

Smart Transportation in Japan: From Maebashi to Expo 2025

Introduction – policy background

Urban centers worldwide are under increasing pressure to enhance public service efficiency, sustainability, and citizen well-being amid rising populations and demographic challenges. In response, a Smart City paradigm has emerged that integrates digital infrastructure, data-driven governance, and innovative public services to improve urban life. According to ISO 37122, a Smart City “increases the pace at which it provides social, economic, and environmental sustainability outcomes through collaborative leadership, cross-sectoral integration, and technology-driven service innovation.” This definition emphasizes that Smart Cities are not just technologically advanced but are citizen-centric and solution-oriented.

In Japan, this vision is operationalized through National Society 5.0, which envisions a “super-smart society” that leverages AI, IoT, and big data to merge cyber and physical spaces. Proposed under the 5th Science and Technology Basic Plan, Society 5.0 aims to balance economic advancement and address social issues, such as aging, depopulation, and regional inequality. This approach recognizes that digital transformation should address structural and geographic disparities between rural and urban areas in Japan.

Building on this, the Digital Garden City Nation Initiative (*Digi-den*), launched by former Prime Minister Kishida, promotes rural revitalization through digital means. Its strategic pillars include: (1) digital infrastructure development, (2) development of digital human resources, and (3) a digital society, where no one is left behind¹.

Since the launch of the Ishiba administration in 2024, Japan has entered a new phase of its regional revitalization strategy, often referred to as “*Chiho Sosei 2.0*” (Regional Revitalization 2.0). A key pillar of this policy shift is the promotion of smart cities under the framework of the Digital Garden City Nation Initiative. This national strategy aims to harness digital technologies, such as data platforms, AI, IoT, and digital identity systems, to address regional disparities and stimulate innovation in local governance,

¹ https://www.cas.go.jp/jp/seisaku/digital_denen/pdf/20221223_gaiyou-e.pdf

healthcare, education, mobility, and disaster resilience.

Rather than viewing smart city development as a top-down infrastructure project, the *Digi-den* approach emphasizes community-driven digital transformation; co-creation among local governments, businesses, and residents; and the tailoring of solutions to specific regional needs. Support measures include dedicated funding programs (such as the *Digi-den Subsidy*), capacity building for local officials, and incentives for public-private partnerships. Through this initiative, the government envisions revitalizing rural and regional areas by building inclusive, resilient, and sustainable communities and enhancing the quality of life in cities and across the country.

Maebashi City – smart transportation

Maebashi City, located in the Gunma Prefecture, exemplifies how national smart city frameworks can be tailored at the local level. Designated as a *Digi-den* pilot, Maebashi adopted a holistic approach through its Digital Green City Strategy, emphasizing citizen well-being, green innovation, and digital inclusion. The Mebuku ID² and Mebuku Pay³ systems have enabled seamless access to municipal services and cashless transactions, thereby enhancing administrative efficiency and civic engagement.

Central to Maebashi’s smart transformation is the Maebashi Mobility as a Service (MaeMaaS) project, which integrates buses, on-demand shuttles, and shared bicycles into a unified digital platform (**Figure 1**). Launched in January 2020, MaeMaaS allows real-time route planning, digital ticketing, and discounts for city residents by using my number authentication. In 2023, the program expanded across the prefecture under the brand GunMaaS, symbolizing a shift from city-centric innovation to a prefecture-wide mobility ecosystem. National recognition followed, with Maebashi awarding top-tier status in the *Digi-den* ranking for three consecutive years.



Figure 1: Interface of GunMaaS (Source: <https://www.pref.gunma.jp/page/202097.html>)

² Mebuku ID is Maebashi City’s digital identity platform that integrates with Japan’s national My Number (Individual Number) system, enabling residents to securely access a range of public and private services.

³ Mebuku Pay is a digital local currency service linked to Mebuku ID, allowing users to make cashless payments at participating stores and facilities, thereby promoting local economic circulation and digital inclusion.

