Special Lecture 'Architectural and Urban DX'

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International Conference on Architecture and Urban DX

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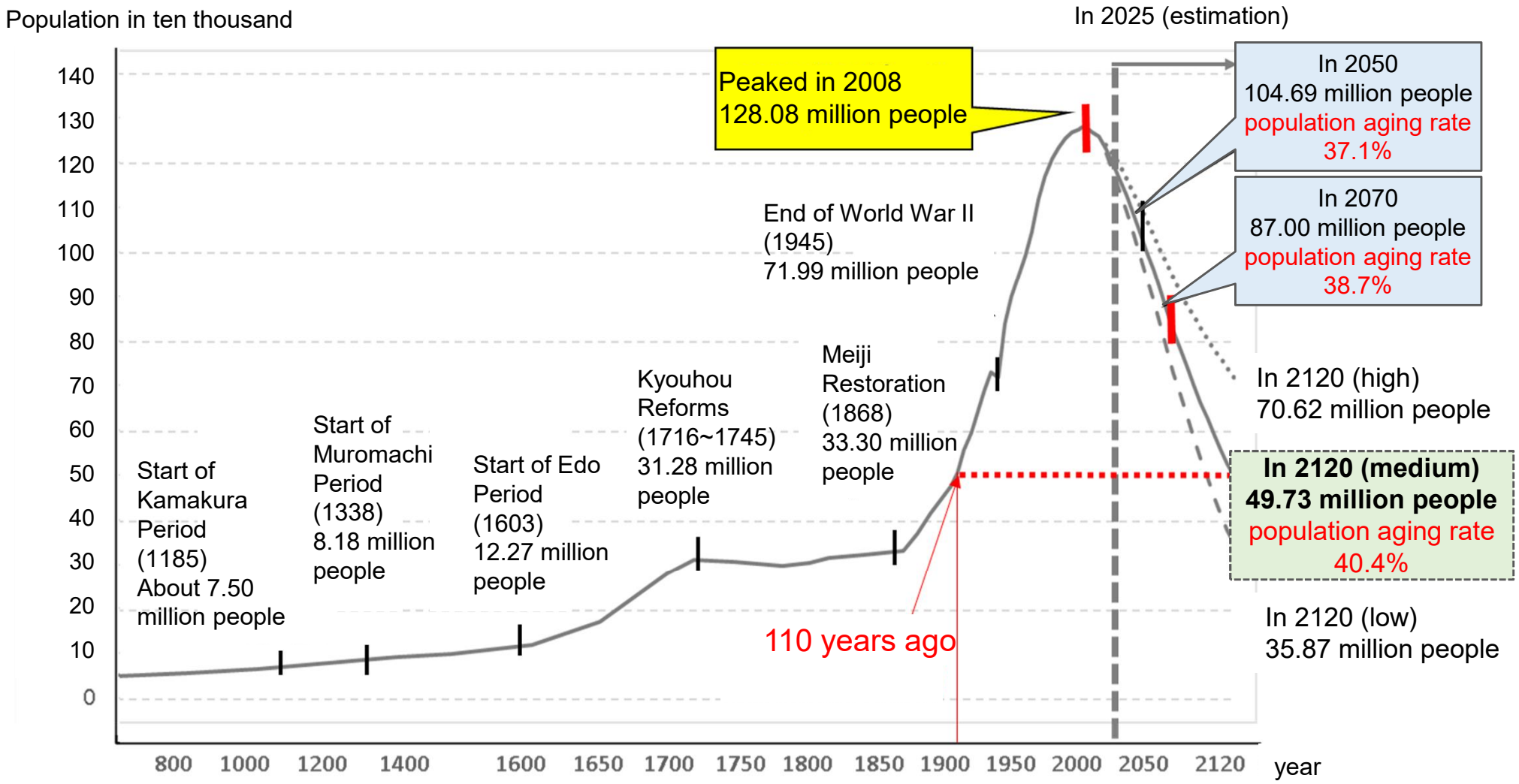
1. The Significance of Promoting DX in the Architectural and Urban Sectors in Japan

Long-term trends in Japan's population

Japan's population **is likely to** peak in 2008 and **return to the level of about 110 years ago over the next 100 years**. In addition, **the ageing rate** is expected to **remain at around 40%**.

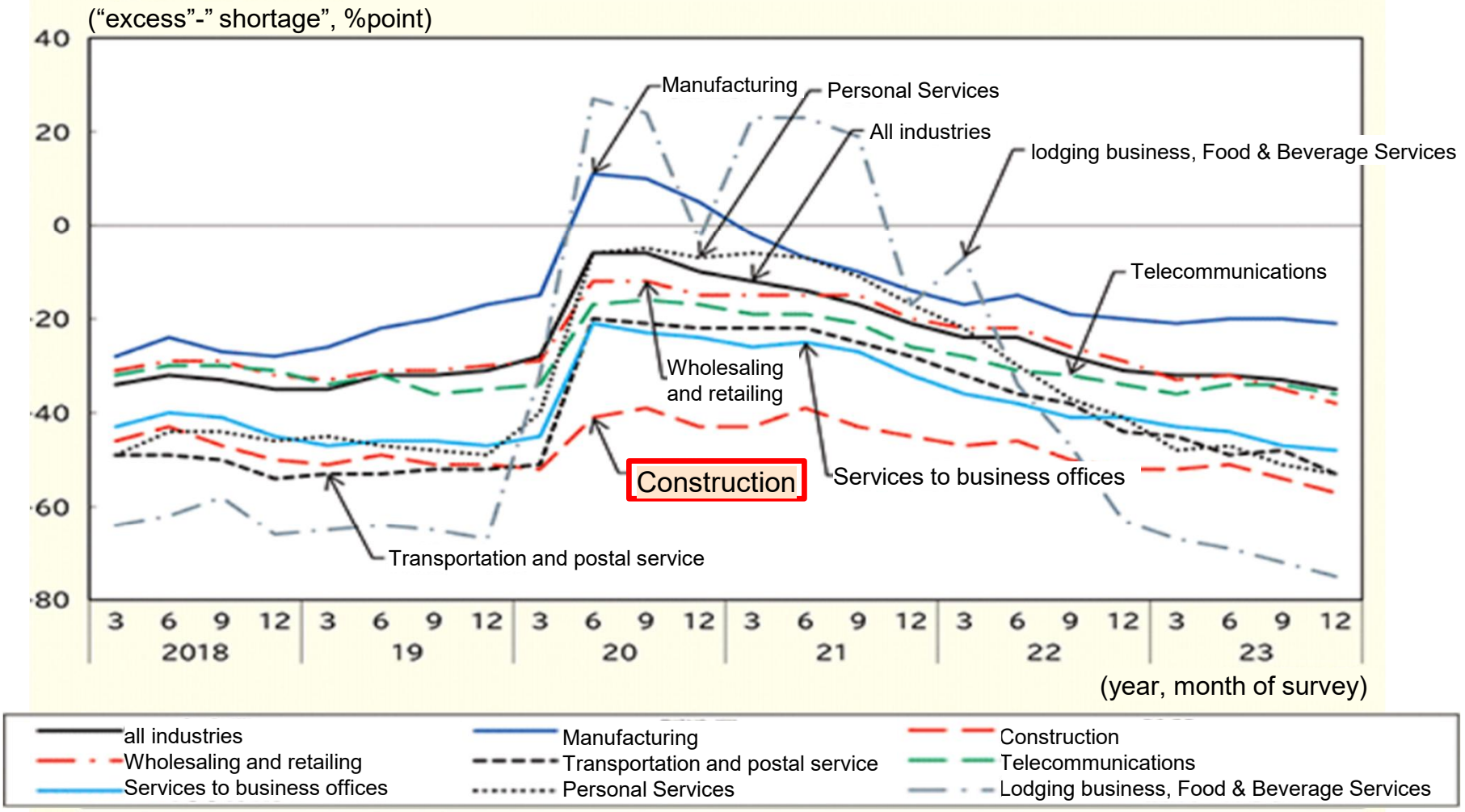


Source: Before 2020, based on the following;
・"Census" and "Interpolated corrected population based on 2005 and 2010 census results" by the Ministry of Internal Affairs and Communications,
・"Long-Term Time Series Analysis of Population Distribution in the Japanese Islands (1974)" by (Japanese) National Land Agency.
After 2025, based on the following;
・"Population Projections for Japan (2023 Estimates)" by the National Institute of Population and Social Security Research

Severe labour shortage in Japan.

