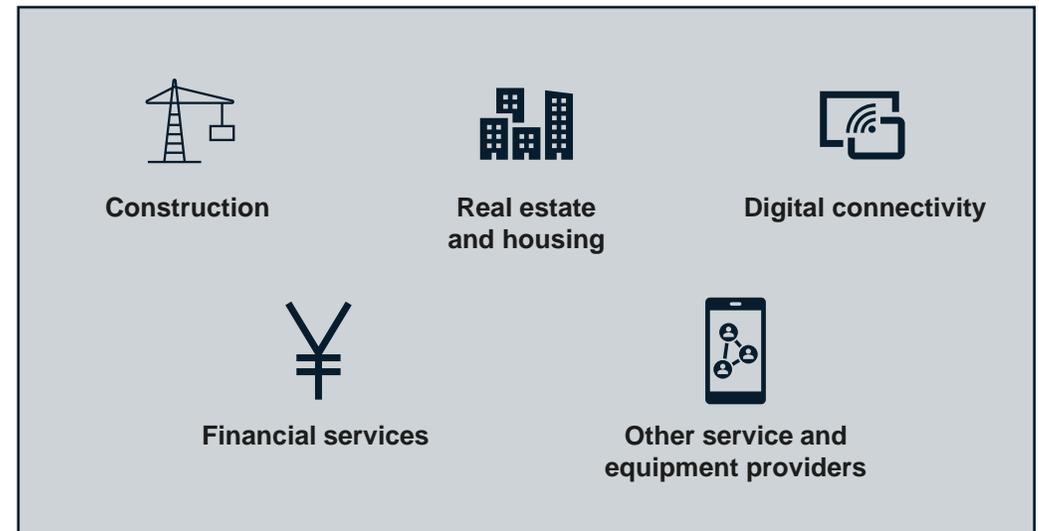
Construction	Real estate and housing	Digital connectivity
Financial services	**Other service and equipment providers**	

Top Smart City application and technology focus areas
(See Section 3 for more details)

Fukuoka D.C.

- Strong interest in startups, which may be relevant to UK companies looking to establish presence in Japan.
- May not be the best fit for UK companies looking to develop large scale DX solutions.
  - Application and technology areas appear broad ranging but there is only a relatively few small-scale projects touching on one or more areas, limited to specific solutions. No evidence of solutions moving past trials.
  - FDC has different levels of ambition, resources and power than Osaka and Kyoto municipal governments.
  - Core focus to date has been primarily on improving the area in general, not limited to the application of advanced technologies.
  - Recently began running a few small pilot projects on data utilisation, but believes any data platform should be publicly owned.
- May be easier and more efficient for UK companies to work with private companies with existing relationships with FDC rather than approaching FDC directly.

京都府 Kyoto prefecture

- Essentially using science and technology at a city scale, primarily to improve the health and wellbeing of all citizens, especially QoL of the elderly.
- Takes a much more science and research driven approach than other Smart Cities, due to its history as a "Science City"; very experienced at working with University and research groups and provides a strong ecosystem for research.
- Open to being directly approached by companies and willing to actively support demos and trials, although it will be the responsibility of the solution provider to determine a business model that generates revenue.
- For UK companies, the Keihanna membership scheme and the Kyoto Big Data Utilisation Platform makes it an interesting city for companies looking to make use of citizen data and/or access to various basic open data.
- Potential opportunity for digital education solution providers given its focus on educating citizens to help improve their QoL, especially for the elderly and children with developmental disorders.
- Very interested in hearing about relevant case studies, especially ways to encourage citizens to participate in projects and share personal data.

大阪府 Osaka Prefectural Government

- Osaka is a key test bed Smart City / Super City in Japan. A UK partnership project with Osaka City in particular could act as a strong promotor for more UK-Japan partnerships.
- Wide range of project application areas, all with a strong focus on ICT technology.
- More ambitious than others when it comes to DX technologies it is willing to support, e.g. it is developing the country's first wide area data integration platform called ORDEN.
- Demonstrated more experience at working with the private sector than other cities.
- However as with other Smart Cities, while UK companies are welcomed, there is little evidence of existing partnerships with companies outside of Japan so there may be challenges if approaching the local government directly.
- Best route to collaboration would be through working with a private sector partner who is already in the Osaka Smart City Partner Forum (OSPF)

Industry challenges and opportunities for UK by industry sector
(See Section 4 for more details)

Construction

- Struggling the most to identify products and services that offer value to citizens or customers, and would lead to revenue and profit.
- Carbon neutrality is a big theme – looking for partners, want UK companies to bring their experience around carbon reduction regulations in Europe, think Europe is more experienced and more advanced in relevant technologies and approaches.
- Want partners with good visions of what they could do with their technologies. Interested in learning about service development and how to add value to the main construction business.
- In particular, need help with understanding how to get / deliver value with advanced technologies. Building sustainable businesses around AI would be especially interesting.
- Does not need help with technology development.

Real estate and housing

- Similar to construction, companies feel there is no clear answer to a sustainable business offering within Smart Cities for real estate and housing.
- Points of view and approaches being used across Japan vary widely. Industry is still in the information gathering phase to decide what to do.
- Looking at open innovation, sees no barrier to working with UK companies and sees UK as a good source of startups.
- Sees governance and regulations as where UK could contribute experience and expertise, especially in defining incentives and roles for different types of partners and informing on international certifications and standards.
- Interested in knowing about foreign Smart Cities that can act as models for Japan Smart Cities, especially examples of sustainable development of DX solutions

Digital connectivity

- Services have been developing for decades, yet these are still evolving and no Smart Cities "killer app" has been identified.
- Struggling to drive adoption by citizens and local governments.
- Greatest challenge is the need for deregulation and reform around data privacy.
- Technologies urgently needed now:
  – Secure data storage and (large volume) data transfer technologies, data translation services and authentication delivery functions.
  – Also security technology for authentication and opt-in for data sharing.
- At this stage any UK companies with relevant experience in relevant technologies such as data / data integration platforms and security technologies, especially international regulations, standards and systems like FIWARE, including deregulation policies, would be of interest to all major domestic players in this industry.

Financial services

- Struggles to find social issues that can be solved by financial services; improving QoL through using financial data is challenging.
- Rely on partners for technology development.
- Limited opportunities for UK companies. Developments are still early stage and not at the point of discussing concrete initiatives with foreign companies.
- Require people who are familiar with banking laws in Japan, and can advise on how to lobby for deregulation in this environment.
- Many banks are not interested in expanding their service overseas, more interested in improving current domestic services. E.g. Information Banking is considered to be a uniquely Japanese approach and cannot be easily deployed overseas.
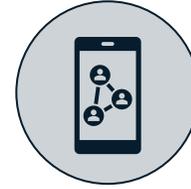
Other service and equipment providers

- For many technology and service providers, it is too difficult and inefficient to target municipalities directly. Difficult to generate revenue.
- Data and platforms are not standardised, meaning lots of data clean up and service / system customisation is needed.
- Many local governments and local businesses, schools, etc. are behind or are still not digitally native, so data acquisition for services that rely on this data can be a challenge. Companies sometimes have to co-invest to help establish the necessary infrastructure to enable their solutions.
- As with other industries, there is a general challenge around companies trying to tackle Smart City problems in a way that aligns with its existing capabilities, profitably. Traditional hardware providers are struggling to identify successful service models.
- Companies are open to working with UK companies, especially those with commercially successful Smart City deployments outside of Japan.

Why should UK companies get involved

- There are many reasons why entering Japan's Smart City ecosystem could be an attractive option for relevant UK companies but more work is needed to communicate and promote UK Smart City capabilities.

- There are already around 100 Smart Cities in Japan and most major domestic companies are already working in this space, which presents a wide range of potential customers and partners.

- Unlike some nations, Japan's telecommunications network, essential to many Smart City solutions, is one of the most advanced and reliable in the world.

- The country presents a unique opportunity for companies developing disaster-related technologies. It is located in the Pacific "Ring of Fire", a region characterized by severe seismic activity which translates into earthquakes, tsunamis, volcanoes, flooding, etc. With the recent COVID-19 pandemic, disease control is now also part of many cities' list of concerns.

- Another advantage is that Japan is already aware Europe is more advanced in making policy and regulations for Smart City developments. It is widely believed that international partnerships is key to helping private and public sector identify solutions that are valuable to citizens and businesses.

- Both the public and private sectors see UK companies and public bodies as a potential source of inspiration and co-creation partners. UK companies with successful solutions in UK Smart Cities such as London, Manchester, Bristol, Glasgow, etc., as well as others outside of the UK, would be welcomed by both the private and public sectors in Japan, for local trials and business opportunities. Ideas on how to deregulate for valuable Smart City services and how to get citizen buy are also articulated needs.

How should UK companies get involved

- UK companies will find it easier to enter the ecosystem by targeting private companies, given the complex and fragmented ecosystem and the preference for municipal governments to work with Japanese companies.

- Where possible, UK companies are advised to do business with companies who are already investing in Smart City developments and are already part of Japan's ecosystem, especially companies that own the problem to be solved. Large companies have the resources to buy or invest in technologies and services, unlike government. These companies will provide the connections to municipal governments where necessary, and act as a go-between. Some will have the political influence to drive real change within the ecosystem.

- A key barrier that needs to be overcome is the language barrier, especially for UK companies looking to work directly with municipal governments. This has been done successfully in the past but native language speakers or translators are a must in these circumstances.

- Companies should explain where its solution(s) would sit within the Smart City Reference Architecture and City OS. It will also be helpful to Japanese organisations if relevant government initiatives, such as those listed in this report, can be referenced as well.

- If a specific city is the intended target, it is important to become familiar with the city's Smart City development plans and administrative structure, e.g. working groups, to make sure the solution being offered fits with the city needs and identify what existing partners or competitors may already exist. In some cases these companies may provide an easier route in than approaching the municipal government or working groups directly.

- Finally, be prepared that in entering the ecosystem at this point in time, it may be necessary to borne some or all of the costs for demos and trials, and some investment may be needed to support implementation work. It may take some time before sizeable returns can be realised if the right commercial customer cannot be identified. However, a successful trial in a major city, especially ones like Osaka Super City and Woven would open the door to significant business potential in other domestic cities.

Why now

- Ultimately, Japan's Smart Cities are somewhat lagging behind the most advanced Smart Cities in the world like London. Right now there are many domestic players and activities are modest in scale. However, Japan's ambition is to be a world leader in Smart Cities.

- Now is a great time to get involved because Japan is taking DX more seriously, with more investment from national government, municipal government and the private sector. Significant progress is expected in the next few years, especially in digital GovTech, CivicTech and City OS type systems.

- The opportunity today exists to be involved from the ground up in defining new policies and regulations that will impact Smart City technologies for years to come. Now is the time for companies to support the ideation of valuable applications, not just in delivering technology solutions.

1. Introduction and overview
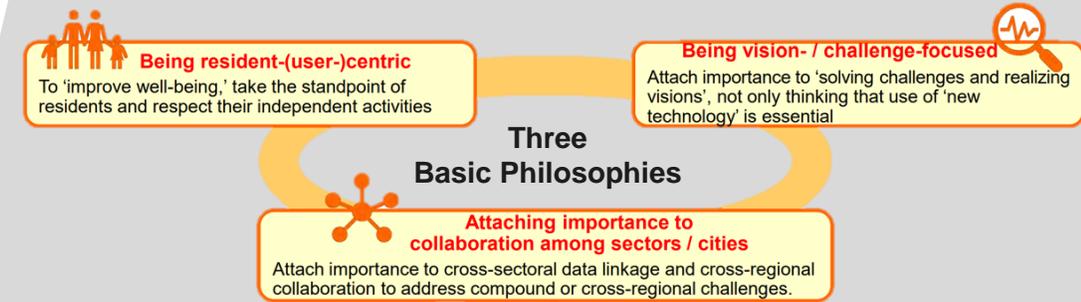
Smart City definition

Domestic ecosystem

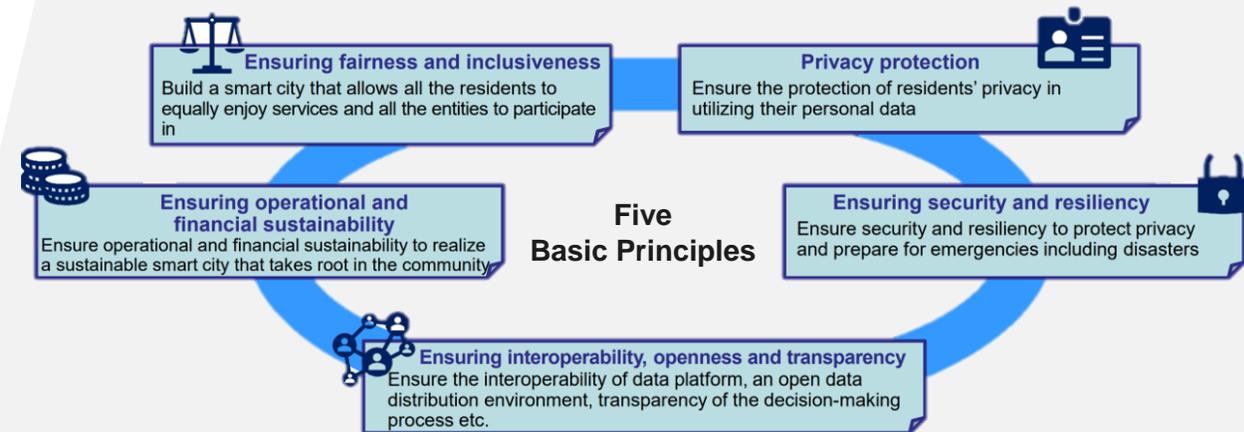Smart City Reference Architecture

City OS

Japan has guiding principles for its Smart Cities but no clear definition

- There has been a recent boom in Smart City developments in Japan. Many local governments, universities and companies have announced and promoted a wide range of projects and development plans. There are also several new private and public organisations that have been formed to direct and support these activities.

- The new Smart City Guidebook which was published jointly by the Cabinet Office, Ministry of Internal Affairs and Communications (MIC), Ministry of Economy, Trade and Industry (METI) and Ministry of Land, Infrastructure, Transport and Tourism (MLIT) in April 2021 provides the framework for Japan's Smart City activities today.

- The Guidebook provides a broad definition of Smart Cities. It should be based on three basic philosophies and five basic principles (see right images). A literary definition commonly cited by government is provided on the next page.

- These guidelines are relatively high level and broad sweeping. There is a notable absence of specific measures to define what makes a city (or area development) "smart".

Being resident-(user-)centric
To 'improve well-being,' take the standpoint of residents and respect their independent activities

Being vision- / challenge-focused
Attach importance to 'solving challenges and realizing visions', not only thinking that use of 'new technology' is essential

Three Basic Philosophies

Attaching importance to collaboration among sectors / cities
Attach importance to cross-sectoral data linkage and cross-regional collaboration to address compound or cross-regional challenges.

Three Basic Philosophies of Japan Smart Cities
Source: Smart City Guidebook

Ensuring fairness and inclusiveness
Build a smart city that allows all the residents to equally enjoy services and all the entities to participate in

Privacy protection
Ensure the protection of residents' privacy in utilizing their personal data

Ensuring operational and financial sustainability
Ensure operational and financial sustainability to realize a sustainable smart city that takes root in the community

Five Basic Principles

Ensuring security and resiliency
Ensure security and resiliency to protect privacy and prepare for emergencies including disasters

Ensuring interoperability, openness and transparency
Ensure the interoperability of data platform, an open data distribution environment, transparency of the decision-making process etc.