The smart mobility project developed by Maebashi is a major step toward a more accessible and efficient urban public transport system. This initiative is a part of a broader trend in urban development that seeks to integrate technology and sustainable practices into transportation systems. The initiative includes the deployment of MaaS (mobility-as-a-service) platforms such as MaeMaaS, which aim to provide seamless multimodal transportation solutions. MaaS platforms integrate public, shared, and on-demand transportation services, offering users a convenient and efficient method to plan and pay for their journeys. This initiative aligns with global trends in smart city development, where the integration of digital technologies and data-driven decision-making is expected to improve the efficiency and sustainability of urban systems. Maebashi sought to reduce reliance on private vehicles, decrease traffic congestion, and promote the use of public and shared mobility options.

Challenges

Despite its designation as a national model for smart city innovation, the city remains highly car-dependent. A 2020 survey conducted by Japan's Ministry of Land, Infrastructure, Transport, and Tourism (MLIT) across 60 mid-sized cities revealed that Maebashi had the second-highest rate of household car ownership, ranking 57th in per capita bus usage⁴. Approximately 75% of all trips within a city are made using private automobiles, whereas public buses account for only 3% of the modal share.

This entrenched automobile culture presents a significant barrier to the adoption of sustainable and inclusive mobility solutions. The challenge lies in introducing alternatives such as MaaS platforms and shifting public behavior, ensuring accessibility for non-drivers, and reducing the environmental and financial costs of overreliance on cars.

The launch of MaeMaaS platform was envisioned as a transformative intervention to diversify transportation options and enhance service efficiency. However, the early implementation phases were hindered by exogenous factors, particularly during the COVID-19 pandemic. Lockdowns and social distancing reduced demand, and local officials observed that user uptake remained low until public awareness campaigns and word of mouth gradually built trust.

Moreover, measuring the actual impacts of digital mobility solutions is complex. While some stakeholders expected rising ridership figures, others emphasized improvements in user satisfaction, equity of access, or cost optimization for the municipality. This complexity underlines the broader issue prevalent in smart city governance: defining and capturing success across diverse and evolving indicators.

⁴ <https://www.tb.mlit.go.jp/kanto/content/000321076.pdf>

Resident survey for MaeMaaS

An on-the-street survey⁵ showed a split between those who have adopted MaeMaaS and those who have not. Approximately half of the respondents (22 out of 46) stated that they had never used the MaeMaaS app or heard of it for the first time during the survey. This indicates a substantial awareness and adoption gap; even several years after the launch, a large segment of residents remained unaware of the service or had not tried it. However, the remaining half of the respondents were active users (24 out of 46), to varying degrees. Among users, 5 respondents reported using MaaS daily, and 13 respondents used it a few times per week. 6 respondents used the service a few times per month. All respondents reported owning a smartphone or similar device, which is a prerequisite for using the MaeMaaS app. 14 respondents (approximately 30 % of all respondents) did not hold a driver's license, implying that many relied on alternatives to private cars.

Motivations for use

The MaeMaaS platform offers multiple functionalities that users often take advantage of. The most commonly cited uses are trip planning, digital ticketing, and on-demand transit booking. Most users (21 respondents) indicated that they use MaeMaaS to purchase bus tickets or passes digitally, and to book rides on on-demand services such as community minibuses. 11 respondents also reported using the app to plan routes and check schedules, consolidating what they used to require multiple timetables or apps. Users appreciate not having to use separate systems to find a route, reserve a local shuttle, or pay for a ticket; MaeMaaS covers all of these needs. The digital ticket purchases and on-demand bookings ranked at the top suggest that the platform's role in facilitating convenient payments and access to public services is key.