The problem of **labour shortages is becoming more serious**, particularly in the **construction industry**, where there has been a consistent shortage of labour throughout the pre- and post-COVID19 period.

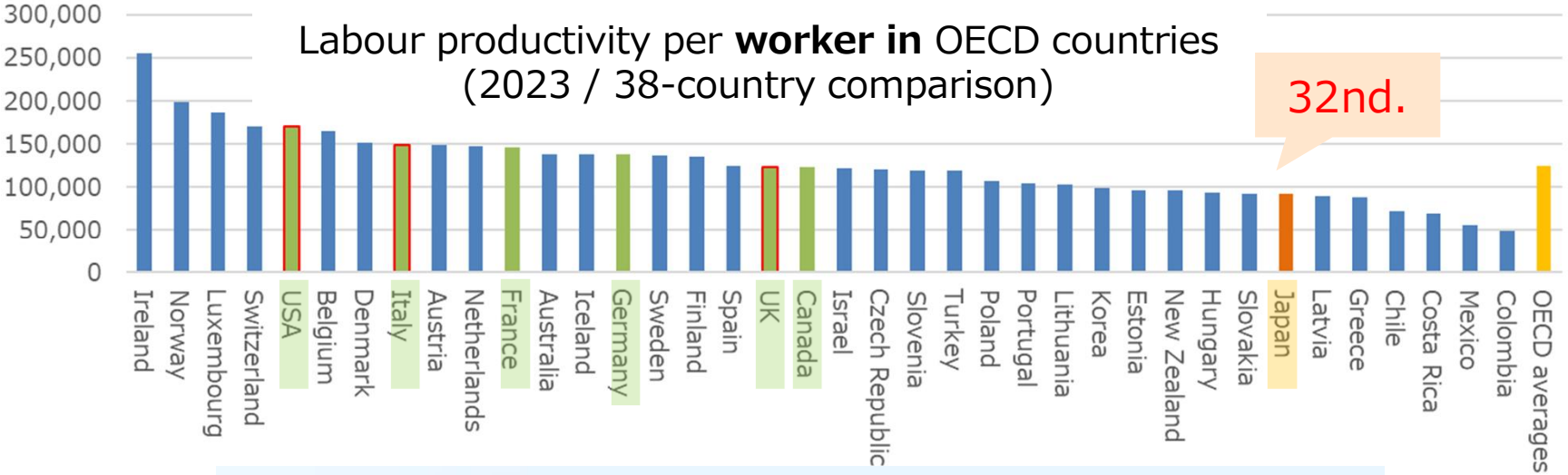
(1) Transition of Employer Judgment D.I. by industry



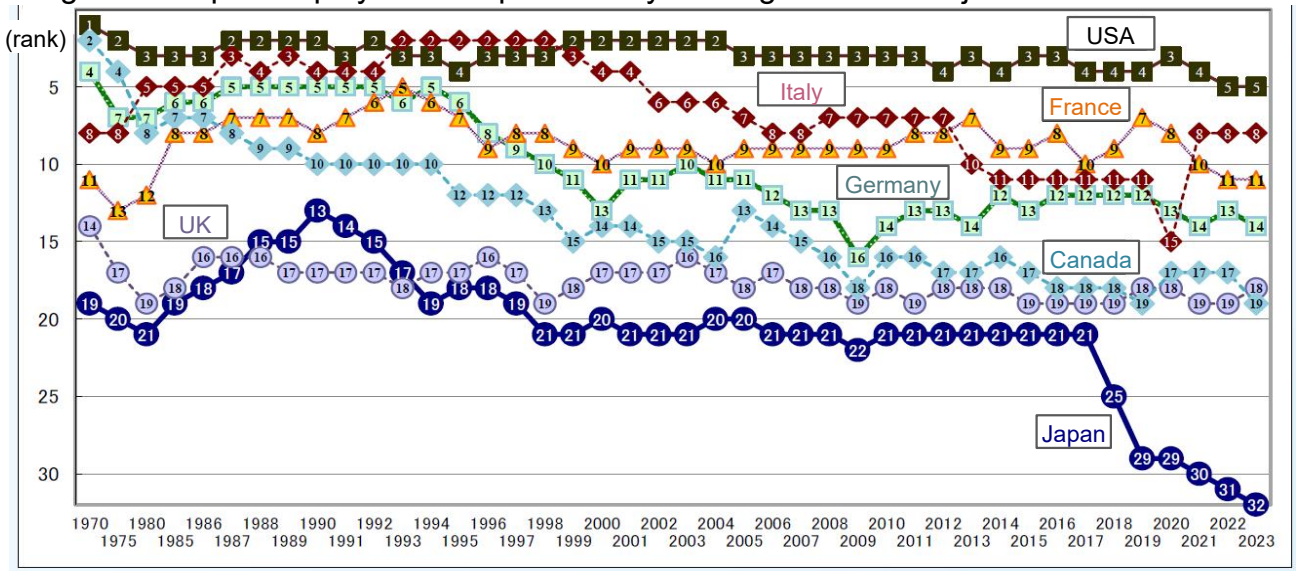
Source: 2024 White Paper on Health, Labour and Welfare.

Current state of labour productivity in Japan.

<u>Japan's labour productivity per worker ranks 32nd</u> out of 38 OECD member countries (lowest among the G7) and **<u>has fallen further</u>** since 2018.



Changes of the per-employee labor productivity rankings of the 7 major industrialized countries



Source: Partially edited from 'International Comparison of Labour Productivity 2024', Productivity Research Centre, Japan Productivity Centre.

2. The 'Architectural and Urban DX' initiative

What is “Architectural and Urban DX”?

The promotion of architectural and urban DX is expected to lead to a society in which diverse data on buildings, cities and real estate can be accumulated, linked and utilised with data from other fields, leading to the creation of new services, disaster prevention and the environment.

Social Issue

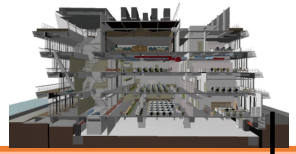
- Decline in the working-age population
  due to falling birthrates and ageing population
- Decline in vitality of regional cities
  due to concentration in Tokyo
- Global warming, more intense and frequent disasters

etc.

Architectural and urban DX

Building Sector

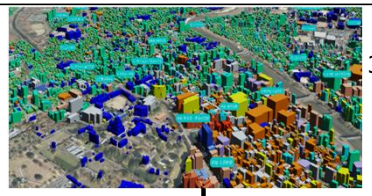
- Building permits online
- Remote interim and completion inspections
- Digitisation of periodic reporting
- Social implementation of architectural BIM



3D digitisation of individual building information

Urban Sector

- PLATEAU
- Increased efficiency and sophistication of data maintenance
- Implementation in the community and society



3D digitisation of spatial information for the entire city

Real Estate Sector

- Real estate ID
- Linking to private and administrative data
- Environmental development and horizontal development for utilisation

By Real Estate ID information linkage

- **'Improving productivity' of** work related to building production and urban development
- **Improving the 'quality' of** indoor spaces (architecture), outdoor spaces (cities) and real estate

The Future Vision of the 'Architectural and Urban DX ’

Information on the architecture, urban and real estate sectors and other sectors (transport, logistics, tourism, welfare, energy, etc.)

Building a society where information can be stored, linked and utilised.