Five Basic Principles of Japan Smart Cities
Source: Smart City Guidebook

One definition of "Smart City" promoted by the public sector is:

"**A holistically optimized, sustainable city or district where management (planning, building-up, management / operation, etc.) is executed leveraging such advanced technologies as ICT* for the resolutions of various issues of the city**"

Ministry of Land, Infrastructure, Transport and Tourism

- This definition is relatively well-publicised by the government. However based on our interviews, many private and public organisations feel there is still a great deal of ambiguity and room for interpretation in the details of what makes a Smart City.

- Many are still determining what specific activities this could entail. Private businesses, especially in the finance and construction industries, struggle to truly innovate within this space.

- A key point to note is that the term "Smart City" may refer to a city, district, region, prefecture, or any other municipal level within Japan. Private developments are sometimes known as "Smart Areas", although this is usually considered a subset of domestic Smart Cities. In this report, Smart City will be used as the generic term to encompass all types of developments unless specified otherwise.

*Information and Communications Technology

Despite the ambiguity in the definition of a Smart City, all agree the main vision and purpose of Smart City developments should be citizen-led, using technology to improve citizens' wellbeing and realise Society 5.0. How this should be achieved varies on a case by case basis.

- Despite the lack of clarity in the definition, both local government and the private sector are clear that the purpose of Smart City developments is to improve the lives of people living in the city (or area), using technology.

- This typically involves improving issues related to healthcare, mobility, the living and / or working environment and disaster resilience.

- Taking societal problems as the starting point for developing solutions instead of starting from advanced technologies and looking for an application area –i.e. "technology push", which was popularised in the early 2000's – is a recent shift in thinking for Japan Smart Cities.

- That being said, technology is still the core component of Smart City solutions. The vast majority of smart city projects focus on or at least relate to ICT or digital technology and digital transformation (DX). However, some take a broader definition to include area improvement initiatives that require very basic or no technology under the umbrella of Smart City developments.

- In addition to improving citizen wellbeing in general, addressing SDGs* is also an important part of most Smart City development plans.

- For rural areas, reinvigorating rural communities and dealing with issues associated with an aging population and aged or limited workforce are also common themes. More details on key application and technology areas is provided in Section 3.

*Sustainable Development Goals

This recent shift from a technology driven approach to a human centric approach has been led by the Kishida administration

- This concept of a Smart City being more about improving citizen wellbeing is a the modern evolution. A problem statement is the starting point, technology is used / developed to solve that problem.
  - In the previous decades, Smart City was about digitising the city and was more technology led. Indeed, applying ICT technology to specific application areas has been main focus for Smart City activity since the early 2000's.
  - While ICT and digital technology is still at the heart of most Smart City initiatives and is the most prominent area that national government is focusing on for policies, regulations and standards, the shift from technology push to starting from a problem statement is an important change.

- A key reason for this shift is the move towards viewing city improvements as being "human centric", which was promoted by the government under the Kishida administration and is embodied by the Digital Garden City initiative (see Section 2 for more information).

- Another potential factor is that it has proven to be difficult to define KPIs* to measure the progress of Smart City projects under the concept of technology-led developments. With the support of the Smart City Institute Japan, there is now a wealth of "Liveability and Well-Being City Indicators" (LWCI), developed to support the Digital Garden City concept.

*Key performance indicators

Framework for measuring wellbeing of citizens
Source: Smart City Institute

Objective liveability indicators
Source: Smart City Institute

Domestic activity today is highly fragmented; most major cities and most large well-known domestic companies with digital technologies are already engaged in a number of projects

- The domestic Smart City ecosystem is fragmented and complex. Given Smart Cities could be at the local district or area development level, city level, prefecture level and national level, it is unsurprising that there are around 100 "smart cities" in Japan (some of which are shown on the next page). However, there are only around 20 that are considered to be leading in the domestic smart city ecosystem. These include:
  - Osaka, Tsukuba, Kyoto, Fukuoka, Tokyo, Yokohama, Woven City (Susona City), Aizuwakamatsu.
    - Note: Woven city by Toyota is exceptional case – it is a privately owned property for Toyota employees by Toyota.
    - More details on Osaka, Kyoto and Fukuoka and the concept of Super Cities are provided in Section 3.

- The ecosystem consists of national government, local government, private area management groups, private companies, universities, industry associations and public associations. The table on the right provides a summary of their respective roles.

- Domestic Smart Cities are vertically integrated. For each Smart City there is typically a steering committee to define the vision for the programme and, especially for larger areas/municipalities, a number of working groups that focus on different application areas. Some or all of these groups will be made up of a mixture of public and private partners. These groups will be entirely responsible for developments for their Smart City. There is typically little or no integration between Smart Cities, although this is starting to change (see Osaka in Section 3).

Entity type	Role in Smart City ecosystem
National government	- Sets the national tone and direction, providing the bigger picture – e.g. Society 5.0, SDG targets - Defines policies and initiatives to drive innovation – e.g. Digital Garden City, Private Public Partnership (PPP) Platform - Allocates budgets to local governments to help fund projects - Works with industry and the public towards standardisation – e.g. Smart City Guidebook, Smart City Reference Architecture, City OS
Municipal government / Area management E.g. town, city, prefectural government or district / private area management committee	- Responsible for their own smart city, setting the framework, developing the future vision and driving principles for the area - Identifies the social issues to be solved for the area to improve citizen wellbeing, which can (but does not have to) include improving the local economy - Responsible for collecting and providing open city data to service providers, e.g. data on local events - Work with other partners to develop and implement solutions - Promotes collaboration between citizens and corporations - See Section 3 for more detailed examples
Private companies and universities E.g. technology companies, utility providers	- Develop or customise (technology) solutions to address identified social issues - Use its commercial network to find and manage the right partners for local government - See Section 4 for more information
Industry and public associations E.g. Smart City Implementation Consortium, Smart City Institute	- Works with industry partners and works with (or lobbies) national government to define new standards and policies, e.g. for digital interfaces, data formats, etc. - Promotes Smart Cities activities and provides a network for connecting potential partners

# Smart City project location map
Source: スライド 1 (japic.org)

At the end of 2021, Smart Cities from 97 regions across Japan submitted 119 project proposals to the Science and Technology Innovation Promotion board.

In order to systematically implement smart cities nationwide, projects in 62 regions were selected based on the evaluation of the Joint Review Committee on Smart City-related projects. Of these, 42 regions have implemented inter-project collaboration.

項番	プロジェクト実施地域	選定事業	過年度選定
1	北海道札幌市	■	□●■
2	北海道旭川市	☆	
3	北海道室蘭市	○	
4	北海道帯広市	○	●
5	北海道芽室町	●	
6	北海道更別村	□■	☆
7	岩手県陸前高田市	☆	
8	宮城県仙台市	□■	■
9	仙台市泉区南光台・八乙女地区	○	
10	秋田県仙北市	■	☆■
11	福島県会津若松市	○■	□○●
12	福島県南相馬市	■	■
13	茨城県つくば市	■	●■
14	茨城県守谷市	■	■
15	栃木県佐野市	□	
16	群馬県前橋市	☆●■	○●■
17	群馬県嬬恋村	□	□
18	埼玉県さいたま市	☆□■	□■
19	埼玉県熊谷市	■	■
20	埼玉県入間市　宮寺・二本木、東金子、金子、藤沢第一・第二 エリア	○	
21	埼玉県毛呂山町	■	■
22	千葉県柏市	□■	■
23	東京都千代田区（大手町・丸の内・有楽町地区）	●■	■
24	東京都港区（竹芝地区）	■	
25	東京都大田区（羽田空港跡地第１ゾーン）	■	□■
26	山手線周辺／横須賀市	●	●
27	川崎市、箱根町	●	○●
28	神奈川県横須賀市、三浦市	●	●

項番	プロジェクト実施地域	選定事業	過年度選定
29	新潟県新潟市	■	○■
30	富山県朝日町	●	●
31	石川県加賀市	■	□●■
32	石川県能登町	☆	
33	福井県永平寺町	○	○■
34	岐阜県中津川市	☆	
35	静岡県静岡市	●	○●
36	愛知県岡崎市	■	■
37	愛知県春日井市	○	☆○●■
38	三重県多気町・明和町・大台町・度会町・大紀町・紀北町	○■	
39	京都府精華町、木津川市（けいはんな学研都市（精華地区・西木津地区））	■	□■
40	京都府与謝野町	●	●
41	大阪府大阪市	○	
42	大阪府河内長野市	■	☆
43	大阪府豊能町	□■	
44	兵庫県加古川市	■	□■
45	兵庫県播磨科学公園都市	○	
46	和歌山県太地町	☆	
47	和歌山県すさみ町	■	
48	島根県美郷町	○	●
49	広島県三次市	■	■
50	香川県三豊市	○	○

項番	プロジェクト実施地域	選定事業	過年度選定
51	愛媛県松山市	■	●
52	愛媛県新居浜市	■	■
53	佐賀県嬉野市	☆	
54	佐賀県基山町	○	
55	長崎県	□	
56	熊本県人吉市	□	
57	熊本県荒尾市	■	■
58	宮崎県	●	●
59	宮崎県延岡市	☆■	
60	沖縄県	●	
61	沖縄県宮古島市	●	●
62	沖縄県北谷町	○	
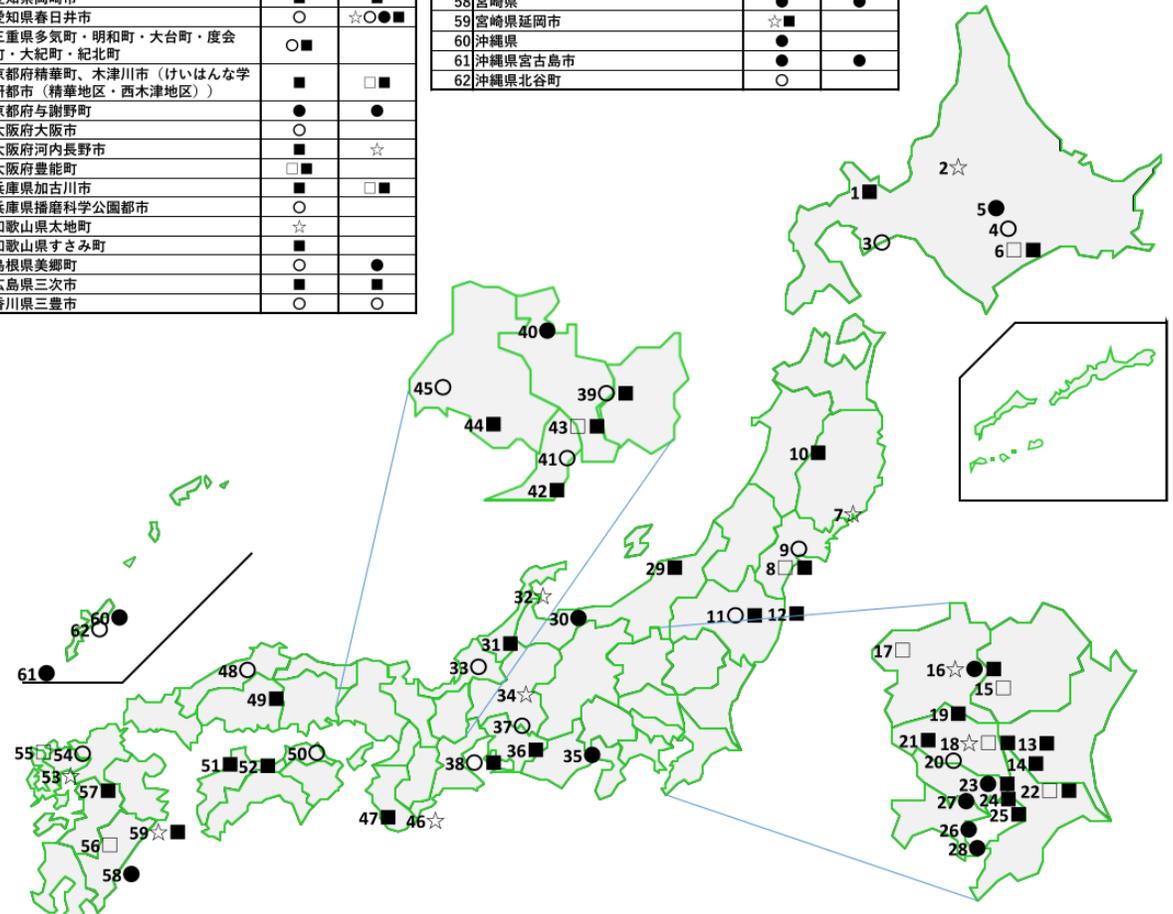
内閣府「未来技術社会実装事業」	☆
総務省「データ連携促進型スマートシティ推進事業」※1	□
経済産業省「地域新MaaS創出推進事業」	○
国土交通省「日本版MaaS 推進・支援事業」※2	●
国土交通省「スマートシティモデルプロジェクト」	■

※1令和２年度までの施策名は「データ利活用型スマートシティ推進事業」
※2令和元年度の施策名は「新モビリティサービス推進事業」

The national government has reinvigorated development efforts in recent years

- The Japanese government has put Smart Cities prominently on the national agenda. A key government-led initiative which helped to reinvigorate Smart City developments is the [Smart Cities Public-Private Partnership (PPP) platform](). This was launched in 2019 to accelerate smart city efforts through public-private partnerships, on the basis of the Integrated Innovation Strategy of the same year.

- Four key government bodies are core to the PPP platform and play a significant role in the domestic Smart City ecosystem, especially for policy planning for smart cities, MaaS and other data driven urban development:
  - Cabinet Office
  - Ministry of Economy, Trade and Industry (METI)
  - Ministry of Land, Infrastructure, Trade and Industry (MLIT)
  - Ministry of Internal Affairs and Communications (MIC)
  - Digital Agency (DA, see next page for more details)

- The four main activities of the PPP platform are:
  1. Effective promotion and priority support for smart city-related projects
  2. Holding of subcommittees for specific common issues, e.g. transportation and mobility, tourism and regional revitalisation
  3. Support information sharing and matching among companies, universities / research institutes, local governments, etc.
  4. Promotion of activities both domestically and internationally

Composition of Smart City Public-Private Partnership Platform: 910 organizations in total as of July 2022
Source: [Public-Private Partnership Platform | Smart City Public-Private Partnership Platform (mlit.go.jp)]()

Moving forward, the newly launched Digital Agency will play an important role in driving Japan's Smart City activities

- The Digital Agency (DA) is a new digital agency that aims to pave the way for the country's digital transformation. It aims to spearhead the development of online public service delivery and integrate IT systems across departments and agencies. It therefore plays an important role in driving domestic Smart City activities.

- Former Prime Minister Yoshihide Suga made the digitalisation of Japan one of his top priorities and launched the new Digital Agency in September 2021. He appointed Takuya Hirai as the Digital Transformation Minister, who promised the DA will have the authority to make meaningful change to enable the government to mirror the private sector's perpetual digital transformation.