When asked which specific features of MaeMaaS users found most useful, two features clearly stood out: the flat-fare discount and on-demand ride-booking. The flat-fare discount for Maebashi residents was the top choice for most users. Approximately 58% of the 24 MaeMaaS users selected the city's special fare incentive as the best feature. This discount allowed registered Maebashi residents (authenticated using MyNumber) to ride city buses at a reduced uniform rate, thereby making public transit more affordable. The popularity of this feature underscores the importance of pricing and incentives; many users are motivated by cost savings, and the MaaS platform's ability to automatically apply discounts is highly appreciated. The second most valued feature was on-demand ride-booking functionality. Approximately 38% of the user pointed to the ability to reserve community minibuses or shuttles through the app (services like the "Runrun Bus" and others) as the most useful aspect. In cities with dispersed populations, these on-demand services fill crucial gaps, and having them accessible via a

⁵ A total of 46 people responded to an on-the-street survey conducted near Maebashi Station in late May 2025. The sample captured a diverse age range, though skewed toward older adults: 48% were aged 65 or above, and 28% were aged 40–64. 17% were 20–39, and 7% were under 20. This age distribution suggests that the survey effectively reached elderly individuals who is a key target group for improved mobility.

simple app interface is likely to unlock their use for more people.

Impact on mobility experiences and attitudes

The survey asked the respondents if their mobility in Maebashi had improved since the use of MaeMaaS. 23 people out of 33 respondents⁶ indicated that their ability to travel had improved. 16 respondents answered “improved in some way”, and 7 respondents saying that “significantly improved”. 10 respondents answered “no change” and no one responded negatively. The respondents mentioned that with MaeMaaS, they could reach places more easily than before, or even access destinations that were previously out of reach when they relied solely on traditional transit information or personal driving. The ability to seamlessly find and book transportation options appears to reduce friction when using public transportation. However, these accessibility gains are currently limited to a subset of residents who use the platform. 10 respondents answered no change, not because the system failed, but because they had not engaged with it. This underscores a broader challenge. Innovative services can improve urban accessibility; however, their impact at the population level is constrained by the rate of adoption.

A critical question for a smart mobility project is whether it reduces the reliance on private vehicles and contributes to environmental and congestion benefits. The survey asked whether the availability of MaeMaaS and improved transit options had changed their personal car use. Among 25 respondents answered this question, 20 reported reduced car use. Specifically, 5 responded “much less reduced” and 15 responded “somewhat reduced” their car usage. Only one person stated that they used it approximately the same way as before, indicating that everyone who adopted MaaS and had a car, there was at least some shift in behavior away from driving. Additionally, 4 respondents indicated “not applicable” which means they did not have a car or did not drive before.”

User Satisfaction

The survey asked about various aspects of the MaeMaaS service: ease of use of the mobile app, reliability of the information, convenience of digital payments/tickets, coverage of the service, cost/value of travel using MaaS (including the benefits of discounts or passes), and overall satisfaction with mobility in Maebashi. The results showed a generally positive outlook. Across these six service dimensions, 31 users responded, with the majority expressing positive ratings, and no one reported dissatisfaction with any aspect. Specifically, 23 respondents rated the ease of use of the MaeMaaS mobile app as “satisfied” or “very satisfied” (14 satisfied, 9 very satisfied), while 8 chose “neutral”. Information reliability earned the strongest ratings, with 24 respondents expressing satisfaction (10 satisfied, 14 very satisfied) and only 7 remaining neutral, reflecting improvements in open data and real-time updates. The convenience of digital payment/ticketing showed more mixed results, with 18 respondents satisfied (10 satisfied, 8 very satisfied) but 13 respondents choosing “neutral.” Service coverage received positive feedback from 24

⁶ In this question, there were 33 respondents and 13 skipped.

respondents, with 17 satisfied and 7 very satisfied, although 7 remained neutral. Cost satisfaction was strong, with 24 respondents rating it positively (13 satisfied, 11 very satisfied) and 7 neutral. Overall satisfaction with mobility post-MaeMaaS showed 24 respondents expressing satisfaction (15 satisfied, 9 very satisfied), with 7 neutral. These results show that all 24 current users of the app report being satisfied. This suggests that the existing user base is largely pleased with the app's functionality and benefits, indicating a strong foundation for service quality. However, the survey also suggests that convenience related to digital payment and ticketing may still have room for improvement.