Improved productivity | New service creation | Regional Development

Improving the efficiency of maintenance and management of buildings and other structures | Sustainability

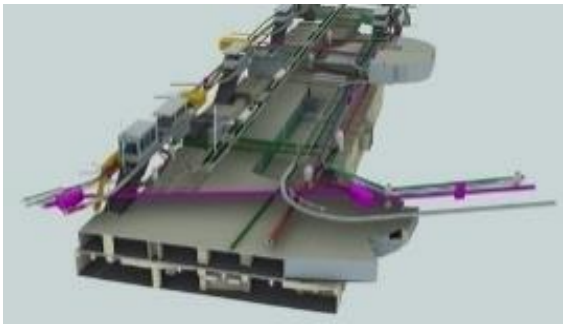
Upgrading disaster preparedness

- Seamless automated delivery using 3D indoor models

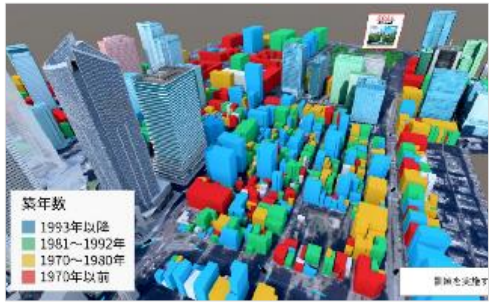
- Autonomous drone operation using 3D city models

- Using BIM to understand life cycle carbon

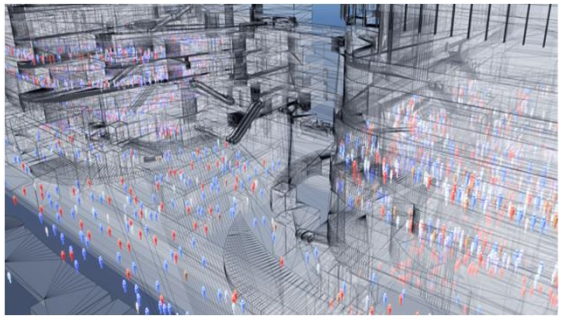
- Visualisation of underground deposits



- Identification of buildings at risk of collapse in an earthquake

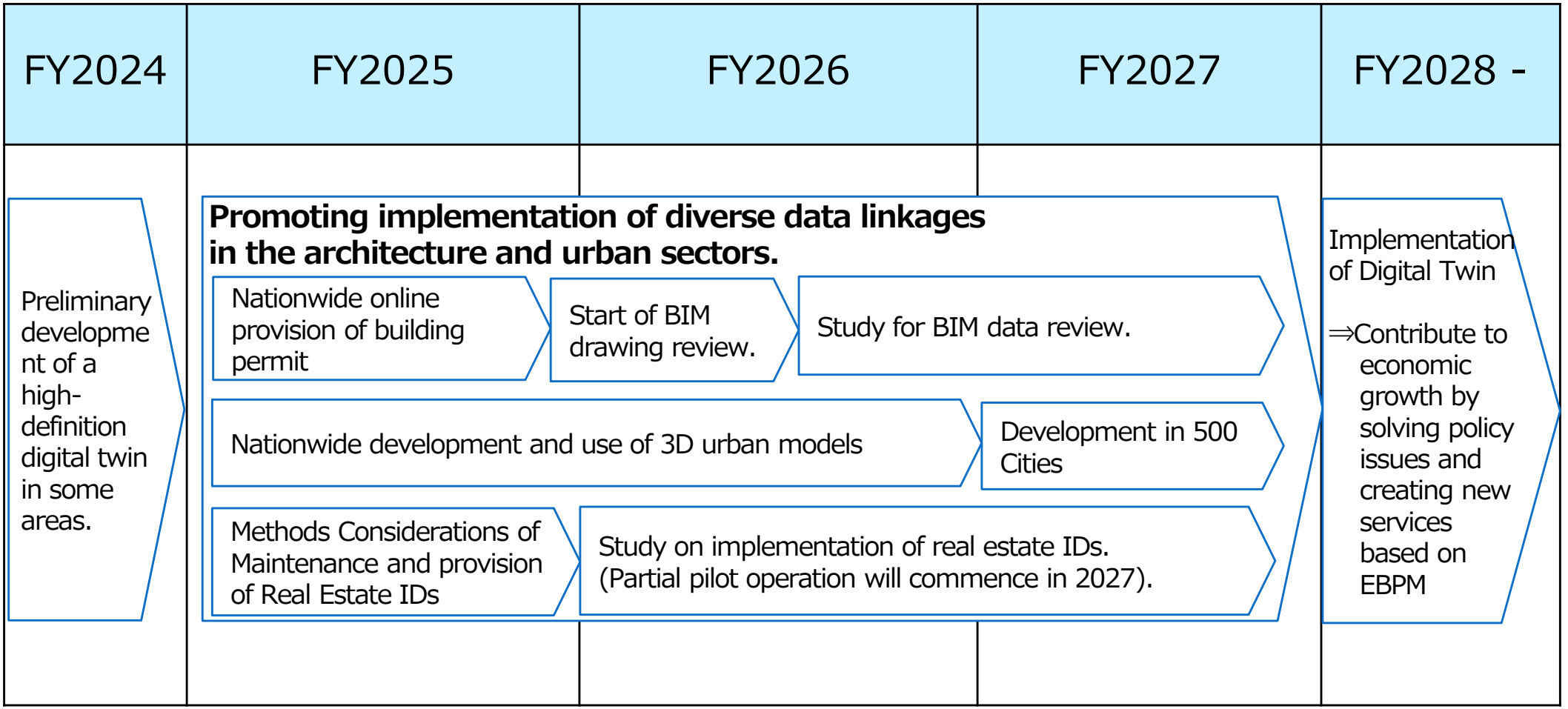


- Advanced evacuation planning by combining building data and human flow data



Roadmap for the ‘Architectural and Urban DX'

Integrated promotion of DX measures in the architectural , urban and real estate sectors towards the social implementation of the Digital Twin in 2028.



Source: "Concretisation of the Reform Process", prepared by the Council on Economic and Fiscal Policy (decided on 26 December 2024), with some modifications.

2) What is BIM (Building Information Modelling)?

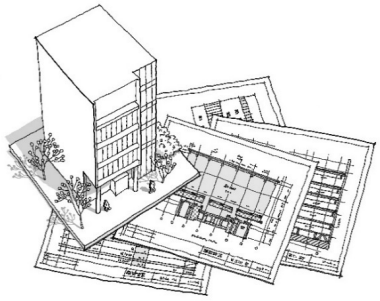
BIM is a system for developing a 'building information model' containing information on (i) and (ii).

(i) 3D shape information.

(ii) Information on building attributes, such as names and areas of rooms, specifications and performance of materials and components, finishes, etc.

Current mainstream system in Japan (CAD)

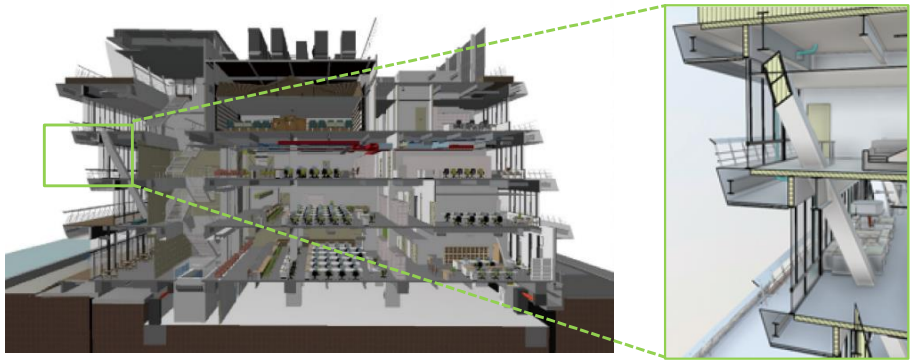
- Drawings prepared separately.
- Attribute information such as walls and equipment is linked to drawings in analogue form.
- After construction is completed, design information use is low.