- The DA's mission statement is "Human-friendly digitalisation: No one left behind". It has visions for Government as a Service and Government as a Startup.

- One of the responsibilities of the DA is to manage the government APIs and open data on the government CIO portal.

- According to its website, the DA has three core functions:

  1. Policy priorities: "total design"

     - Improvement of user-friendliness of online public services

     - Development of common functions such as IDs, certifications, and infrastructure such as cloud services and networks

     - Comprehensive data strategy

     - Building digital capabilities through training and education

     - Regulatory reform to allow the use of new technologies

     - Securing accessibility

     - Ensuring safety and security

     - Promoting R&D and demonstration

     - Examine and evaluate the program

  2. Serve for the benefit of the people

     - E.g. the Vaccination Record System (VRS)

  3. In the global context: Data free flow with trust

- The Digital Society Promotion Council was established in tandem with the agency and is charged with examining and evaluating the implementation of measures taken by individual departments. It works with the DA and is involved in developing the data collaboration infrastructure, e.g. in working with the Data Society Alliance and its "DATA-EX" platform.

Other key groups in the domestic ecosystem include the Smart City Institute Japan and potentially the newly announced Smart City Shared Fab, which is expected to be very influential in the future

Smart City Institute Japan

一般社団法人 スマートシティ社会実装コンソーシアム

SMART CITY SHARED FAB

- The Smart City Institute Japan (SCI-J) is a private-sector-led, non-profit general incorporated association established in October 2019 as a knowledge and public-private partnership platform to promote the expansion and sophistication of smart cities in Japan. It was established by Mitsubishi UFJ Research and Consulting Co., Ltd. and Nikkei, Inc.
- It aims to gather, share and promote the latest information and know-how on Smart Cities around the world, facilitate discussions and proposals for domestic Smart Cities, and promote networking within the Smart City ecosystem
- Has around 500 members, including around 100 from the private sector.

- Japan Research Institute (JRI) and NEC have set up a consortium, launch in May this year called the Smart City Social Implementation Consortium. The consortium also refers to itself as the Smart City Shared Fab.
- It is believed that JRI's role is to lead the development of the strategy and planning activities for the consortium. NEC would act as an aggregator, gathering companies to help develop applications on the City OS.
- The consortium is inviting specific solution providers and is open to anyone, including overseas companies.
  - Would like companies who can develop applications / apps, or data analysis and algorithms. No specific applications in mind at the moment.
  - Perceived value or overseas companies would be to help domestic members develop business models and services that are applicable not just to Japan. In addition, sharing information on standardised algorithms and methods would also be of value. In particular, experience with working with FIWARE would be an advantage
- Expecting 100-200 members to join on launch, 200+ members by 2025.
- Note: There is limited public information as of June 2022 so the information provided here is based on interviews and is subject to change.

The recently published Reference Architecture is useful for understanding how modern domestic Smart City efforts might be structured, but is not (yet) always applicable

- In 2020 Japanese government published the "Smart City Reference Architecture White Paper" as part of the Strategic Innovation Program. It is intended for those looking to implement Smart City solutions, including government and other organisations that are still developing their own local plans and entities working to provide those solutions.

- It aims to help groups work together in an aligned way by acting as a reference document to "confirm the necessary components required for the implementation and relationships between them as well as required relationship with outside the Smart City" – i.e. it acts as a checklist for the components and operational interfaces that Japanese government believes are needed to implement a successful Smart City.

- There are five "common basic principles" behind the architecture, and the architecture itself has four basic concepts (see right).

- The next pages provides an overall picture of the Smart City Reference Architecture. This provides a useful set of terminology but it should be noted that most cities have been undertaking projects since well before 2020 and will not have necessarily structured any or all of their activities in this manner yet, or using these terms.

Smart City Reference Architecture

Common basic principles

1. Define a clear vision – solving region-specific issues
2. Visualise overall perspectives using architecture model
3. Ensure interoperability (of data) – e.g. open APIs
4. Ensure scalability
5. Formulate regional organisation/initiative

Basic concepts

1. User-centricity principle: all participants in Smart City project must always be aware of the users of Smart City services in their efforts
2. Role of City management: to maintain sustainable management of Smart City, a city-wide governance and management mechanism is needed
3. Role of City OS: by provisioning Smart City services via City OS, data and services must be federated efficiently without obstacles
4. Importance of interoperability: to efficiently advance Japan-wide Smart City implementation, securing interoperability with other regions and systems is needed

Overall picture of Smart City Reference Architecture: Components for Smart Cities
**Source: Adapted from link**

A key component of the Smart City Reference Architecture is the "City OS"

- A key component of the Smart City Reference Architecture is the City Operating System or "City OS". This is not an operating system in the traditional sense, but a conceptual framework. Indeed many City OS type platforms have already been in operation or have been in development since long before the City OS guidelines were published.

- City OS is defined as a set of system functions that enable access to a variety of data provided from or to Smart City Assets and external systems. In essence, it is the framework to manage the cyberspace for Smart Cities.

- It should also enable appropriate brokering of data with Smart City Services, both data accumulation (where data is registered and kept on the City OS, which centrally manages it) and data exchange (where data is distributed or federated and City OS manages the location and availability of the data). The data source could be from national and local government, companies and / or citizens.

- Features and requirements for the City OS are listed below. These were determined by the government after examining lessons learned from earlier Smart City efforts in Japan:
  1. Interoperability / "Connect"
     - Enables reuse and horizontal development of services
  2. Data exchange / "Flow"
     - Enables data to be brokered within and outside the community
  3. Scalability / "Future-proof"
     - Enables extension of City OS as functions and architectures are updated

Case without City OS

- IT systems of each region are different from one another resulting in the situation of **restricted sharing and connectivity of data and services**

- Even when good examples of services are developed, their expanded deployment to others is almost as costly as the initial development, ending up being just a **demonstration without further expansions**

City OS (unified region PF)

SC utilizing nature

SC utilizing history

Safe & secure region

SC federated to universities

Tourism-centric SC

Case with City OS

- **Unrestricted collaboration and connectivity of services and data** are enabled on City OS as the common systems implemented across the regions

- Each region can focus on building Smart City and regional development leveraging the resources and characteristics of the region without having to allocate work force and expenses for the systems

City OS is a drive towards standardisation and the use of open source materials

- Until now, all Smart City developments in Japan have been individual efforts. The government is now driving towards standardisation and interoperability, especially for the City OS platform. The City OS initiative comes to enable horizontal expansion of digital platforms, connecting platforms across the country, and for citizens to be able to move between regions and access services more easily.

- More standards for elements necessary to City OS such as data formats and APIs are expected to be announced by the government in 2022.

- There are plans to have a City OS in 100 cities by 2025, which will serve as data collaboration infrastructure and data collaboration between private and public sectors, especially for healthcare, education and disaster prevention.

- An interesting point to note is that the City OS, while it ties into the Smart City Reference Architecture, is actually designed with the following international Smart City architectures in mind:
  - SynchroniCity, FIWARE, X-Road, IndiaStack, IES-City.

- Furthermore, City OS is expected to maintain transparency by adopting open source as much as possible without relying on a particular vendor.

- More detailed information on City OS can be found here.
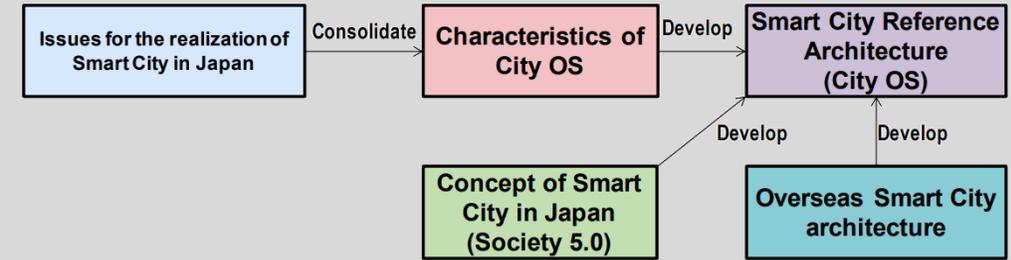
Development of City OS in Smart City Reference Architecture
Source: SIPサイバー/アーキテクチャ構築及び実証研究の成果公表 (cao.go.jp)
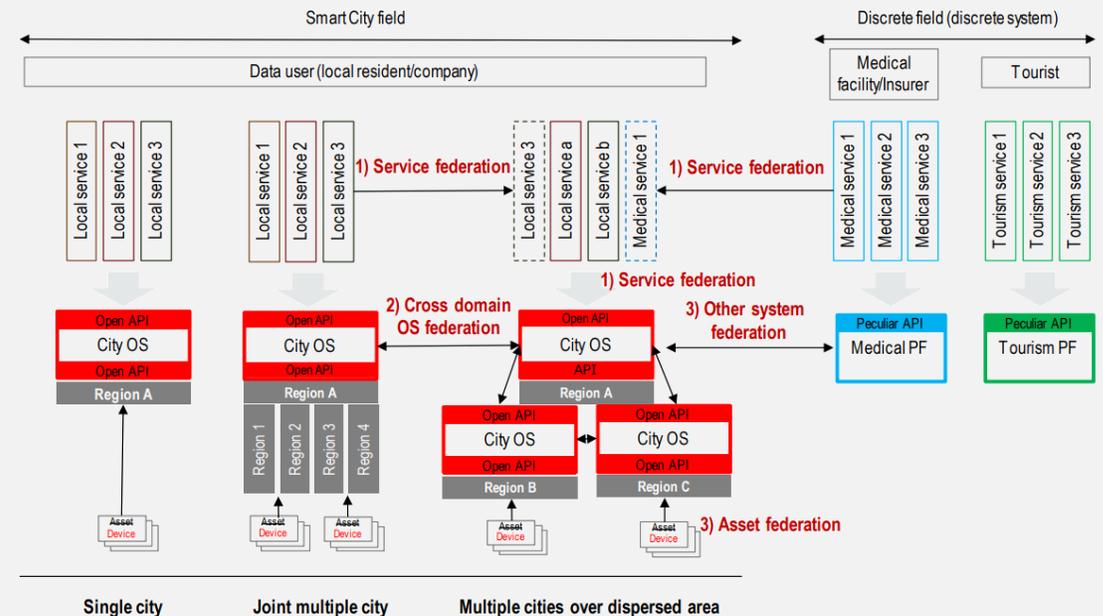
Smart City service federation enabled via interoperable City OS
Source: SIPサイバー/アーキテクチャ構築及び実証研究の成果公表 (cao.go.jp)

2. Key drivers and barriers

Drivers

Barriers

Expectations for 2025

Key drivers and barriers for Smart City developments

- There is a myriad of factors at play in Japan's Smart City ecosystem today. The following pages provide an overview of the main drivers and barriers to the development and progress of Japan's Smart Cities, and a note on the likely progress in the next 3-5 years.

  – **Drivers** are grouped by who is responsible for these drivers.

  – **Barriers** are grouped by which group is (most) hindered by those barriers.

- Details on drivers and challenges for specific Smart Cities and which ones are more specific to certain private sectors can be found in Section 3 and Section 4.

Drivers

PUBLIC SECTOR DRIVERS

National government

National government has played an important role in driving the recent boom in Smart City developments in Japan. Key initiatives which will continue to drive adoption, innovation and implementation include:

▪ **Society 5.0:** When it comes to government-led initiatives, arguably none is more fundamental to Smart Cities than Society 5.0, a human-centred society in which anyone can enjoy a high quality of life. New digital initiatives are being organized around this vision.

   – The aim is to achieve a high degree of convergence between cyberspace (virtual space) and physical space (real space). A large amount of information from sensors in the physical space would be gathered in cyberspace, with big data analytics by AI applied and the results fed back to people in the physical space. The official definition is provided on the right.

   – The government is promoting smart city initiatives as a comprehensive showcase for Society 5.0. Smart Cities presents an opportunity to improve the lives of millions of urban citizens while kickstarting economic growth. These act as living laboratories or large fields for technology trials, and will eventually help form the basis of Society 5.0.

"A human-centred society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space."

Definition of Society 5.0
Source: Society 5.0 (cao.go.jp)

Current status in Japan
Source: SIPサイバー/アーキテクチャ構築及び実証研究の成果公表 (cao.go.jp)
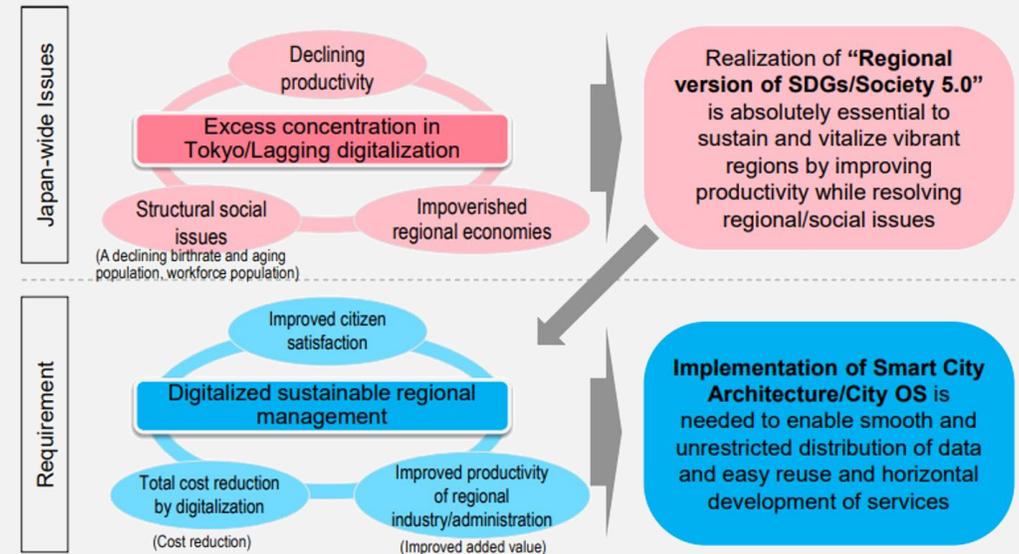
- **Digital Garden City:** Launched in 2022 aiming to achieve "rural-urban digital integration and transformation". This is a government initiative that is an especially major driver for rural Smart Cities and rural rejuvenation.

  - Has four broad initiatives:
    1. Building digital infrastructure
    2. Developing and securing human resources with digital skills
    3. Implementing digital services to solve rural issues
    4. Initiatives to leave no one behind

  - A common structured digital infrastructure, including a data linkage platform like City OS, is identified as a crucial key to success for this initiative. 20 Billion yen has already been allocated to over 700 projects this year.

  - The insistence on an evidence-based-policy-making (EBPM) cycle has led to the development of a number of KPI, which is starting to shape the way Smart Cities assess their progress.

- **Private-Public Partnership Platform:** A forum to encourage and facilitate partnerships between private and public bodies. A significant enabler and accelerator for Smart City efforts. (See previous section for more details.)