User experience

The survey asked if users had encountered any problems while using MaeMaaS, with options such as technical difficulties, confusing interfaces, and a lack of required features. Among 24 MaeMaaS users, only one responded that it was initially difficult to understand how to use the application. No one reported problems such as app glitches, payment failures, or inaccurate information. This indicates that the platform is technically reliable and user-friendly for those who have adopted it. The task remains to translate a positive user experience to a broader population base.

Adoption of the MaaS application was slower than expected. Gunma's MaaS service saw an average of only 7,203 uses per month in FY2023, barely half the usage it had two years prior (14,000/month in 2021). This drop in active usage suggests that the initial interest has tapered off and that achieving habitual use is challenging. Awareness and user engagement are key issues, and the prefecture conducted 38 on-site registration events in 2023 at train stations to promote the app. These efforts have increased the number of registered users; however, converting registrations into daily active users remains a challenge.

Liveable Well-being City Indicators

As part of Japan's Digital Garden City Nation initiative (*Digi-den*), the national government has adopted the Liveable Well-Being City Indicators (LWCI) as a framework for evaluating quality of life in regional communities. Unlike traditional economic development indicators, the LWCI focuses on people-centered metrics such as well-being, liveability, inclusiveness, and local engagement. The framework consists of quantitative indicators across areas, such as healthcare, education, mobility, digital life, environmental sustainability, and community connection. By adopting LWCI, the *Digi-den* initiative seeks to promote digital transformation and ensure that technology contributes meaningfully to the everyday lives of residents, particularly in rural and regional areas. This reflects a broader shift in policy from measuring growth by GDP alone to measuring the well-being and vitality of communities.

A notable feature of the LWCI is its hybrid evaluation method, which combines objective data and subjective perceptions. Objective indicators include measurable statistics, such as healthcare access rates, Internet connectivity, and transportation coverage. In parallel, subjective indicators were derived from

residents' responses to questions about their satisfaction with local services, sense of safety, perceived well-being, and willingness to engage in community activities. This dual approach allows policymakers to assess the functional infrastructure and service levels of a community and understand how people feel about their quality of life, thus enabling more people-centered and context-sensitive planning. Both objective and subjective indicators are represented as standardized scores⁷.

Maebashi's latest data⁸ shows a low subjective score for mobility; residents rated their ease of "Mobility/Transportation" below the national average (**Table 1**). This aligns with the known dependence on private cars; many citizens likely feel that getting around without a car is difficult, which reduces their satisfaction scores. Objective score of mobility was also below the national average. This indicates that mobility-related services and residents' satisfaction with transportation are relatively low compared to other regions. Other LWCI categories highlighted related aspects: for instance, "Shopping/Dining" convenience scored around the national average, suggesting moderate satisfaction and service provision levels. For "Housing Environment" and "Digital Life", subjective scores are notably lower than objective ones, indicating that while the infrastructure and data availability are relatively strong, residents do not perceive them as positively. This gap is especially pronounced in Digital Life. On the other hand, "Healthcare/Welfare" scores exceed the national average for both subjective and objective indicators, showing higher satisfaction and well-developed service systems in this domain.

Among all 24 indicators of the questionnaire, Digital Life recorded the highest objective score, reflecting city's advanced digital infrastructure and policy environment, whereas Mobility/Transportation had the lowest subjective score, suggesting that people's perceived satisfaction with mobility remains the weakest despite broader smart city initiatives.

⁷ The objective indicators are represented as standardized deviation scores based on municipalities with populations over 100,000. The subjective indicators are also standardized scores, calculated using responses from municipalities with populations over 100,000 and at least 100 valid survey responses.

⁸ The city office had 109 respondents for the subjective questionnaire in 2025.