Floor plans, elevations and sections / structural drawings / equipment drawings

Building production and maintenance processes using BIM.

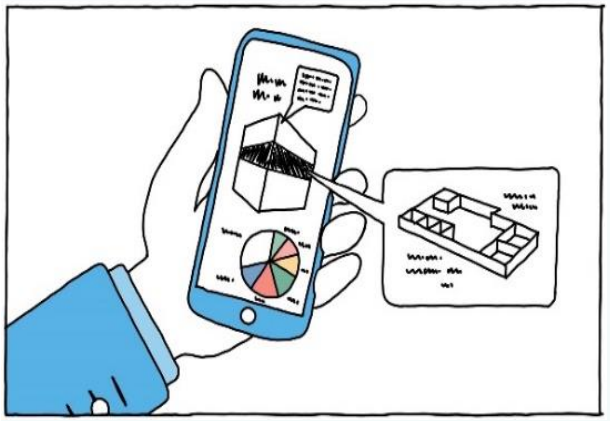
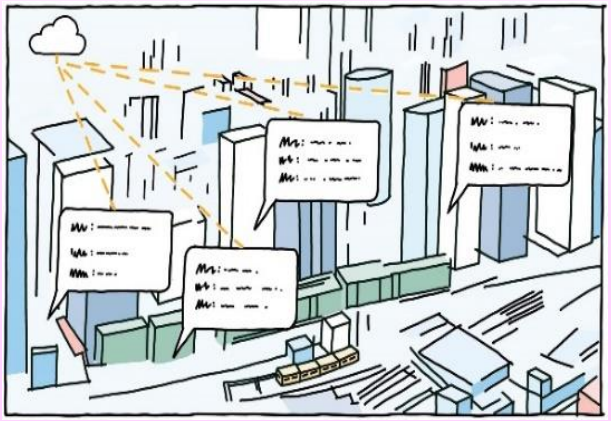
- Improved communication and understanding by 'visualising' buildings in a single 3D shape model in an easy-to-understand manner.
- Attribute information can be added to each model.
- Information can be used throughout the building lifecycle / linked to IoT



BIM Model (Whole building).

BIM Model
(Enlarged interior section).

Future vision through the use of architectural BIM

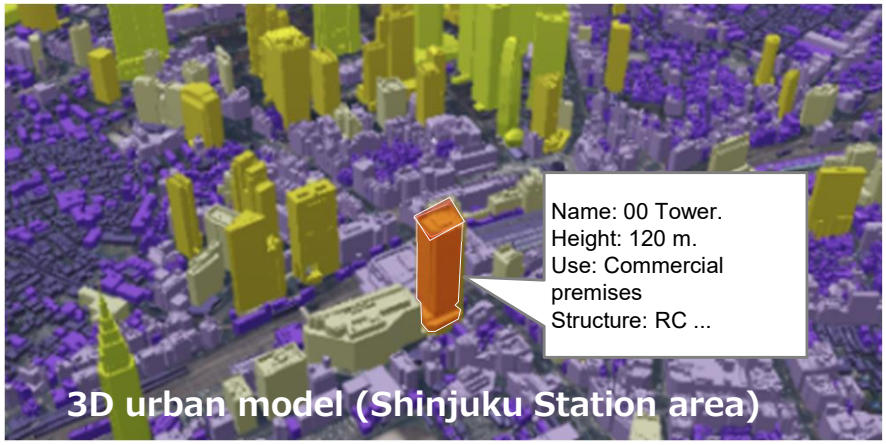
Realisation of building production and maintenance with high quality and precision	Highly efficient life cycle	Expanding the value of buildings as a social asset
Good products	**Lean and fast**	**Buildings and data with value**
		

3) What is the 3D city model (PLATEAU) of Japan?

'Project PLATEAU'

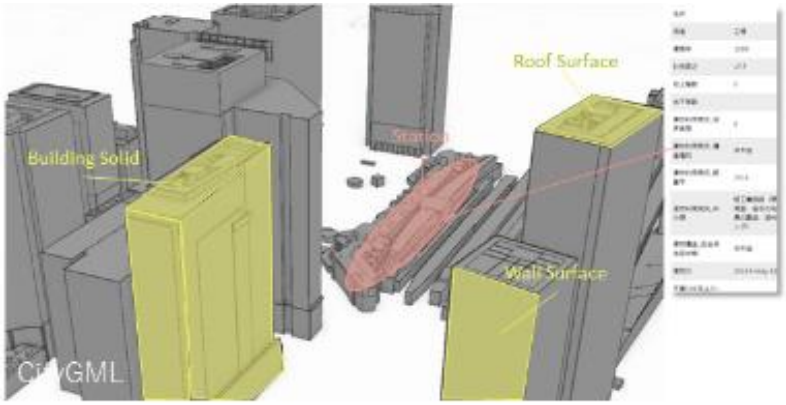
- Launched in 2020, 3D city models is developed and converted into open data
- Retains information on attributes such as use and structure as well as the shape of the city: **data not only on 'shape' but also on 'meaning'.**

PLATEAU by MLIT

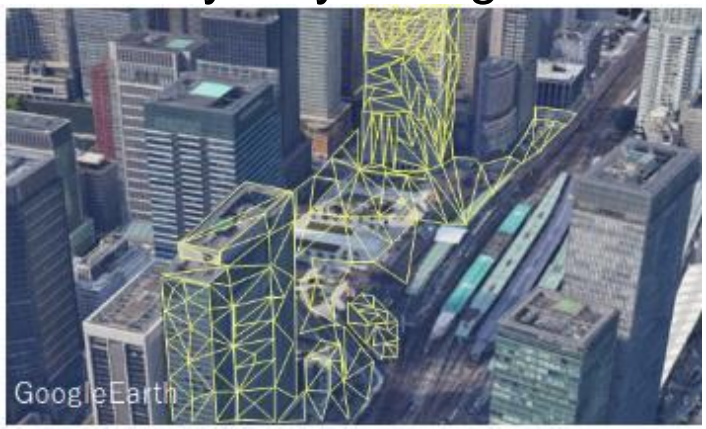


3D urban model (Shinjuku Station area)

Shape + attribute information (Semantics): PLATEAU



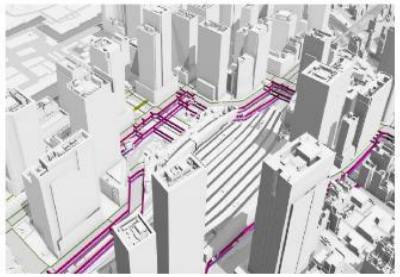
Geometry only: Google Earth



Current development (FY2024)	Estimated development (FY2027)
250 cities	500 cities

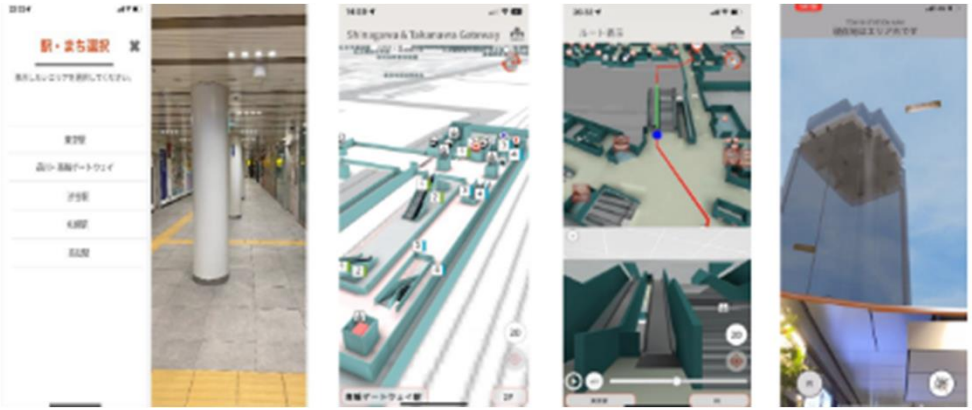
Linking BIM and 3D urban models to develop underground models

- Data maintenance of underground buried structures in metropolitan centres in conjunction with BIM data. (parts of Tokyo, Osaka and Nagoya)
- Information is shared among infrastructure providers to streamline the survey, design and management of urban development.
- Currently, the MLIT is building a navigation system and improving the efficiency of data maintenance.