- **Super City:** Select Smart Cities which are acting as testbeds for deregulation and major implementations. These have just been launched in the last year. They are driving innovation and will act as models for other cities in the future (more details in Section 3).
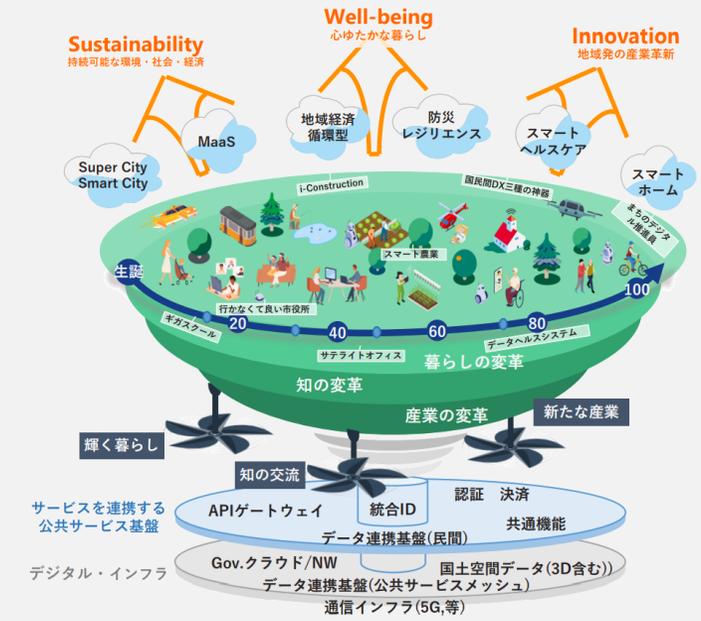
Key to the success of Digital Garden City Nation
Source: siryou2-1.pdf (cas.go.jp)

Key performance indicators (KPIs) for EBPM
Source: PowerPoint プレゼンテーション (eubusinessinjapan.eu)
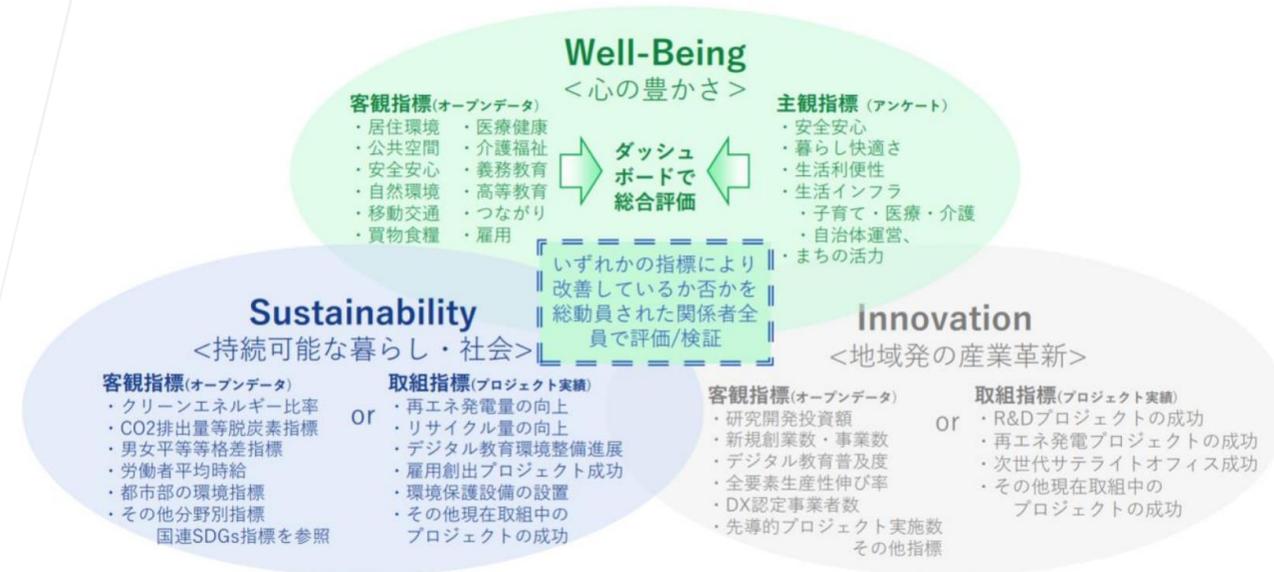
- **Standardisation:** An important aspect to note is the general drive from Japanese government for standardisation to enable scalability and interoperability to benefit solution providers, city operators and citizens. To this end, the Smart City Reference Architecture, Smart City Guidebook and City OS guidelines will become increasingly influential in shaping domestic developments.

For reference, key influential government bodies listed in the previous section include:

- Cabinet Office
- Ministry of Economy, Trade and Industry (METI)
- Ministry of Land, Infrastructure, Trade and Industry (MLIT)
- Ministry of Internal Affairs and Communications (MIC)
- Digital Agency (DA)

Local government

- **Local government:** Municipal governments and Area Management groups are fundamentally the key drivers for all domestic Smart Cities. While national government sets the tone and the private sectors defines the solutions, it is the local governments that identify local needs and push through new projects. They organise forums and face-to-face discussions between citizens and the private sector.

- **Aggregation of local services to reduce costs:** Some local governments see a need for aggregation of local services to reduce costs associated with maintaining many disparate services and to reduce the burden on citizens.

PRIVATE SECTOR DRIVERS

The private sector provides both Area Management of Smart Areas as well as the services and solutions needed in Smart Cities. Key drivers from the private sector for advancing domestic Smart Cities include:

- **Potential for new business generation:** Still an important driver today but less so than in the past. Interest from the private sector in Smart City technology and services used to be primarily about identifying new business opportunities and new sources of revenue. However, this has

  proven to be challenging for most sectors. Yet, investment and development efforts continue (see next driver).

- **Opportunity to help society / CSR*:** With the backing of government, many see the importance of Smart Cities for the betterment of society and some see it as an ethical imperative to pursue this field. Most companies therefore also see this as a brand and marketing opportunity.

- **Professional consortiums:** Consortiums like the Smart City Institute Japan and the Smart City Shared Fab described in the previous section are key drivers for change and progress. They help advise and / or lobby government on standards and policies, which are still being developed in Japan.

*Corporate social responsibility

- **FIWARE development:** While there are many technologies being developed which will advance Smart Cities, FIWARE is one that is worth specifically highlighting as a potential game changer for the ecosystem. It could help address the issue of scalability for many service providers.

  – FIWARE's mission is "building an open sustainable ecosystem around public, royalty-free and implementation-driven software platform standards that ease the development of new Smart Applications in multiple sectors".

  – It is a type of data integration platform for connecting any data, comprising of a suite of software modules and common information models to enable interoperability between different city systems and to enable the collection and use of open data. It started being used in smart cities in Europe when there existed no other open source data integration platforms.

  – In Japan, NEC is developing this unifying platform with significant backing from Japanese government as a push towards improving interoperability between cities and systems, and for standardisation. The goal is to develop a platform that integrates data from multiple domains such as traffic data, disaster management data, tourism data, etc. – data that would potentially be open data – so public and private entities can utilise the data to provide services to citizens.

  – FIWARE is intended for open data and would be customised for each municipal government by companies like NEC. City OS is intended for both open and personal data, so FIWARE is an option for part of City OS.

  – Some Smart Cities have already adopted FIWARE, with more looking to adopt it or develop compatible interfaces for its existing platforms (e.g. Takamatsu, Kakogawa, Toyama and Niihama cities, Okinawa, and Shizuoka prefectures). As FIWARE matures, more solution providers are likely to make use of it to develop new solutions.

FIWARE-compliant information platform

Source: FIWARE, Information Platform for Implementing Data Utilization Based City Management: NEC Technical Journal | NEC
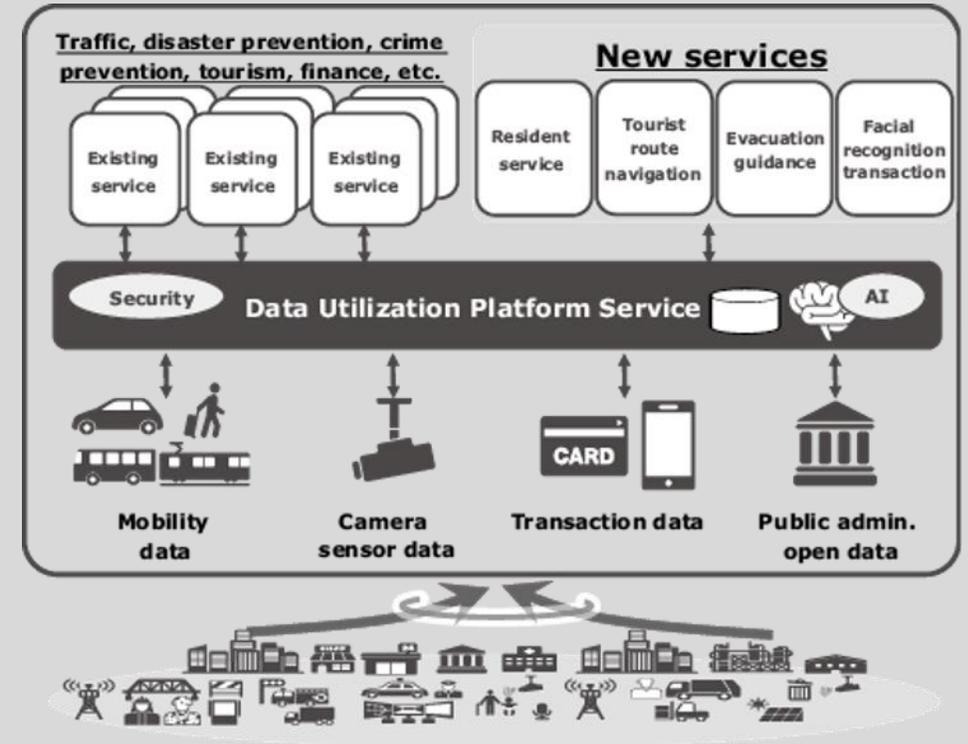
SOCIETAL DRIVERS

- **COVID-19 pandemic:** The pandemic has been a wake-up call for Japan's digital transformation. It highlighted the need for DX to radically transform and modernise public services, from education to health, in order to adapt to the changed circumstances the pandemic has wrought.

  - In the past, each ministry, agency, and local government was promoting digitalisation separately. This resulted in 1,700 local governments with 1,700 systems, procured and managed separately with distributed responsibility. The COVID-19 pandemic highlighted such practices as ineffective.

  - In addition, management of the health crises was hampered by outdated and cumbersome administrative system.

  - As a result, many are updating Smart City strategies with calls for solutions for disease management, prevention and control, DX of healthcare, GovTed, CivicTech and other areas.

  - For citizens, the pandemic has led to people being more aware of their surroundings and becoming more involved in local activities. This is driving more interest in Smart Cites and driving service and technology adoption.

- **Users:** Residents, visitors and government officials are themselves a group that drive Smart City developments because there is an expectation and need for better digital connectivity, ease of information access and better services. It is their needs that define Smart City development plans.

- **Aging population:** This is a common issue for local governments to address through Smart City initiatives. This typically drives solutions that improve the QoL of the elderly, improve accessibility of services to the elderly, and solutions that enable an aged workforce.

- **Rural regeneration:** Rural communities use Smart City initiatives to revitalise the region, making it more enticing for people to move into the region and improving the local economy by attracting more businesses, tourists and MICE* visitors.

- **Sustainability and SDG targets 2030:** SDGs as defined by the UN is an important driver in all aspects of Smart City initiatives, particularly in areas relating to carbon neutrality, waste recycling and decarbonisation. These drive both public policy and private sector activity, in rural and urban cities.

OTHER DRIVERS

- **Osaka World Expo 2025:** The next World Expo is being treated by many in the public and private sectors as a key milestone to showcase Smart City developments and new technologies.

  - The theme for the expo is "Designing Future Society for Our Lives", with sub-themes of "Saving Lives", "Empowering Lives" and "Connecting Lives".

  - Organised by the Bureau International des Expositions (BIE), it will take place for six months during 2025, opening 13 April 2025, and closing 23 November 2025.

*Meetings, Incentives, Conferences and Exhibitions

Barriers

PUBLIC SECTOR BARRIERS

National government

While Japan government has put in place a number of important initiatives in recent years, there is still a great deal of uncertainty in how it can further drive innovation. Barriers to progress for the government include:

- **No clear direction:** Japan government is looking to catalyse activities but is reliant on the private sector and other international governments to advise and provide examples of what policies and initiatives would be useful. This is particularly true in needing guidance for how to deregulate.

  – This is evidenced by the enormous range and number of projects being backed by local and national government. Most of these will not reach implementation stage.

- **Japanese government is very bureaucratic with many silos:** Making it hard for them to work together or integrate on large scale projects and slow to act. Most activities are small scale and local.

- **Hard to deregulate data privacy:** Japan is similar to European countries in that it is difficult in Japan to demonstrate or implement technologies that require personal data, such as in services that can monitor the flow of people or identify faces to an unspecified number of people. Data is crucial to Smart City developments but any deregulation must be done carefully and in a transparent manner to citizens.

Local government

- **Difficult to know what to invest in:** As with national government and the private sector, local government also struggle with identifying what problems are most valuable to its citizens and what solutions should be used to do so. Local governments have small budgets to support projects and is reliant on the private sector for solution ideas.

  – For example larger cities may have the budget to develop its own City OS but small municipalities will not. This is partly why Japanese government is supporting the development of a basic module of the data exchange layer like FIWARE.

- **Difficult to get citizen buy-in, participation and social acceptance:** A lot of effort is needed to promote Smart City investments and efforts to citizens, to get their buy in and participation.

  – Many have historically not seen the benefit of Smart City technologies. Some local governments are starting to use wellbeing indicators to measure success and better communicate success to citizens.

  – All solutions come with risks and some can be difficult for citizens to accept. For example, drone regulations allow drones to fly over dense populations by FY 2022 but it is socially unacceptable to people to have a drone malfunction and crash over a densely populated area. Therefore, drone applications is limited to industrial applications and rural areas. Personal privacy is of course another major area of concern for many citizens.

PRIVATE SECTOR BARRIERS

Commercial challenges

- **Private sector does not yet see this as a profitable market:** There is a fundamental commercial challenge for companies today, and that is how to make a successful sustainable business in the domestic Smart City space. While there is still belief that Smart Cities presents the potential for new business generation, current activities are investments and net profit loss for most sectors. There are a number of factors that go into this, as listed below.

- **Limited funds available from municipal governments:** Japan takes a brown field approach to Smart City development, mostly retrofitting systems. There is little money available in rural areas and local governments.

  - This is driving some companies to target citizens as a potential revenue source. However, not all Smart City services can rely on public interest as revenue, especially those that are not citizen-facing.

  - Some feel municipal or national government should invest in a small proportion of the initial development and implementation costs, but then fund a larger proportion of the operating costs. However, this is still an area of debate and the limited funds available from municipal governments is a strong barrier to R&D for many private companies.

- **Difficult to monetise small scale PoCs and single solutions:** Many Smart Cities will support a large number of small PoC projects and single solution projects (e.g. image recognition, sensor implementation). Single solutions for disaster management is popular with many municipalities (e.g.. using a sensor to monitor the condition of something, provide early warning to citizens). However, these small projects are difficult to monetise

- **Hard to move past PoC stage:** Taking minimum revenue from PoC projects is to be expected, but the problem for the private sector is compounded by the fact it has proven to be difficult for the vast majority of companies to move past the PoC stage. There is then a barrier to deploying them at scale.

  - National government has shown no interest in funding and implementing large scale solutions in cities.

  - Local governments often have no real intention to move past PoC.