Table 1: LWCI Scores for Maebashi City (2025) – Ranked by Subjective score

Indicator	Subjective score	Objective score
Childcare	55.3	48.2
Environmental Harmony	54.5	53.0
Digital Life	54.0	61.3
Healthcare/Welfare	53.9	51.8
Community Connection	53.9	52.7
Health Status	52.9	50.1
Diversity/Inclusiveness	52.8	45.7
Natural Disasters	51.6	57.3
Natural Resources	51.4	51.9
Leisure/Recreation	51.3	51.2
Business Creation/Entrepreneurship	51.1	46.8
Public Spaces	51.0	52.0
Self-efficacy	50.7	48.4
Accidents/Crime	50.4	34.8
Housing Environment	50.1	56.1
Educational Opportunities	50.0	49.2
Natural Scenery	49.8	52.9
Employment/Income	49.8	51.2
Shopping/Dining	49.6	46.6
Local Government	49.4	48.5
Culture/Arts	49.0	48.5
Primary Secondary Education	46.8	44.2
Urban Landscape	43.4	46.1
Mobility/Transportation	40.9	45.0

(Source: <https://well-being.digital.go.jp/dashboard>)

Toward future mobility: cases from the Osaka Expo

Although Maebashi’s case highlights the persistent challenges of promoting behavioral change and achieving satisfaction with everyday mobility, Japan’s broader innovation landscape continues to explore forward-looking solutions. The smart mobility showcases at the Osaka Expo, for instance, represent an ambitious demonstration of how emerging technologies might reshape the way people move, connect, and experience cities in the years ahead.

At Expo 2025 in Osaka, the future of transportation takes place in the sky. In the “Mobility Experience” and “Advanced Air Mobility Station” zones, companies are showcasing flying vehicles that once belonged only to science fiction. Marubeni Corporation has brought the one-seat HEXA eVTOL (flying car) to Japan (Figure 2). Meanwhile, the Japanese startup SkyDrive presented its SD-05, a compact air vehicle designed to shuttle a single pilot across dense cities (Figure 3). Later in the year, ANA Holdings



Figure 2: Marubeni Hexa (taken by author)



Figure 3: SkyDrive SD-05 model (taken by author)

and California-based Joby Aviation plan to stage public demonstration flights of the four-passenger Joby S4 air taxi, branded in ANA colors. The ANA has openly stated its ambition to operate over 100 eVTOLs across Japan in the coming decade, cutting long ground journeys to minutes in the air.

Honda Motors' UNI-ONE offers a more intimate glimpse into the future (**Figure 4**). This futuristic personal mobility device resembles a sleek, motorized chair; however, it responds to subtle shifts in body weight, allowing riders to glide hands-free through urban spaces. By eliminating the need for handlebars, UNI-ONE provides independence and convenience, particularly for seniors and those facing mobility challenges. At the Expo, Honda demonstrates how UNI-ONE can serve as a “last-meter” solution, seamlessly connecting major transport hubs with personal movement. It is a reminder that mobility is about speed and networks, as well as inclusivity and dignity.



Figure 4: UNI-ONE (taken by author)

Kawasaki Heavy Industries' ALICE SYSTEM (Accessible Linkages for Innovative and Comfortable Experiences) represents another layer of that mobility stack, but from the perspective of system integration and user experience (**Figure 5**). ALICE is conceived as a seamless modular mobility framework where ALICE Cabins transport users for short stretches (perhaps from a vertiport to a train station or across a waterfront), docking with larger modes of transport without forcing users to disembark or navigate stairs or lifts. The design is modular, hydrogen-ready (in Kawasaki's broader mobility roadmap), and emphasizes universal accessibility; boarding is level, transitions are smooth, and the cabin includes robotic assistance (for support or light tasks) to aid comfort. With its AI- and IoT-enabled controls, ALICE monitors usage and traffic density, and connects with transportation schedules to optimize transfers. In the Expo context, ALICE was shown to interact with ground transport and

anticipate how eVTOLs and aerial nodes might synchronize with urban flows, providing a more detailed picture of how future systems can reduce friction across multiple transport modes.