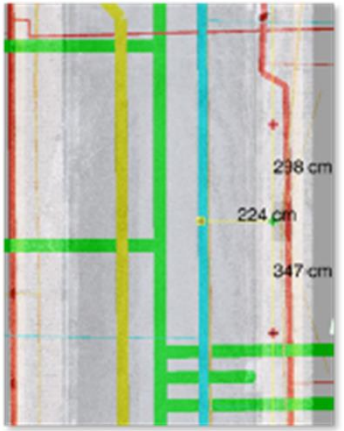


Latest developments in underground-related technology development.

•Development of a navigation system to improve the situation where people can easily get lost in underground, including in Shibuya Station.



•Verification of the efficiency of data maintenance through the construction of underground burial models using radar surveys, etc.



International standards and overseas development of 3D city models

- PLATEAU conforms to international standards set by the Open Geospatial Consortium (OGC), and the MLIT has joined the OGC in autumn 2024 and participate in discussions on the development of standards.
- The data development in foreign countries, including Cambodia (agreed in December 2024), is currently being discussed.

International Standards Organisation:
Open Geospatial Consortium (OGC)

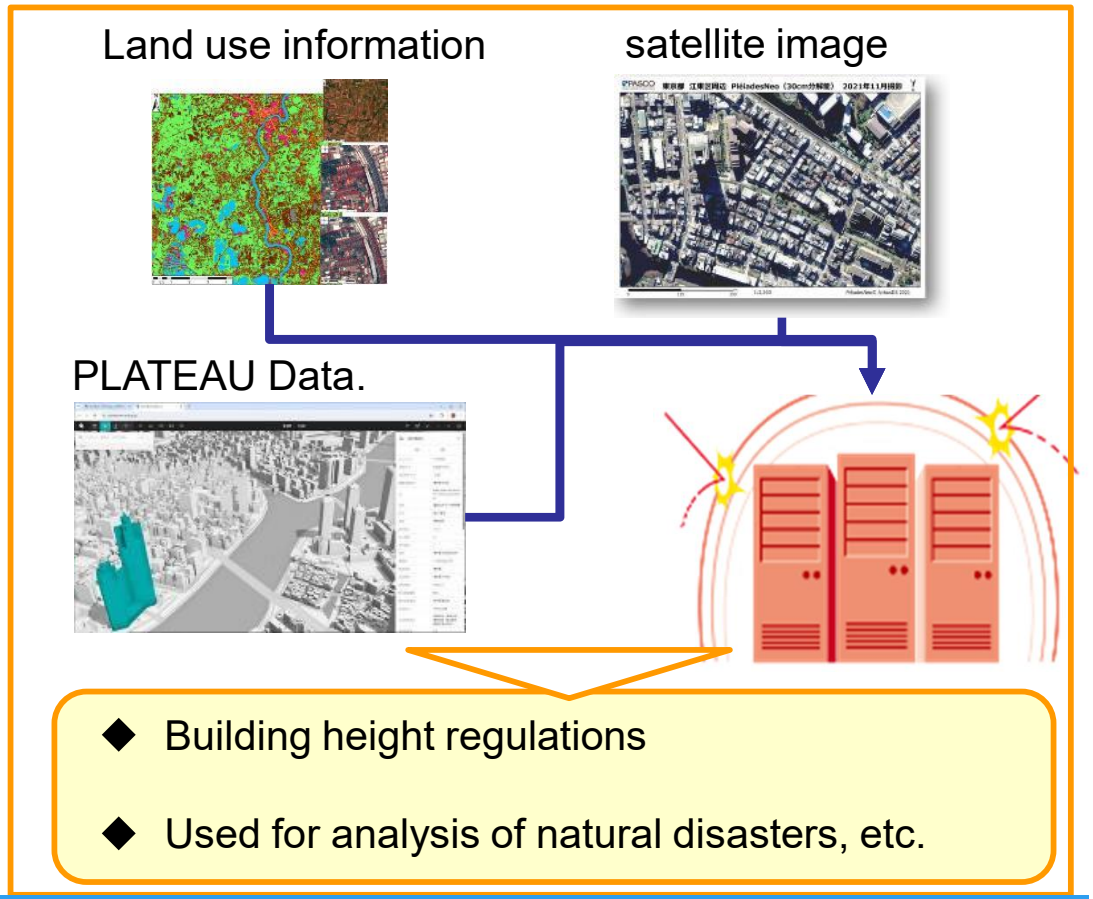
OGC™ Open Geospatial Consortium, Inc.

CityGML

International non-governmental, non-profit standardisation body of about 500 organisations/individual geographic information professionals representing industry, government and academia.

PLATEAU maintains data in the CityGML format, the standard format of the OGC.

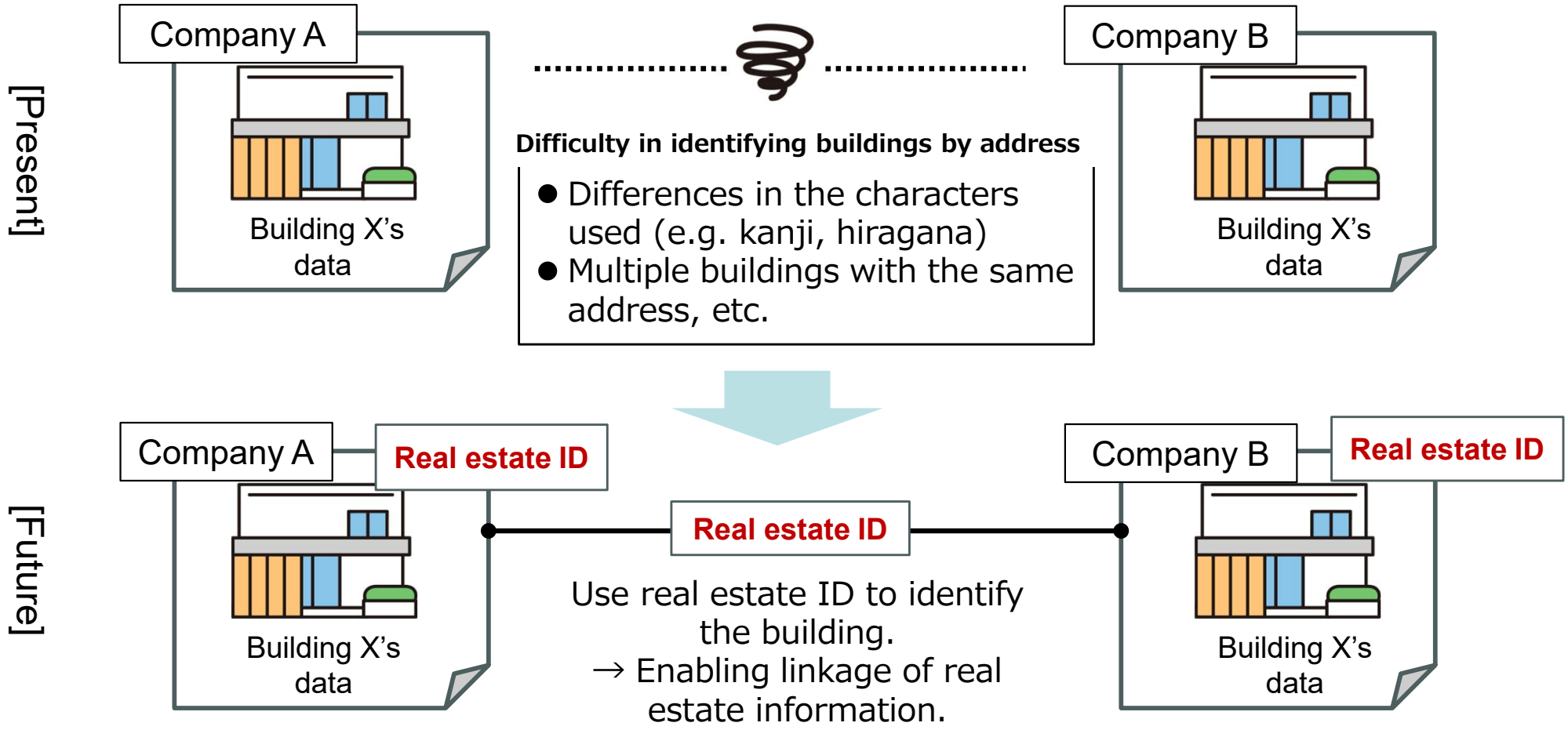
Example of overseas development:
PLATEAU in Cambodia



(4) Promotion of 'real estate ID'

- Address notation in Japan is very complex.
- This makes it difficult to identify buildings by address and to link information relating to real estate.