  - Everyone is still waiting to see and / or competing for what services will win out in the end (see below).

- **Unclear what application will succeed:** There are various business models, services and approaches being tested in Smart Cities across Japan but as yet, there are no clear business success stories. Many are still in the gathering information stage, trying to find examples and inspiration for successful, sustainable businesses within this space.

  - Need ideas of good services that are valuable to Smart Cities, not technologies. Most do not feel technology is the limiting factor to progress today.

  - Many still search for the ideal Smart City solution that is profit generating and adds to the main business, or at least is not wholly separate to the main business – e.g. financial service providers working on local currencies and construction companies creating data platforms struggle to link this activity back to their main businesses.

– Still trying to identify what data is needed and how to make good use of the data already available to improve citizen's QoL.

Practical challenges

- **Hard to penetrate small-scale municipal governments and area management groups:** Municipalities and Smart Area Managements often have complicated organisational structures with many existing partners, which makes it difficult for solution providers to identify a route in. This is particularly true for small individual service and technology providers who do not already have established connections with local governments or area management groups.

- **Data availability:** Many companies struggle to find ways to obtain the data needed for services – either because the necessary data is not available (e.g. data source not yet digital or trying to gather data on something difficult to measure / monitor) or the data format is not standardised, making it hard to aggregate / link datasets. Japan data is highly regulated and there is no single dominant data owner.

- **Data privacy concerns:** In cases where the data does exist, there are often privacy concerns from the public. However, many Smart City services require this type of data in some form.

  – There are calls for deregulation from both the private and public sectors to reduce the limitations from current data privacy laws, with a need for guidance from those who already have experience of designing and working with these types of policies.

– Initiatives like the Super Cities will test out some approaches. However until policies and regulations are changed, data privacy laws will greatly hamper Smart City developments.

- **Application specific deregulation:** While the topic of deregulation typically centres around data privacy, there are needs for deregulation in other areas. For example, mobility and autonomous vehicles is one of the most important and popular applications in Japan Smart Cities but it is an area that is difficult to regulate.

- **Lack of standardisation leads to inefficient technology development and scalable solutions:** Particularly true for digital platform providers and single solution providers. While this is starting to change with the advent of the Smart City Reference Architecture and City OS guidelines, with more standards and policies expected from the Digital Agency soon, this will remain a problem for some time to come because many guidelines are optional and there are many legacy systems. Many struggle with scalability while there is no standards in place, and much solution customisation is needed.

- **Few IoT platform providers:** IoT platforms are a critical element of Smart Cities and many companies need help to develop these. However, while there are many edge device and single solution providers, there are almost no IoT platform providers in Japan.

By 2025 many expect data privacy regulations to loosen, there to be more digital standards and more cities with City OS, much will depend on how the various PoC and Super City projects progress

For many, the domestic Smart City plans in motion today are seen to have a timeline horizon of 2050 for achieving real change. Since everyone is still struggling to identify the best technologies and applications, most players are waiting to see how the Super City initiatives and various projects / demos go in the next few years. However, some expectations for 2025 are:

- **Data privacy regulations will loosen:** While Japan will follow the trends in global data protection law, many in the private sector believe Japan's data privacy regulations will reach a significant level of change in by around 2025. Some are already making R&D investments and doing trials in anticipation. Expecting deregulation by the Digital Agency.

- **More standards:** Expect Japan government to create (more) standards for digital technologies, including data formats, APIs and the City OS platform

- **Few projects, fewer applications, more deployments and larger scale implementations:** Today smart cities are at the stage of trying lots of things and don't know what will succeed,

efforts are too unfocused. It is expected that cities will shift from the planning stage with PoC projects and demos that are typical today, to having more technology solutions being implemented at scale. As more PoC projects conclude, it will become clearer which solutions provide real value.

- **More cities with City OS:** There is a national target for City OS to be in 100 cities by 2025. This means we can expect a greater need for municipality business efficiency systems and personal data utilisation services to comply with government specified formats.

- **More interest in DX implementation related technologies:** As City OS platforms become more prevalent, there will be increasing interest in the related technologies such as data storage, data resilience and security.

- **5G to become more widespread with a race to 6G technology well underway:** 5G is a key enabler for Smart City developments and Japan's telecommunications infrastructure is already one of the most advanced in the world. Use of 5G for Smart Cities will become more widespread over the next few years. The race for 6G technology has already begun and is expected to be well underway by 2025.

- **More widespread use of advanced technologies:** Especially AVs, drone photography, robots, AI. Autonomous medium speed vehicles including taxi services are expected to become more widespread.

- **No real change for small local governments:** Does not expect real changes from small local governments or how they operate, other than some incremental advances in digitising their systems and data.

3. Domestic Smart Cities

Smart Cities and Super Cities

Application and technology trends

Example 1: Fukuoka

Example 2: Kyoto

Example 3: Osaka

The recent emergence of "Super Cities" as a result of the Super City Law can be considered to be an early test bed for Smart City services, and aims to incorporate the most advanced technologies

- The Super City Law was enacted in May 2020. Out of the 31 cities that applied to be Japan's first Super City, only two were selected in March 2022: Osaka City (more details provided later in this section) and Tsukuba City.

  – One of the key reasons these two cities were chosen is that the Japanese government is interested in understanding how to deregulate. Osaka and Tsukuba are believed to have had more ideas on what and how to deregulate than other applicants.

- There is significant overlap in the goals of Smart Cities and Super Cities in terms of using technology to improve the quality of life (QoL) of citizens and the sustainability of a region.

- However, Super Cities are intended to focus on large scale projects and should showcase the "holistic future state" of cities in Japan in 2030. They act as a city-wide demonstration experiment of cutting edge technology for Japan.

- As mentioned in the previous section, Super Cities are intended to be ambitious undertakings and are expected to be a major driver for advancing Smart City developments in Japan.

Super City Data Linkage Platform

Source: The National Strategic Special Zones (chisou.go.jp)
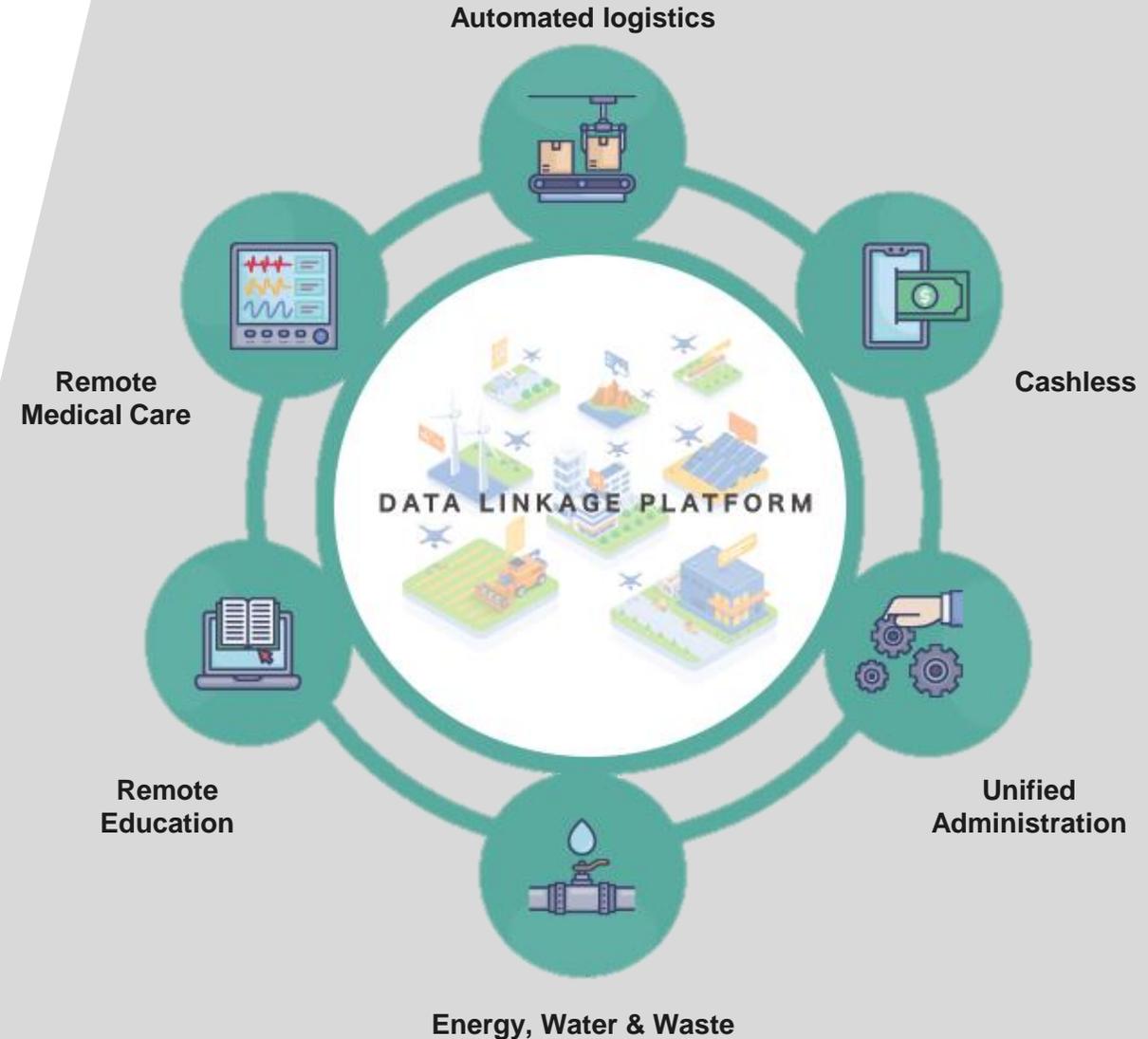
Super Cities are essentially a subset of Smart Cities

- A key aim of Super Cities is to encourage traditionally siloed agencies to cooperate and sure systems are interoperable across different jurisdictions. The shift is to a cross-domain, issue-solving type vision rather than focusing on individual services.

- A key differentiating factor for a "Smart City" and a "Super City" is therefore concept of the Data Linkage Platform.

Smart City	Super City
Data combination will gradually change to Data Linkage Platform.	Developing a cross-disciplinary Data Linkage Platform all at once, along with drastic regulatory reforms.

- Another aspect of Super Cities is that it is intended they should cover at least five of the digital solutions listed below:

  1. Mobility
  2. Logistics
  3. Payment

4. Administration

5. Healthcare and nursing care

6. Education

7. Energy and water

8. Environment and garbage

9. Crime prevention

10. Disaster prevention and safety, etc.

- The Super City Open Lab was set up as a way to promote collective action and impact. As for Jan 2022, 266 organisations have registered (see next page).

- It is worth noting that while the national government is setting the tone, cities are also themselves driving change. Fukuoka, for instance, has removed the need for the traditional hanko stamp on official Japanese documents, so that forms can go digital. Kakogawa City is introducing Decidim, a platform for participatory democracy that originated in Europe. Many of these changes are being driven by a younger generation of municipal and public sector leaders who are committed to overcoming institutional resilience to radically overhaul public services through innovation and embracing new technologies.

Super City Open Lab partners
Source: [PowerPoint プレゼンテーション (eubusinessinjapan.eu)](eubusinessinjapan.eu)

Top Smart City applications include wellbeing and healthcare, mobility, elderly QoL, disaster management, DX and sustainability, although all link to improving citizens' QoL

- Most Smart Cities will list projects that span a broad range of application areas, although an application area may only have one specific limited project, typically a small scale PoC trial.

- The most prominent application area uniformly mentioned in all Smart Cities is **Quality of Life (QoL) applications**. However, this does not have a specific definition and tends to act as a catch-all term for all Smart City activities, which all tie into improving QoL of some or all citizens.

- More specific popular application areas are:

1. **Wellbeing and health** ⊕
   - Includes digital health but also any service that improves QoL
   - E.g. can extend to technologies to improve the physical living and working environment, improving air quality, reducing stress, providing more entertainment, etc.

2. **Mobility and MaaS** (mobility as a service) 🚊
   - Includes autonomous vehicles, congestion management, connecting and managing different modes of transportation (incl. non-motorised – i.e. pedestrians)
   - Note: Some cities classify logistics projects under mobility as well, e.g. drone / unmanned delivery services in rural

– communities. Logistics is a popular application area for rural communities but less so in urban environments

3. **Elderly QoL** 🚶
   – Includes technologies that improve the education of the elderly and those that support an aged workforce
   – More prominent for rural Smart City initiatives

4. **Disaster management / resilience** ⚠
   – Especially important to rural communities
   – Includes disaster modelling, monitoring, relief and recovery services
   – COVID-19 has had a profound effect on Japan and many cities, especially urban areas, are starting to look at disease control measures

5. **Digital transformation** 🗄
   – Primarily related to the City OS data platform for connecting service providers to citizen data and city operations
   – Also extends to GovTech and CivicTech and applying ICT technology to all areas of city operations and services for citizens
   – Very important focus area for Super Cities

6. **Sustainability, especially reducing energy consumption and decarbonisation** 🌀
   – Typically refers to technologies and services that improve efficiencies and / or enable reduction in energy usage, although some cities may include recycling related technologies
   – May also include replacing the use of fossil fuels with renewable energy. Many private Smart City developments led by the private sector include renewable energy generation, use and management

Addressing the decrease in working population and regional rejuvenation are also popular application areas for some Smart Cities

7. **Decrease in working population** 🦾
   – Usually translates into robotics, automation and autonomy, as well as technologies that improve efficiency and reduce manpower needed
   – Can also include technologies that enable more elderly citizens to join / stay in the workforce, thus also tackling the problem of an increasing aged population and aging workforce

8. **Regional rejuvenation / attracting visitors and MICE events** 👥
   – Includes technologies and services that attract and improve the experience of visitors and MICE events, and / or attract businesses
   – A common application in urban cities, but not always viewed as a top priority compared to others
   – Top application for all rural communities and private-led smart cities

▪ Note: Many of these key application areas understandably tie in with many of the drivers listed in Section 2.

Top technology focus areas include digital platforms and the associated operational technologies, data collection and analytical technologies, and autonomous vehicle technologies

- When it comes to technology trends, local and national government all emphasise that the focus of Smart Cities in Japan today is on solving societal problems to improve the wellbeing and QoL of citizens, and not on any specific technology. Smart Cities are application driven and not technology driven, and any technology can be used.

- However, this is somewhat in contradiction to other government messaging that talks of IoT, DX and other advanced technologies being important for domestic Smart Cities.

- In our opinion, the lack of technology focus is in part related to the fact that most Smart City applications are still at the demo / PoC stage. Beyond the need for the City OS and DX for GovTech and CivicTech, there is as yet no clear technology(s) that is universally important to all Japan Smart Cities.

- That being said, a few important technology foci common to many Japan's Smart Cities are:

1. **Digital platform and cloud technology**
   – Main type of technology underpinning many, especially large, Smart City developments, which need their own "City OS".