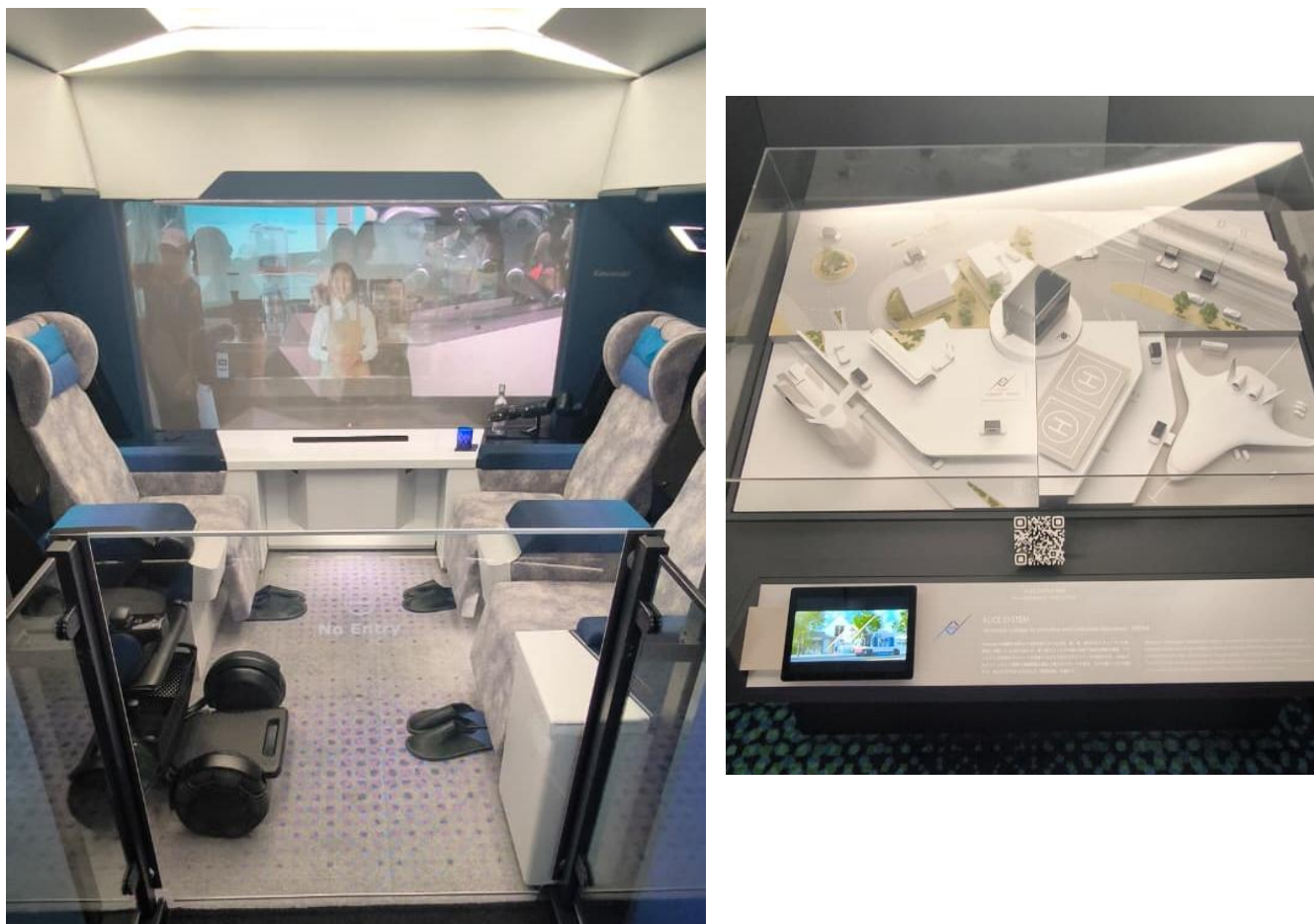


Figure 5: ALICE SYSTEM (Accessible Linkages for Innovative and Comfortable Experiences)
(taken by author)