- To tackle this issue, IDs are to be assigned to buildings nationwide.
  (under consideration for pilot operation by the end of 2027).

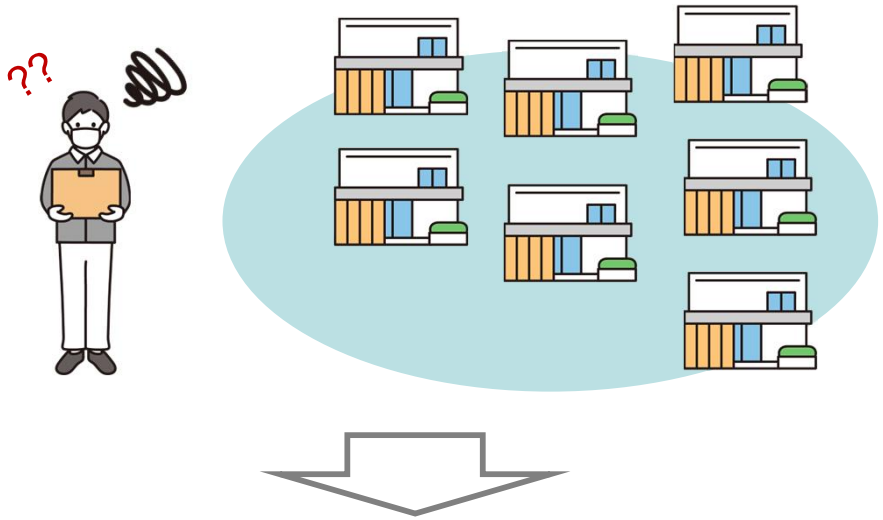


Use cases of 'real estate IDs'

Improving logistics efficiency

- The burden on delivery staff has increased significantly due to the expansion of EC.

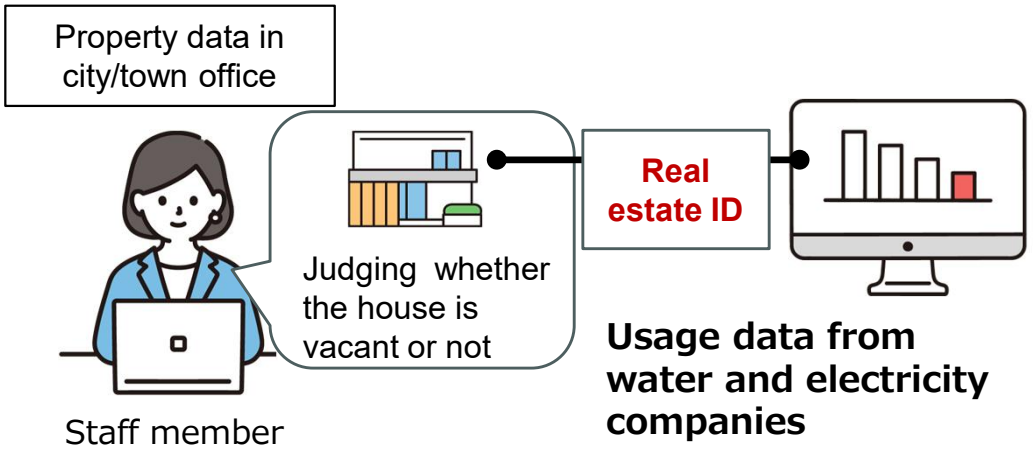
  (Difficult to identify the delivery address.)



- Real estate ID facilitates the identification of the delivery address.

Improving the efficiency of identifying vacant houses

- The increase in the number of vacant houses due to population decline is a social challenge.
- In order to take action, it is necessary to understand where and approximately how many there are empty houses.
- Real estate IDs make it easier to identify vacant properties by linking them to water and electricity usage data.



3. From Architectural and Urban DX to Smart Cities

Further use of architectural and urban data and future vision (i)

	short term	mid-range
Productivity Improvement	Advancement of facility management	Drone delivery, use of automated mobility
	Making buildings smarter	Data-based pricing and service recommendations
	Stimulating property investment through disclosure of building information	Real-time monitoring and disclosure of information on building management

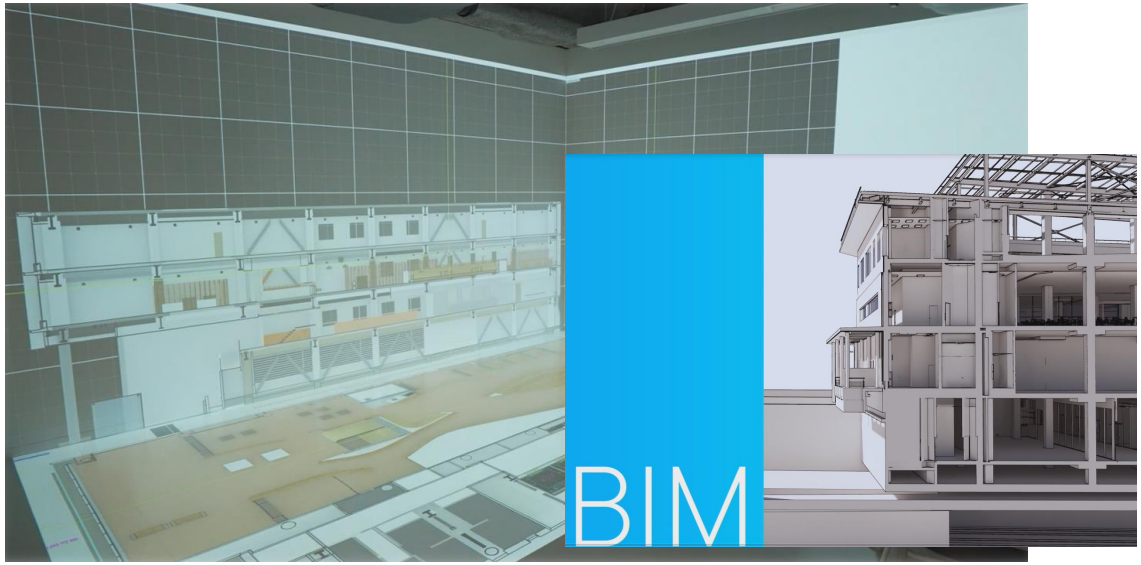
Further use of building and urban data and future vision (ii)