- While there are guidelines in place for City OS, the current situation in Japan is that each Smart City will have already developed a data management platform – i.e. its own form of City OS – without adhering to these guidelines.
- Most intend to align with any standards that may be announced, and expect it may be necessary to consider compliance and integration issues in the future.
- However, the reality is that any UK businesses looking to work with a Japan Smart City will need to adapt to its City OS or equivalent platform

2. DX operational technologies, including 5G/6G

- As City OS platforms become more prevalent and mature, next tier related technologies like 5G antennas, data storage, data resilience, under water cables, etc. are becoming more important.
- While communications infrastructure and technology such as 5G and 6G are considered invaluable to Smart Cities, these are not considered to be within the realm of the local governments to influence or develop, merely to work with the infrastructure that is provided. However, some have noted that competition for developing 6G technologies is intensifying within Japan, believing it will be a game-changer and that the technology winner will win the market share.

3. Data collection, including IoT, sensing

- Almost all domestic smart city projects are at the demonstration / proof of concept (PoC) stage. Many planned developments and application areas are at the information gathering stage. Therefore, data collection in the form of IoT devices, sensors and gathering citizen data through smartphones and tablets are very relevant technology areas.

4. Big Data analytics and AI, including digital twins

- AI and Big Data analytics (and data analytics) are widely considered to be important technologies for Smart Cities – these are listed as two important focus areas for the future development in Super Cities like Osaka. However, projects are still at the planning / testing stage and there is no wide adoption or agreed set of subset technologies withing Big Data analytics or AI that have been identified as important at this stage.
  - Some believe Japan is not leaders in this area, and that there could be an opportunity for UK to provide leading technologies here.
- Many private and public Smart Cities are building digital twins. On the surface, people are attracted by the digital twin idea of learning from simulations. However, most are now struggling to identify use cases and gain real value from these developments.
  - Project Plateau led by MLIT is for the implementation of digital twins (3D city models) across Japan, starting from Tokyo and then in 2nd-tier cities. Part of its aim is to develop use cases in Smart Cities.

5. Autonomous vehicles and robotics

- Popular technology for public led Smart Cities. Lack of manpower, accessibility challenges and aging populations drive the need for autonomy, especially in transportation services and delivery services for both rural and urban Smart Cities.

Example Smart Cities and Super Cities

- The following pages provides an overview of the Smart City activities and ecosystems for three municipalities

  - Fukuoka Directive Council (FDC)

  - Kyoto Prefecture

  - Osaka Prefecture

- All three cities, like many others in Japan, have been working on Smart City related projects and initiatives for many years, sometimes decades. The cities have supported many projects both historically and live now.

- This is especially true for the newly appointed Super City, Osaka, which has a large array of projects and initiatives both in Osaka City and across the rest of the Osaka prefecture.

- The information here provides a snapshot summary of each city's main approaches, drivers, activities and challenges. Much more detailed information is available from the city governments themselves.

Fukuoka D.C.

Background

- Fukuoka is the capital city of Fukuoka prefecture in Kyushu region of Japan
  - 6th largest city in Japan, 2nd largest port city after Yokohama
  - A commercial district – developed in the tertiary industries, i.e. service industries
  - Vision for a Sustainable City that combines People, Environment and Urban Vitality
- Whilst Digital Agency is trying to standardise the data platform in the initiative of vision for Digital Garden City State (see Section 2) as a cooperation model, FDC have been doing physical cooperation model already more than 10 years
- Designated a NSSZ* since 2014, specifically for Global Startups and Job Creation, focusing on facilitating startups and maintaining a startup-friendly environment
- Fukuoka Directive Council (FDC) is intended to spearhead the Urban Vitality initiative
  - Multi-sectoral, industry-academia-government-citizens joint "think-and-do-tank"
  - Has formulated regional growth strategies to create a new vision for the future of Fukuoka and to strengthen the international competitiveness of the region
  - Focuses on Fukuoka Metropolitan area
  - Smart City Working Group established 2021, is leading all smart city initiatives

Approach to Smart City developments

- Aiming to be a hub of East Asia
- Aims to solve social problems by using technologies or applying new business models
- Mission is to stimulate the economy around Fukuoka by
  - Encouraging people to move people into the area
  - Encouraging MICE events to be hosted in Fukuoka
  - Motivate companies to move in by deregulating, especially startups
  - Efforts are led by Mayor Sōichirō Takashima
- However, the Smart City activity is framed in the context of improving the wellbeing of its citizens, not the growth of the economy. Particularly improving QoL through DX

Main external drivers for Smart City activity

- Challenges for startups:
  - Companies based in Tokyo (~half of the members) come to Fukuoka to conduct trials which they cannot do in Tokyo
  - FDC can provide chances to match startups with large companies, which gives start-ups chances to be service providers in smart city
- Mobility is important in rural areas, such as parts of Fukuoka prefecture. There are a lot of problems, such as there being no public transportation and difficulties in hiring drivers

Main application focus areas

- Energy
- Environment and living & work
- Town planning with IoT
- Mobility
- Wellness and healthcare
- Safety and security
- Cashless payment
- Food and agricultural and marine products
- Education and research

Main technical focus areas

- AI
- Autonomous driving and location information
- Energy saving and renewable energy
- Image analysis
- Recognition technology
- Security
- Blockchain – various trials have been done such, e.g. in healthcare by collaborating with medical institutions, in agriculture, and for issuing certificate of residence
- Autonomous driving – some trials have been done, ranging from personal to mid-size (i.e. bus) mobilities

Thoughts on working with UK

- Any companies from UK are welcome
- Expecting UK companies to bring what Japanese cannot do. Needs to make people move around more beyond Japan – i.e. how to scale up to providing global services

* NSSZs (National Strategic Special Zones) are designated by national government, created to boost international competitiveness of industry and promote the creation of centres of international economic activities. Exclusive regulatory and system reforms are implemented to verify their impact

Fukuoka D.C.

How it works with partners

- FDC is in charge of all Smart City strategies in the Fukuoka district
- The FDC includes a number of public and private partners
  - Private sector works with local government
  - FDC provides outline visions, needs and plans for each municipality
  - FDC member companies discuss how they are to collaborate
- Note: Companies which can really implement solutions is considered to be valuable but the FDC is wary of vendor lock-in, which it wishes to avoid
- Providing solutions are viewed as more important than structuring systems
- FDC has provided frameworks for implementation and monetisation

Organisational structure

- FDC has 149 regular and 67 affiliate members (both public and private sectors)
- Had been discussing initiatives for Fukuoka in the subcommittees in the Smart City Section until 2021, and have now consolidated all the themes and started a Smart City Working Group with focus areas:
  - 2012-2016: smart mobility, smart energy, global business / city
  - 2017-2019: healthcare / wellness, town planning IoT utilisation, reformation of work style, new value exchange system
  - 2019-2021: data utilisation solutions, data utilisation integration platform
- Organisational structure of FDC has changed recently:
  - Formerly 4 sections - tourism, food, urban regeneration, smart city
  - Currently 3 sections – industry creation, urban creation, digital. The digital section will discuss how to create a digital platform including data integration in Fukuoka

Example development projects

- FDC supports private companies who wish to conduct trials of new solutions in the Fukuoka area. Example projects include:
  - Using LINE for administrative procedures (e.g. changing address), cashless payment
  - Bike sharing programme "Charichari"
- Doing away with the traditional hanko stamp required on official Japanese documents, so that forms can go digital
- Fukuoka Smart East project at a town in Hakozaki (former location of Kushu University)
  - Creating a model city for the future, greenfield approach
  - Working on 11 areas including mobility, healthcare, life-related services, energy, etc. based on vision of the future of Japan
  - Example projects: selling local vegetables in the boxes located in stations using an app provided by Cookpad (selected by public vote).

Highlights for UK companies looking to work with FDC

- FDC leads the Smart City initiatives in the region and there are already some domestic companies involved. Appears to be open to solution providers that address a specific city need and in making connections with entities (public or private) that can help inform them on how to build global services (e.g. for the startup community)
- Strong interest in startups, relevant to UK companies looking to establish presence in Japan
- May not be as good a fit for UK companies looking to develop large scale DX solutions
  - Application and technology areas seem to be broad ranging but there are relatively few small-scale projects touching on one or more areas, limited to specific solutions. No evidence of solutions moving past trials yet
  - FDC acts as a platform for creating the urban growth strategy for Fukuoka, and has different ambition, resources and power vs Osaka and Kyoto municipal governments
  - Core focus to date has been primarily on improving the area in general, not limited to Smart City nor the application of advanced and cutting edge technologies
  - Recently began running a few small pilot projects on data utilisation, but believes any data platform should be publicly owned
- May be more efficient to work with private companies with existing relationships with FDC rather than approaching FDC directly

KYOTO PREFECTURE

Background

- Capital of Japan and emperor's citizen for 1100 years since 794
- Home to various universities including Kyoto University, one of the top Universities in Japan
- Main Smart City is Keihanna Science City, officially known as Kansai Science City.
  - Began development in the mid-1980s with the goal to use science (and technology) to improve the lives of citizens, mostly through developing a smart grid. This has evolved to include other aspects of Smart City today
  - Concept of Keihanna Smart City – contributing to the world with cutting-edge technologies, triggered by 1970s oil shock which caused serious lack of natural energy sources
- Aiming for the Kyoto approach to a Smart City to be a model for Japan nationally

Approach to Smart City developments

- Key concept:
  - Realising "annnei (安寧)" i.e. peaceful and tranquil society
  - Prolongation of healthy life years – shorten the gap between healthy life years and real life years
  - A Smart City should provide a mechanism where old people can participate in society

Main external drivers for Smart City activity

- Originally driven by 1970s oil shock, which led to the smart grid initiative
- More recent wellbeing-related initiatives are driven by low birth rate and longevity concerns

Main application focus areas

- Originally smart grid back in the 1980s
- Now the focus is on public health, wellbeing and QoL
  - Particularly focusing on improving QoL for elderly people
  - Educating elderly and young people and children with developmental disorders

Main technical focus areas

- Kyoto focuses on being issues driven, not technology driven – i.e. health and wellbeing focused
- There is no specific technology of interest

Known challenges

- Sees a strong need for deregulation for utilisation of personal information
- Currently trialling and looking for ways to improve the participation of citizens, e.g. for the provision of personal information

Thoughts on working with UK

- Kyoto is interested in working with partners like UK companies to share relevant information and case studies, especially for approaches to town development
- Feels that UK is more advanced in working with a universal health insurance scheme and collaborative research approaches

KYOTO PREFECTURE

How it works with partners

- Promotes open innovation approach
- Used to working with universities and companies for collaborative research in cohorts
- Unlike some local governments, Kyoto believes the public sector should play a prominent role to involve citizens in the projects
  - E.g. organised a Smart City Expo in 2021to facilitate collaboration between solution providers and citizens
  - Has Club Keihanna, a voluntary scheme where citizens sign up as members and voluntarily provide personal data for research and development (~3,000 participants)
  - Has the Keihanna Open Innovation Center to connect research institutions
- Has created a business structure to solve social problems
  - E.g. currently building the "Kyoto Big Data Utilisation Platform", split into a number of working groups such as for Smart Tourism, Infectious Disease Control, Data Distribution Acceleration, etc

Known partners

- Known to be collaborating with all of the sectors (i.e. industry, ministry, academia and citizens)
- Public entities include Kyoto University Hospital
- List of Kyoto Big Data Utilisation Platform includes around 140 companies and organisations

Example development projects

- Healthcare related:
  - Pocket Chart: digital clinical record and data analysis, run in partnership with National Hospital in Fushimi
  - Investigating use of mmWave for contactless measurement of vitals
  - Building a "1000 years chart" of DNA databased records
- Technology to accelerate social participation of the elderly:
  - A robotic baby by ATR to help start conversations among the elderly at aged care facilities
- Considering the building of an "Art and Technology Village", based on a concept from France where philosophers, artists and historians define the concept first and then technologies and town planners take the ideas forward
- Other demos conducted using solar cells, e-vehicles, fuel cells using city gas

Highlights for UK companies looking to work with Kyoto Prefecture

- Essentially using science and technology at a city scale, primarily to improve the health and wellbeing of all citizens, with a special focus on improving the QoL of the elderly
- Takes a much more science and research driven approach than other Smart Cities, due to its history as a "Science City"; very experienced at working with University and research groups and provides a strong ecosystem for research
- Open to being directly approached by companies and willing to actively support demos and trials, although it will be the responsibility of the solution provider to determine a business model that generates revenue
- For UK companies, the Keihanna membership scheme and the Kyoto Big Data Utilisation Platform makes it an interesting city for companies looking to make use of citizen data and/or access to various basic open data
- Potential opportunity for digital education solution providers given its focus on educating citizens to help improve their QoL, especially for the elderly and children with developmental disorders
- Very interested in hearing about relevant case studies, especially ways to encourage citizens to participate in projects and share personal data

Osaka Prefectural Government

Background

- Selected as a Super City-type National Strategic Special Zone in March 2022
  - Both Osaka City and Osaka Prefecture are synonymous with the Osaka Super City
- Second largest city after Tokyo with a long history, centre of Western Japan
- Osaka (or Japan) is behind in national Smart City rankings (Tokyo: 79th, Osaka: 80th)
- Has a Smart City Strategy Department
- Undertaking large number of small and large projects across the prefecture with new policies to support future initiatives as part of its Super City plans
- There have been two versions of Osaka's Smart City plan, Version 1 released March 2020, Version 2 launched March 2022 with modified and additional goals:
  - V1: Collaboration between public and private sectors (which transformed to the creation of an ecosystem between public and private sectors in v2), from demo to implementation, improve QoL of citizens
  - V2: added Strengthening urban immunity and promotion of DX and expansion of the need to solve social/local issues as a business

Main external drivers for Smart City activity

- While Osaka is working towards a 10 year plan to 2030, the World Expo in Osaka in 2025 will be a major milestone, intended to be a "testing ground for future society"
- Many projects and initiatives today are intended to be exhibited in 2025, including a health focus for "Osaka Smart Health City 2025"
- Highlights a need for digitalisation. Osaka was ranked low in digitalisation of office work in Japan and there is large disparities across municipalities in Osaka Prefecture, so many projects are related to DX
- Also cites COVID as a cause of lifestyle changes for citizens, which has led to a new focus area to strength Urban Immunity – i.e. mitigating risks to urban life with technology
- Social issues which centre around low birth rate, aging population, decrease of working age and the need to regenerate aging infrastructure and need for new towns

Approach to Smart City developments

- Osaka Prefecture and Osaka City are working together on various projects to accelerate smart city, actively collaborates with companies, academia and other municipalities
- Sees local government's role as the promotion of strategy and execution, the role of municipalities is to act as cores for demonstration projects, and companies and academia to support the demos and do the implementation
- Osaka Smart City Partners Forum is responsible for leading individual projects. It has >400 members (320 corporate members)
- Most important theme is improvement of QoL for citizens
  - Aiming to achieve a more convenient and rich urban life for citizens, designing a future society where people are more active
- For DX, the private sector is expected to collaborate with individual municipalities. Osaka City and Osaka Prefecture will support through joint procurement and dispatch of advisors
  - Note: some municipalities in Osaka Prefecture are now advanced in digitalisation: Toyonaka City, Osaka City, Sakai City
  - Osaka DX initiatives are now intended to lead national policy in Japan for DX

Main application focus areas

- DX: doing at the administration, local and urban levels, led by national government. Includes development of DX infrastructure
- Cashless payment
- Mobility – e.g. AI on demand transportation
- Logistics
- Medical
- Healthcare – e.g. experience of future diagnostics and future medical care in Expo, demonstration and implementation of future healthcare at the incubation hub called "Future Life Park"
- Tourism
- Infrastructure
- Aging population
- Raising children
- Education
- Safety
- Disaster management
- Town planning
- Industry