Beyond specific devices and platforms, the Expo also presented a vision of cities as digitally connected ecosystems. Sumitomo Corporation showcased its Smart City Data Platform (**Figure 6**), which collects real-time information from energy grids, transportation networks, and citizens. At the Expo site, sensors track everything from crowd movement to energy demand, with the data used instantly for smooth operations. The goal was to demonstrate how cities can become adaptive living systems. In practice, this could mean that bus routes automatically adjust to demand, the eVTOL schedule is updated based on weather, or charging stations reallocate power to priority vehicles. This approach aligns directly with Japan’s national Society 5.0 vision: the merging of cyber and physical spaces to achieve sustainability, equity, and resilience.

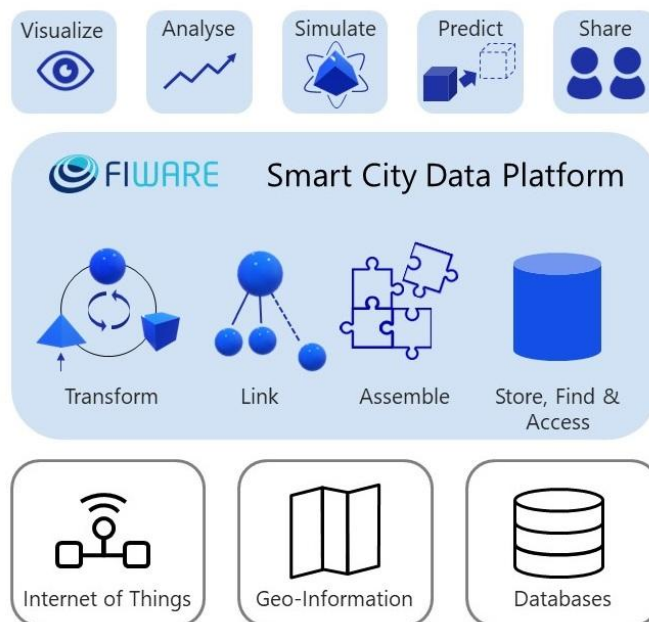


Figure 6: Smart City Data Platform

(Source: <https://mirainotane.sumitomoexpo.com/en/tech/detail/?id=112082>)

At the individual level, the Mobility Passport offered by SMAS (Sumitomo Mitsui Auto Service Company) is an operational app aimed at businesses and organizations managing vehicle fleets and employee travel⁹. These features include reserving company cars, renting cars when they are not available, and integrating external services such as trains, planes, and hotel bookings. Daily reporting is simplified for drivers; driving logs are automatically generated with options for adding images of vehicle damage. Safety and compliance include built-in alcohol check recording, license expiry notifications, and administrative features for managers to verify use, approve logs, and monitor utilization rates. In pilot studies, organizations using the Mobility Passport have reduced inefficiencies (such as unused vehicles), reduced manual paperwork, and improved oversight of travel costs. In the broader Expo-inspired mobility ecosystem, the Mobility Passport represents a user-facing interface that ties together air, ground, and personal mobility: one credential or app to manage many modes, with transparency and efficiency built into it.

This is a vision for future transportation and mobility. They might begin on a shared electric bike, transfer to an autonomous bus, ride the subway into the city center, and then hop onto an air taxi at a rooftop

⁹ https://asset.lmsg.jp/17478/DL_mobilitypassport_V12.2.pdf

vertiport. All activities are managed by one app and supported by a data-driven city infrastructure. At every stage, sustainability is baked in, from electric propulsion to efficient fleet use. These tools can be used to transform regional revitalization. Remote islands or mountain villages could gain fast, reliable connections through eVTOLs; small municipalities could cut costs and emissions with Mobility Passport systems; and personal devices like UNI-ONE could give aging populations newfound independence. While Maebashi represents the current frontier of citizen-centered smart mobility, the Osaka Expo points toward what the next generation of such systems might look like — a seamless bridge between people, places, and technologies.

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