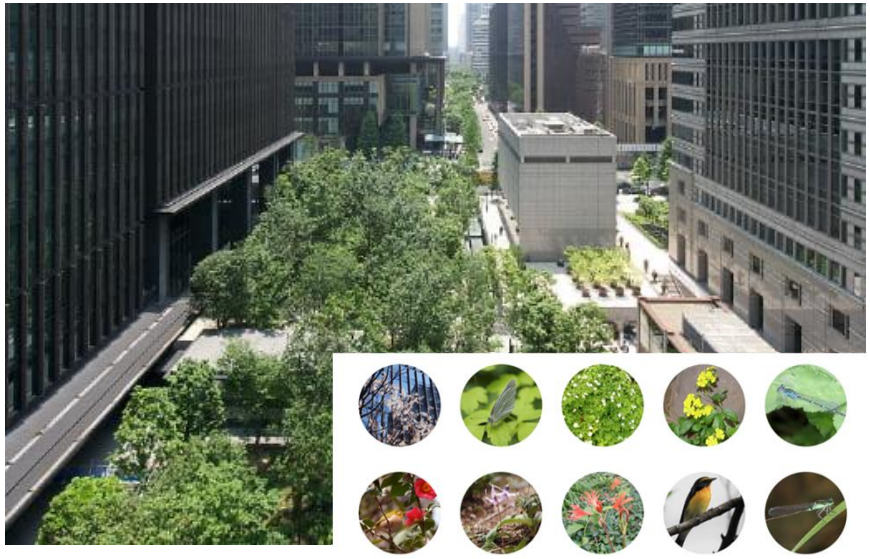
	short term	mid-range
City Planning	**DX of disaster prevention, including evacuation guidance** (sharing evacuation routes and stockpiles, making rules)	Creation of new services **such as the use of empty houses and tourism**
	Presentation of barrier-free routes	**Consensus building based on data on** stock utilisation, income and expenditure, etc
	Visualisation of vacant properties open to the community, matching with prospective migrants and settlers, and higher quality of area management	

Further use of architectural and urban data and future vision (iii)

	short term	mid-range
ESG	**Understanding and studying life cycle carbons** through the use of BIM and building materials data, etc., **and evaluating the reuse of components**	Disclosure of impacts on **biodiversity** **Visualisation of the contribution to the town and society**, including the opening up of the region and contribution to productivity

Monitoring of actual values such as CO2 emissions and concentrations, visualisation of wellness performance



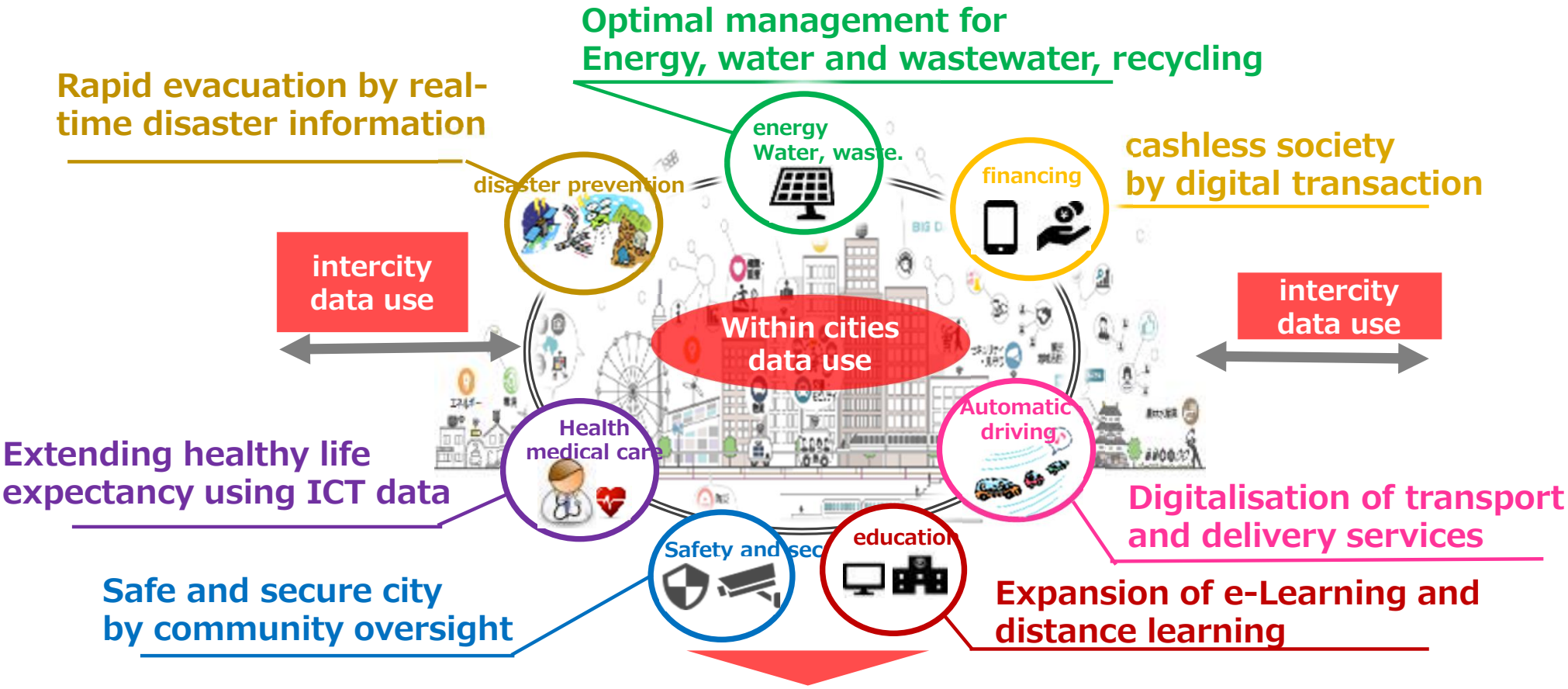


Source: Tokyo Tatemono Co. website, Otemachi Tower, Urban and Natural Regeneration.

Significance and necessity of smart cities

What is a smart city?

Designed to create new value by solving various problems in cities and regions through the use of new technologies, various types of data from the public and private sectors, and the advancement of data management.



Smart city promotion system in the Japanese Government

Integrated Innovation Strategy Promotion Council
Chairperson: Chief Cabinet Secretary; Acting Chairperson: Minister of State for Science and Technology

instruction ⇩ ⇧ report

Smart Cities Task Force meeting
Relevant ministries (Secretariat: Cabinet Office)

A system for measures through cooperation among ministries and agencies

Cabinet Office

overall summary
Building a smart city architecture

⇔

Digital Agency

Digital Inc.
Association Priority Plan
etc., formulated by

⇕

Establishment of model cases and horizontal development across the country

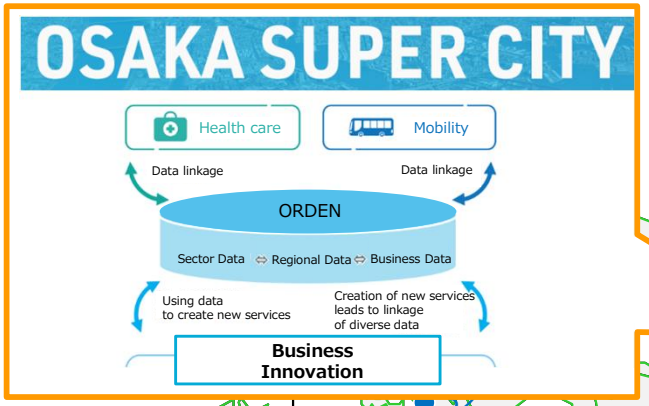
Ministry of Land, Infrastructure, Transport and Tourism
(City Bureau)
Urban infrastructure-related Model projects in

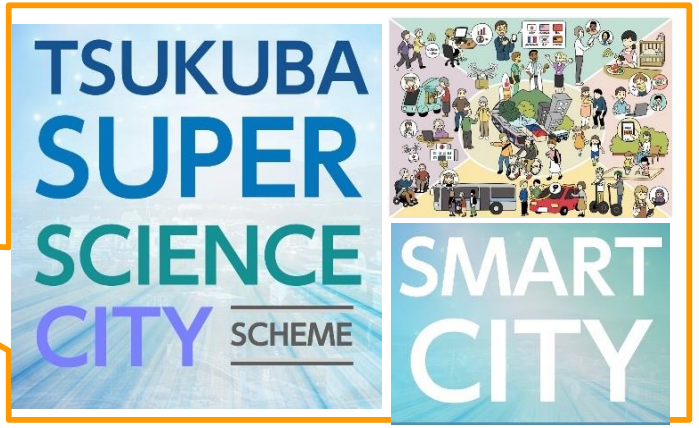
Ministry of Internal Affairs and Communications
Development of data linkage infrastructure

Ministry of Land, Infrastructure, Transport and Tourism and Ministry of Economy, Trade and Industry
(General Policy Bureau)
Model projects for mobility services.