大阪府
Osaka Prefectural Government

Main technical focus areas

- Technologies that are growing development areas for Osaka include:
- Next gen service tech: AR / VR, MaaS
- Drone delivery
- AI
- 5G
- Online diagnostics

Example development projects and initiatives

- Plans for / undergoing multiple initiatives / projects in each application area
- Strong focus on ICT and DX related projects and initiatives
- Notable examples:
  - ORDEN: wide area data integration platform to link to City OS data, first time a wide-area municipality has its own data integration platform
  - Working with DNP on MaaS services in Wide Area Cooperation Super City Initiative in Kishiwada City, Osaka
  - Smart Health City Plan: using ICT technology across the prefecture through PPP to improve QoL, including services for the elderly though the Smart Senior Life project. This initiative was still calling for proposals in Jan 2022
  - DX for govtech
  - AI for on-demand transportation

Known challenges

- A survey showed Osaka's scores in the areas of mobility, e-voting system, etc. were comparatively low (note: the survey was conducted just during COVID19 pandemic)
- While DX is now being taken seriously by local government, there is still a wide gap between where Osaka is today and where it wishes to be

How it works with partners

- Smart City projects are conducted through the Osaka Smart City Partners Forum (OSPF), which is overseen by the Smart City Strategy Department
  - Matching the municipalities which have social problems and the companies which have the ability to solve the problems
  - In 7 areas, 16 municipalities have/are working with 27 project coordinator companies
- Building on the success of the Smart City Partners Platform, Osaka is committed to setting up an ecosystem where public and private sectors collaborate together

Known partners

- Large list of partners can be found in the OSPF website and in promotional material on smart city projects
- Example private sector partners include: Hitachi, DNP, NTT Docomo, Panasonic, Toppan, NEC, SoftBank, Iwatani, Microsoft, MS&AD Insurance Group

Thoughts on working with UK

- Companies that have good solutions for the social problems in Osaka would be welcomed

Highlights for UK companies looking to work with Osaka Prefecture

- Osaka is a key test bed Smart City / Super City in Japan. A UK partnership project with Osaka City in particular could act as a strong promotor for more UK-Japan partnerships
- Wide range of project application areas, all with a strong focus on ICT technology
- More ambitious than others when it comes to DX technologies it is willing to support, e.g. ORDEN
- Demonstrated more experience at working with the private sector than other cities
- However as with other Smart Cities, while UK companies are welcomed, there is little evidence of existing partnerships with companies outside of Japan so there may be challenges if approaching the local government directly
- Best route to collaboration would be through working with a private sector partner who is already in the OSPF

4. Private sector activity

Introduction

Activity by industry

Level of involvement, investment and clarity of purpose varies widely across the private sector, though all agree that Smart City projects are worth investing in for society and national strength

- There is naturally a significant overlap between the public and private sector activities in the domestic Smart City landscape. Most major well-known domestic companies with digital solutions are already engaged in municipal government led Smart City projects. Therefore, the private sector shares a number of key application areas and technologies with the public sector.

- Some companies are also working on developing offerings independently. This is true across the landscape, for service, software and hardware providers.

- As mentioned in Section 1, some companies are building their own Smart Cities (e.g. Woven) and Smart Areas (e.g. OMY) at a much smaller scale, usually consisting of privately owned buildings. These are used as test beds for new connectivity platforms, services, business models and implementation approaches.

- Many view working on Smart Cities as contributing to society and national strength. This aligns with corporate social responsibilities. In addition for some, especially the telecomms and infrastructure companies like NTT, it is beneficial even if there is a net profit loss because if the local economy weakens, this would adversely affect its main business.

- As part of this study, seventeen interviews were conducted with representatives from each of the following four industry sectors that are key to Smart City developments:

  - Construction and infrastructure (including energy)

  - Real estate and housing

  - Digital connectivity (including data platforms, telecommunications)

  - Financial services

  - Other service and equipment providers (including sensors, robotics, AV)

- The level of involvement, investment and clarity of purpose varies widely across the different industries. For example, the construction industry is still trying to identify ways to add value that complements their existing business, while the digital platform providers like NEC, Accenture and NTT Data have developed a multitude of City OS type platforms and are key to all top tier domestic Smart Cities.

- The following pages provides an overview of the key roles and activities undertaken by the different industry sectors. It also highlights specific challenges most relevant to each sector.

- As with the public sector, the key application areas and key technologies listed are those of some interest to these industries. The level of investment and maturity are still relatively low. Most applications and technologies have not yet reached the proof of business model stage. Some are areas that companies are intending to invest in within the next year, but have not necessarily done a PoC.

- Note: A summary of general challenges common to all sectors is detailed in Section 2 above.

CONSTRUCTION

Activities

- **Role in Japan Smart Cities:** Focus on "Smart Area" approach – believe private companies should be responsible for preparing "area platforms" and city governments should focus at the city level. Aims to create functional urban, regional, and industrial infrastructure capable of meeting new needs, developing sustainable and long-lasting social infrastructure, providing technologies and services for disaster preparedness that support safety and security, and contributing actively to society's transition to a carbon-free footprint

  – Typically gathers data and provides Smart Area services to customers (e.g. building owners and tenants), building users (e.g. visitors, office workers, shoppers, etc.). For both private- and public-led Smart Cities, construction companies are also developing ways to improve the construction process, making it safer for workers and less disruptive to local citizens. Companies not only build buildings, but also infrastructure to enable data collection, as well as data analytics to enable service offerings during design though to the construction and operation of the building.

  – Note: There is a general struggle for construction companies to understand what they can do in Smart Cities (see Challenges)

- **Key application areas:** Wellbeing and health (of building users), Mobility and MaaS (modelling flow of movement and transport, transport infrastructure), Disaster management / resilience, DX, Sustainability (including carbon neutrality)

- **Key technologies:** Digital platforms, Data collection (sensors), Data Analytics and AI, especially digital twins, Robotics (in construction), Technologies to help maintain transport infrastructure, e.g. electric vehicles, buses, drone delivery

- **Typical Smart City services:** Area management platform service, Smart energy system, Smart building management (BIM*), Air quality sensing / HVAC management, Disaster management systems and disaster simulation using digital twins for building design and scenario planning in completed buildings, Smart construction (i-Construction, CIM**) – using digital technologies to plan, manage and do construction projects safely, securely, efficiently while minimising disruptions to locals – e.g. impact to local traffic, noise, etc., using more sustainable materials, recycling build materials, construction of renewable energy plants. In complete buildings, implementing sensors and models for managing human traffic, ZEB[#], sensors to monitor structural health

Challenges

- General struggle for construction companies to understand what they can do in Smart Cities. They are trying to apply technologies and services they have already done in the construction area.
- Struggling the most to identify products and services that not only offer value to city citizens or customers, but also lead to revenue and profit
- Difficult to link potential Smart City offerings with the main construction business
- Recognises value of data for improving lives but cost of sensor systems and data privacy are barriers
- Not seeing technology challenges, all necessary technology is mature

Opportunities for UK companies

- Carbon neutrality is a big theme – looking for partners, want UK companies to bring their experience around carbon reduction regulations in Europe, think Europe is more experienced and more advanced in relevant technologies and approaches
- Want partners with good visions of what they could do with their technologies. Interested in learning about service development and how to add value to the main construction business
- In particular, need help with understanding how to get / deliver value with advanced technologies. Building sustainable businesses around AI would be especially interesting
- Does not need help with technology development

*Building Information Management **Construction Information Management [#]Zero Energy Building [##]Haneda Innovation City, Smart City project at Haneda Airport

REAL ESTATE AND HOUSING

Activities

- **Role in Japan Smart Cities:** Provide housing, commercial buildings and Smart Area management services and guidelines to benefit building (or area) users, including tenants, citizens and business owners. Overlaps with construction companies in their roles, although real estate and housing companies tend to focus more on BIM, BMS*, area management and rental services, less on CIM; many feel responsible for preparing a platform to manage data but will not take ownership of the data. Many act as a coordinator and aggregator, ecosystem builder and manager, using their platforms to connect users with service providers. Partners would be responsible for design, test and implementation of services for building users. Some companies will also provide and / or support service providers through data collection infrastructure and data gathered from the estate, but some will not have data of their own. Current activity also includes updating and retrofitting estates to align with Smart City goals. Looking into interfacing with wider Smart City and government digital systems in the future

- **Key application areas:** Wellbeing and health (area design, air quality management), Mobility and MaaS (frictionless movement, pedestrian routing through buildings, transport through buildings and estates, and connections with other transport services), Elderly QoL (accessibility, general enjoyment of area), Disaster management / resilience (digital twin scenario planning and estate design), DX (more BIM, BMS, and retrofitting systems for building / area management), Sustainability, especially renewable energy urban developments, NZE** towns and ZEB/ZEH# with renewable energy plants to help hit targets for environmental sustainability, Attracting tenants, visitors and MICE events (especially for real estate companies). Note: Area management / public initiatives includes many non-SC initiatives, e.g. landscaping

- **Key technologies:** Technologies needed are often simple technologies – e.g. lighting for flexible zoning, digital signage, smoother road surfaces. Most work with partners to offer digital platforms and DX, usually through partners like NTT Data (e.g. for City OS type platforms), some implement Data collection technologies, most will develop / have some form of Data analytics and digital twins technology, e.g. for disaster scenario planning, BIM, BMS, etc. Technologies to enable ZEBs / ZEHs / NZE towns / etc are also important. There is interest and an expectation for applications of more advanced technologies in the future, especially AI, drone photography via 5G, robots with cameras and sensors to collect data, autonomous vehicles including autonomous taxis and medium speed personal mobility vehicles

- **Typical Smart City services:** BIM, BMS, local area-type City OS, creating partnership groups / consortiums to create / upgrade Smart Areas (see Role description above)

Challenges

- Similar to construction, companies feel there is no clear answer to a sustainable business offering within Smart Cities

- Points of view and approaches being used across Japan vary widely, making it difficult to define a business offering. Believe Japanese government cannot unify Smart Cities (and Smart Areas) to 1 platform; various platforms will be developed and will need to eventually connected through APIs

- Platform and technologies are not enough. Need manned IT counter to help users. Need ethics committee to discuss how to manage the platform – this is more important than any technology challenges

- Deregulation will take time

Opportunities for UK companies

- Industry is still in the information gathering phase, to decide what to do

- Looking at open innovation, sees no barrier to working with UK companies and sees UK as a good source of startups

- Sees governance and regulations as where UK could contribute experience and expertise, especially in defining incentives and roles for different types of partners and informing on any international certifications and standards.

- Interested in knowing about foreign Smart Cities that can act as models for Japan Smart Cities, especially examples of sustainable development of DX solutions

*Building Management System **Net Zero Energy #Zero Energy Housing ##Otemachi, Marunouchi, and Yurakucho Area Management

DIGITAL CONNECTIVITY

Activities

- **Role in Japan Smart Cities:** Key role in developing and managing platforms and systems for City OS, usually for construction and real estate companies, for private and public Smart Cities. Often acting as system aggregators, helping to connect Smart City governance bodies with service providers. Major players like NEC and Accenture also work with partners to lobby government and influence and / or recommend national policies, standards and regulations
  - For telecomms and infrastructure companies like NTT, it is beneficial to work with municipalities because if the local economy weakens, this would adversely affect its main business. Working with municipalities contributes to society and national strength
  - Generally calling for countries and companies to collaborate and not compete, focusing on sharing costs with municipalities and not on profit at this stage to help move Smart City developments past PoCs
- **Key application areas:** Offerings are for DX, mostly as City OS type platforms and related communication technologies. However, these would then serve all other Smart City application areas
  - Mainly aims to enable aggregation of local services to reduce costs associated with maintaining many disparate services and to reduce the burden on citizens
- **Key technologies:** Digital platform and cloud technology, DX operational technologies, including 5G/6G, Big Data analytics and AI
  - Specific technologies needed now include technology for secure transfer and translation of data and authentication technologies (see Challenges)
  - For 5G/6G technology, NTT data provides the domestic network infrastructure upon which all Smart City technologies are built
- **Typical Smart City services:** Development, management and maintenance of digital platforms, including City OS, data linkage and data integration platforms, Data storage and management services, Data architecture guidelines

Challenges

- Services have been developing for decades, yet these are still evolving and no Smart Cities "killer app" has been identified
- Struggling to drive adoption by citizens and local governments
- Difficult to generate revenue from public projects; work with municipalities require much more effort than similar work for private real estate assets, but revenue is mostly from private real estate assets. Sees limited cases where there is a real intention to move past PoC
- Feels like the necessary data linkage and utilisation has stalled – need to develop rules for linking data and form a consensus among citizens, need leading examples of Smart Cities in Japan and abroad
- Tech urgently needed now:
  - Technologies that ensure secure storage and transfer of large volumes of data, data translation services and authentication delivery functions
  - Need security technology for authentication and opt-in for data sharing
- Greatest challenge is the need for deregulation and reform around data privacy, including the establishment of an accredited organisation(s) that can help operate Smart City systems in the future

Opportunities for UK companies

- At this stage any UK companies with relevant experience in relevant technologies such as data / data integration platforms and security technologies, especially international regulations, standards and systems like FIWARE, including deregulation policies, would be of interest to all major domestic players in this industry

¥ FINANCIAL SERVICES

Activities

- **Role in Japan Smart Cities:** Working with technology providers to create financial service solutions related to Smart Cities. Still defining and evaluating the business value of Smart City business but most companies help develop digital local (token) currencies. Financial companies typically take on the advisory or orchestrator role, bringing their knowledge of the financial systems, regulations and needs. Technology partners are responsible for development and implementation

- **Key application areas:** Regional rejuvenation through attracting tourists and visitors is the main application area, in the form of establishing local currencies. DX of the banking service in the form of digital payments or a cashless society is another popular application area relevant to Smart Cities. Some companies like SMBC are applying technologies like secure information storage ("Information Banking Service") to other Smart City services, such as the management and storage of hospital data

- **Key technologies:** Digital platform and cloud technology, Data collection and storage, Data analytics, Digital security. Do not see a need for sensor technology for data collection within Financial Services. Interested in prediction technology in the future for services and data analytics

- **Typical Smart City services:** Issuance and management of local (token) currencies, digital payments and digital banking. Some like SMBC also offer secure data management services

Challenges

- Struggles to find social issues that can be solved by financial services; improving QoL through using financial data is challenging. Not interested in collecting all the data possible, but to use the data available in a useful manner and identify ways to obtain the data needed

- Struggles to identify sustainable business models and ways to make profits. No existing synergy with main banking business

- Rely on partners for technology development, still uncertain how much involvement is correct for financial institutions. Can be difficult to get exactly what is needed from technology partners

- There are too many digital currency / small payment models – challenge in standardising a platform

- Ethics surrounding data privacy still being discussed

Opportunities for UK companies

- Limited opportunities for UK companies. Developments are still early stage and not at the point of discussing concrete initiatives with foreign companies

- Interested in people who are familiar with banking laws in Japan, and can advise on how to lobby for deregulation in this environment

- Note: Many banks are not interested in expanding their service overseas, more interested in improving current domestic services. E.g. Information Banking is considered to be a uniquely Japanese approach and cannot be easily deployed overseas

OTHER SERVICE AND EQUIPMENT PROVIDERS

Activities

- **Role in Japan Smart Cities:** Service providers provide services to citizens and / or governments that connects to City OS type platforms. Equipment providers will supply to service providers and other industries to enable and deploy Smart City solutions, such as robots for construction, logistics and city services and sensing systems for data collection

- **Key application areas:** There are service and equipment providers for all application areas but Disaster management / resilience is a highly popular application area for many rural Smart Cities, with many service and equipment providers. Other services relating to Wellbeing and health, Mobility and MaaS, Elderly QoL, and Reginal rejuvenation and tourism are also popular. For equipment providers, technologies that enable DX (e.g. sensors) and those that address decrease in working population (robotics and automation) are popular. Sustainability is also a popular application area, especially for those that provide technologies for renewable energy generation, storage and energy management

- **Key technologies:** Digital platform and cloud technology (created by the service provider, separate to the City OS, or service subsystems that sit on top of the platform layer), Data collection, including IoT, sensing, and Data analytics and AI (although this is usually done by a service provider, not necessarily provided by equipment suppliers), Autonomous vehicles and robotics (mostly equipment suppliers, although transportation on demand services are being tests in urban Smart Cities), Security and authentication devices and services, decarbonisation technology (including technologies for utility providers, solar panels, energy management systems, hydrogen technologies)

- **Typical Smart City services:** Wide range of services offered. In addition to those listed above, other examples include drone delivery service and equipment, robotic delivery service and equipment, digital services that aggregate local area information for citizens like store opening hours, traffic, etc., sensors and equipment for smart construction, city services, remote health services and disaster reconnaissance, management and recovery (for natural disasters such as earthquakes, floods, and disease outbreaks), ride sharing and transportation equipment sharing services

Challenges

- Data and platforms are not standardised, meaning lots of data clean up and / or service / system customisation is needed if solution providers need to interface with existing ICT systems and / or City OS type systems

- Many local governments are still behind on technology adoption. Expect rural areas to advance the slowest. Companies need to work with and invest in helping municipal governments improve their systems first

- Local businesses, schools, etc. are still not digitally native, so a challenge today is still data acquisition for services that rely on this data

- Can be difficult to run PoCs in cities with more complex urban environments to navigate. Rural environments often value certain services more, with fewer complexities to manage, making it easier to deploy there (e.g. drone delivery)

- For many technology and service providers, it is too difficult and inefficient to target municipalities directly. Difficult to generate revenue. Preference is to work with private sector partners who are already connected with municipal government, or who can provider other parts of the solution such as operational and integration services, mass manufacturing, etc.

- As with many others, there is a general challenge around companies trying to tackle Smart City problems in a way that aligns with its existing capabilities, in a profitable way. E.g. traditional hardware providers are struggling to identify successful service models

Opportunities for UK companies

- Companies are open to working with UK companies that can help create a monetizable Smart City solution, especially those with experience of commercially successful Smart City deployments outside of Japan

5. How could UK companies get involved

Why should UK companies get involved

Main types of Japan Smart Cities

Perceived benefits and barriers to overcome

Recommended approach and messaging

Japan would be most attractive for UK companies with experience of international Smart City standards and successful DX solutions, those wanting a supportive environment to test PoCs, and those offering disaster-related solutions

Japan presents an attractive option for UK Smart City solution providers for a few key reasons:

- **Strong need to learn from those with experience:** Japan is aware it is behind Europe in regulations and standards, and that it is playing catch up in digital platform solutions. There is great respect for any entity with experience or knowledge of service solutions that address societal problems. Both the public and private sectors are clear that they are willing to collaborate with foreign companies and learn from international best practices.

- **Supportive municipal governments:** These are comparatively open to supporting technology trials and are willing to work with both small and large companies. In particular, public-led Smart Cities often looking for partners that want to demo services and technology in their cities. People with experience elsewhere that can help municipal governments to promote solutions to citizens and overcome the privacy concern barrier are also welcomed.

- **Potential to influence the direction of the ecosystem:** Now is a good time to join the ecosystem. There is a clear opportunity for helping to shape the policies, standards and regulations for all Japan Smart Cities if the right networks and consortiums can be accessed.

- **Wide range of potential customers and partners:** Given there are already around 100 Smart Cities in Japan, ranging from small rural areas to large urban cities and prefectures, and that most major domestic companies are already working in this space, there is a wide range of potential customers and partners.

- **Private sector need co-creation partners:** Similar to municipal governments, domestic companies are also keen to work with international partners with experience of creating successful Smart City solutions, especially revenue-generating services and data platforms. The private sector is not only interested in solution providers but also co-creation partners.

- **Strong telecommunication infrastructure:** Japan's telecommunications network is one of the most advanced and reliable in the world, which is essential to most Smart City solutions.

- **Opportunities for disaster-related solutions:** Japan is a particularly good country for companies developing / offering technologies for natural disaster monitoring, prevention and recovery. It is located in the Pacific "Ring of Fire", a region characterized by severe seismic activity. Japan is subject to earthquakes, tsunamis, typhoons, cyclones, volcanic eruptions, flooding and mudslides. With the advent of the COVID-19 pandemic, disease control is now also part of many cities' list of concerns. There is a great need for solutions that can help avoid, mitigate and recover from natural disasters. This, coupled with the impressive telecommunications infrastructure, makes Japan an ideal choice for PoC trials and business development for companies providing high tech disaster-related solutions.
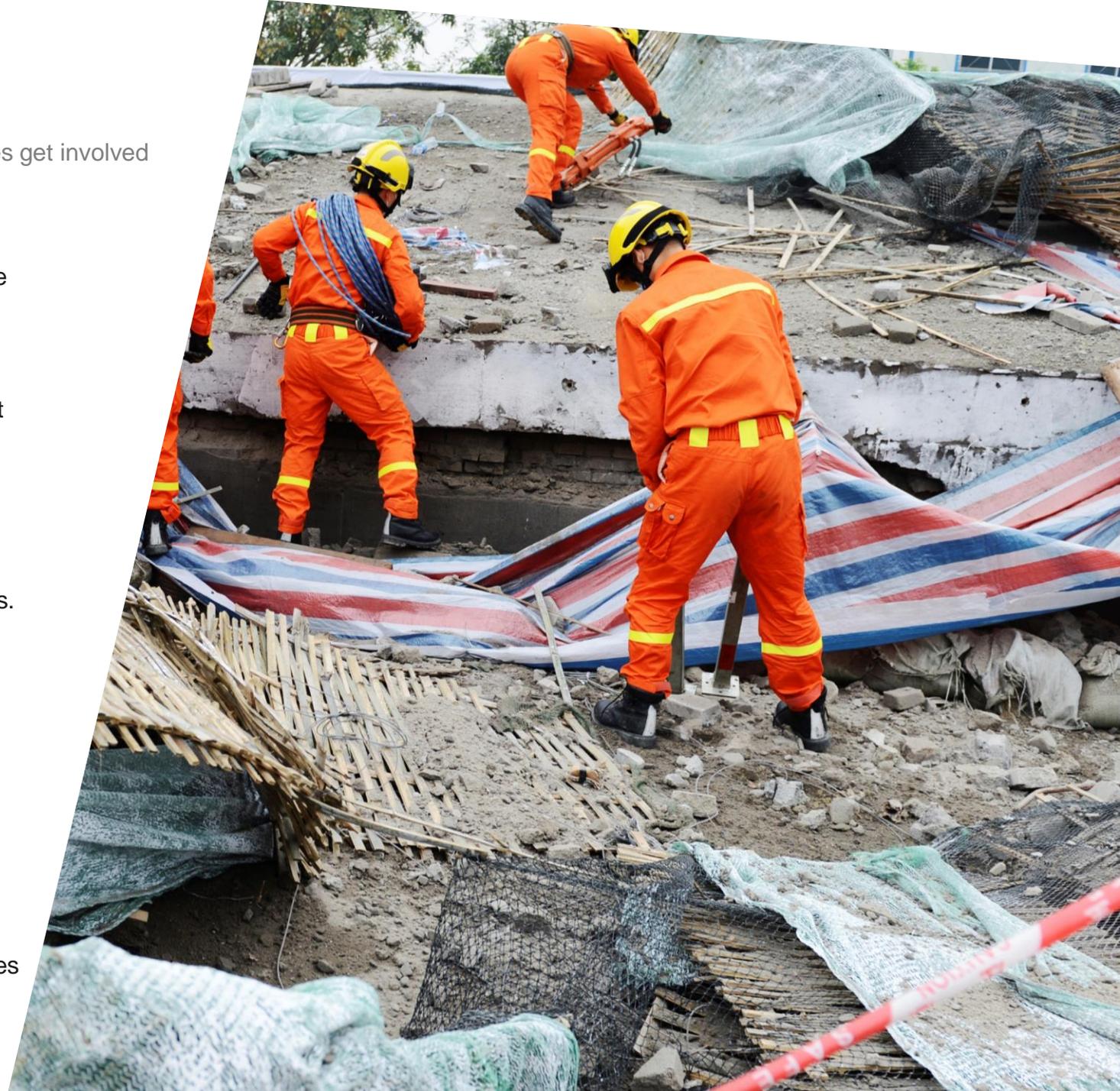
As touched on throughout this report, there are two main types of Smart Cities in Japan which operate using different business models and present different opportunities for UK companies

PUBLIC-LED / ADMINISTRATION-LED SMART CITIES

Activities are initiated by municipal governments who will be responsible for creating or overseeing the development plan.

Uses the public-private partnership model.

Takes the government-promoted human-centric approach by first identifying the social agenda/issue, then identifying the technology solution from anywhere in the world.

PRIVATE-LED / AREA-MANAGEMENT TYPE SMART CITIES AND SMART AREAS

Activities are initiated by either:

1. Private company
E.g. Woven City led by Toyota, Fujisawa led by Panasonic

2. Real estate company
E.g. Otemachi, Marunouchi, and Yurakucho Area Management

These frame their activities in the same human-centric approach as public-led Smart Cities but the activity in many private-led Smart Cities is also driven by the desire to add value to a property development. Technologies and smart solutions are developed and implemented on a project-by-project basis.

Of all the reasons why UK companies should consider entering the Japan Smart City ecosystem, there are a few key perceived benefits from Japan's side, and barriers to overcome

Key perceived benefits to working with UK companies

- Believes international partnerships and experience from international Smart Cities – especially world leading cities like London – is key to helping Japan's private and public sector identify Smart City solutions that are valuable to citizens and businesses. This would solve one of the biggest problems in Japan today.

- Believes Europe is more advanced in making policy and regulations to guide Smart City developments. Europe moves faster than Japan and are leading the way in making rules that allow for more innovations. In particular, Japan's personal data privacy regulations are expected to follow Europe's GDPR.
  - As mentioned above, both the public and private sectors see UK companies and public bodies as a potential source of inspiration and co-creation partners.

- The biggest concern with engaging foreign companies for the public sector is the language barrier. Most municipal governments have had little experience in collaborating with foreign companies. Those who have, have typically had difficulties and are hesitant to work with foreign companies again.

- For both private and public sectors, a major barrier to collaboration is that they are not familiar with British offerings and capabilities. Most do not know what UK companies would be good at for Smart Cities, especially in relation to other European countries for technologies and regulations like FIWARE.

Key perceived barriers to working with UK companies

UK companies will find it easier to enter the ecosystem by targeting private companies instead of municipal government

- As mentioned above, there is a wide range of potential customers and partners in Japan. However given the complex and fragmented ecosystem and the preference for governments to work with Japanese companies, it is hard for UK companies to enter the market without an existing network.

- Therefore, where possible, UK companies are advised to target private companies who are already investing in Smart City developments and already part of Japan's ecosystem. Large companies would have the resources to buy or co-invest to co-create technologies and services, unlike municipal government. These companies will provide the connections to municipal governments where necessary, and act as a go-between. Furthermore, companies are typically less hampered by the language barrier mentioned above.

  - Advice is to work with large corporations or entities like Japan Post who own the problem to be solved. They can more easily convince regulatory departments and get a demo going with their political influence, or implement a solution at scale.

- Some UK companies may wish to work with municipal government directly and may have reasons to not want a commercial partner, or wish to work with local government directly for trials and demos. In these cases it is important to take note of the perceived barriers mentioned above. These companies are strongly advised to:

  - Make efforts to minimise the languages barrier, e.g. by making use of Japanese staff or third party resources.

  - Take time to understand the local citizen needs, Smart City development plans and administrative structure, e.g. working groups, to make sure the solution being offered fits with the city needs and identify what existing partners and competitors may already exist.

  - Understand that the cost of demos and trials will most likely be borne wholly or mostly by the company because most municipalities have very little funds. More money may be available for supporting implementation work and for purchasing complete solutions.

  - Understand that almost all Smart Cities in Japan take the brownfield approach, so companies offering solutions that require overhauling an existing system(s) is advised to focus on cities with greater ambitions such as Osaka, and to target companies that work with foreign greenfield Smart Cities.

- It is believed that UK research institutes and think tanks would find it relatively easy to gain the ear of public and private entities, including industry consortiums and possibly JP government, if they have learnings from success stories to share.

Messaging should highlight what societal need(s) and government initiatives the solution addresses, make references to government initiatives and guidelines, and highlight successful use cases

For all UK companies (and others) looking to enter the ecosystem, there is great advantage to tailoring the messaging on the benefits of its offerings. This is especially important to companies reaching out to municipal governments directly.

- **Frame the solution in terms of what societal need(s) it addresses:** It should fit with the vision-driven value-add approach to Smart Cities (see Section 1 for more details)
  - Should help revitalise the local economy and improve the wellbeing of citizens
  - When approaching a municipal government directly, this must be **specific to the municipality** (see Section 3 for examples)
  - Especially important for solutions that require citizen participation or private data. Local governments are wary of having too many "pushy" services of limited value to citizens.

- **Make references to government initiatives** that the solution would fit within or help realise, such as the Digital Garden City and Society 5.0 (see Sections 1 and 2 for more examples).

- **Explain where the solution would sit within the Smart City Reference Architecture and City OS** if applicable.

- **Highlight use cases and / or business models** that make the solution a sustainable commercial business.

Now is a good time for relevant UK companies to get involved as all stakeholders are staring to invest more seriously

- Ultimately, Japan's Smart Cities are somewhat lagging behind the most advanced Smart Cities in the world like London. The Japanese government is driving for accelerated progress to catch up.

- Now is a great time to get involved because there is a clear push from national government in recent years and all stakeholders, public and private, are starting to invest more seriously. Significant progress is expected in the next few years, especially in digital GovTech, CivicTech and City OS type systems.

- The UK has a good general reputation for technology and is seen as having more experience in Smart Cities than Japan. However, most do not know the specifics of what UK's strengths are. More work is needed to communicate and promote UK Smart City capabilities.

- Right now there are many domestic players and activities are modest in scale. However, Japan's ambition is to be a world leader in Smart Cities and today's concepts and plans are on par with some of the most advanced cities in the world. This presents a number of opportunities for UK businesses, and an opportunity to be involved from the ground up in defining new policies and regulations for all future Japan Smart Cities. Now is the time for companies to support the ideation of valuable applications, not just in delivering technology solutions.