Districts for the Smart City Implementation Support Project

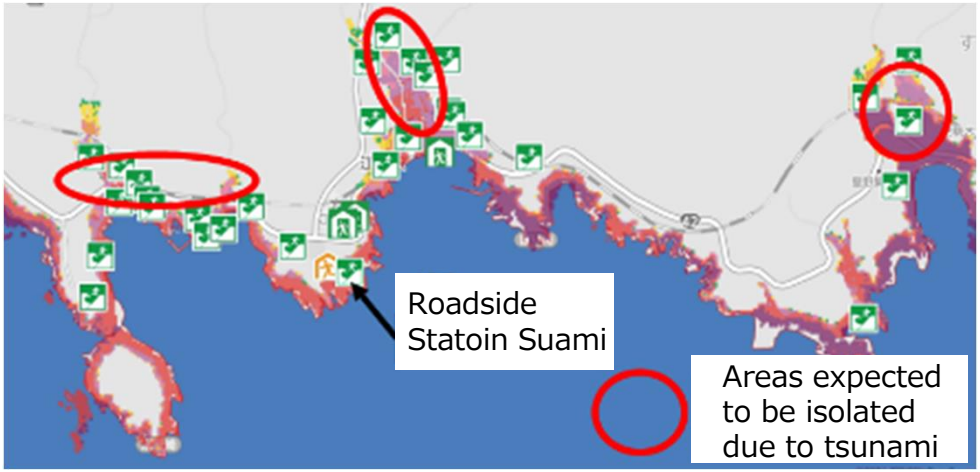
1	Sapporo City	12	Koto ward	23	Seika Town and Kizugawa City
2	Senboku City	13	Ota Ward	24	Osaka City
3	Aizuwakamatsu City	14	Shibuya Ward	25	Kakogawa City
4	Utsunomiya City	15	Niigata City	26	Susami Town
5	Tsukuba City	16	Kaga City	27	Masuda City
6	Saitama City	17	Gifu City	28	Miyoshi, Hiroshima
7	Kumagaya City	18	Atami and Shimoda City	29	Higashi-Hiroshima City
8	Moroyama Town	19	Fujieda City	30	Takamatsu City
9	Kashiwa City	20	Okazaki City	31	Matsuyama, Ehime Prefecture
10	Chiyoda Ward	21	Kasugai City	32	Arao, Kumamoto Prefecture
11	Minato Ward,	22	Yokkaichi City		

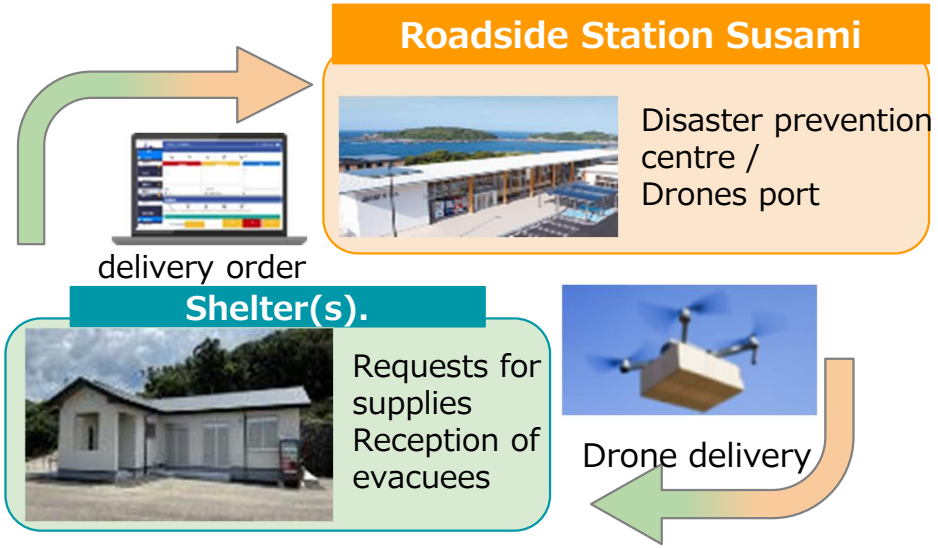




Smart city implementation (disaster prevention and response)

The project demonstrated the use of automated drones to deliver relief supplies to evacuation centres on the assumption that some villages would be isolated in the event of a tsunami from a Nankai Trough earthquake or similar event**. (Susami Town, Wakayama Prefecture)**





The system is used to improve the efficiency of flood prevention management systems and to provide evacuation instructions to residents. **(Fujieda City, Shizuoka Prefecture)**

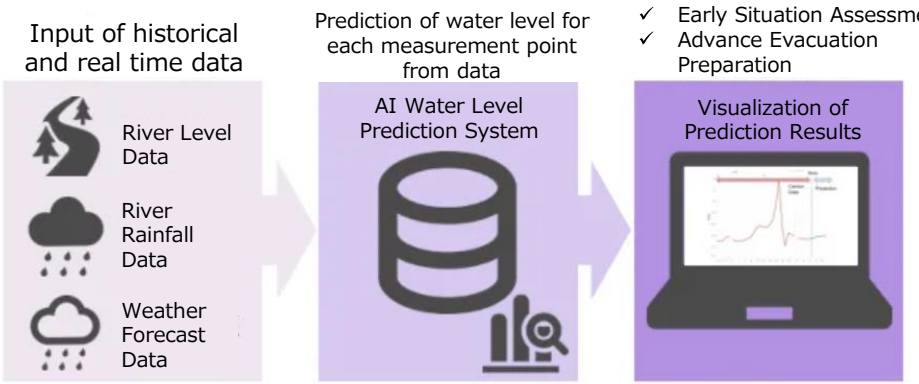


Fig. AI water level prediction system overview

Fig : AI water level prediction system screen

Photo : Flood drills

Smart city implementation (for vulnerable users: Tsukuba City)

Medical MaaS demonstrations for the elderly and other vulnerable users, seamlessly linking hospital visits and consultations through next-generation mobility and hospital reception with facial recognition **(Tsukuba City, Ibaraki Prefecture)**.

■ Outcomes and findings from the demonstration (2020-2022)

AI Demand taxi and location information

Older people were shown to be receptive to demand taxi and MaaS apps

Hospital reception by facial recognition

Successful linkage between facial recognition and medical information system in taxis

Automated patient transport

Reduction of the burden on patients and and healthcare professionals and high user satisfaction were achieved

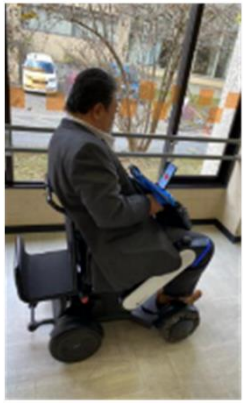
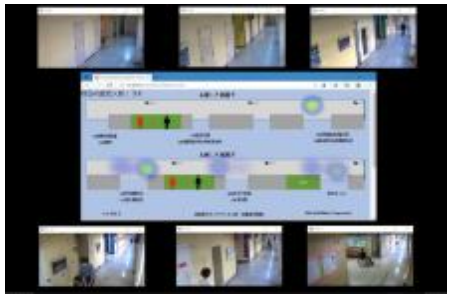


Image-based human flow analysis and congestion avoidance

Analysis of camera images successfully identifies congestion and selects appropriate routes

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