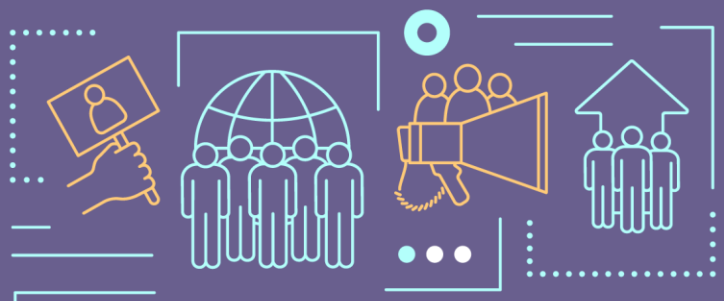


This project is funded by
the European Union

EU-Japan Joint Study:
Demographic trends and territorial policy responses

Annex 2: Japan Case studies

Tokyo

General Information

(1) Geography of Tokyo

Tokyo Metropolis, the capital of Japan, consists of three areas: the wards area in the east, the Tama area in the west, and the islands spread over the Pacific Ocean[1]. With an area of 2,194 km^2, Tokyo is the third smallest prefecture in Japan, but it has a high concentration of governmental agencies, businesses, and commercial facilities in its special wards area[2].

(2) Economy

Tokyo's gross prefectural product in FY 2018 was 107 trillion yen, with an economic growth rate of 1.0% (105.9 trillion yen and 0.8% in the previous year). By industry, wholesale and retail trade (approximately 21.7 trillion yen, or 20.3% of the total) was the largest, followed by real estate (approximately 12.1 trillion yen, or 11.3% of the total), professional, scientific, and technical activities (approximately 12 trillion yen, or 11.2% of the total), and information and communications (approximately 11 trillion yen, or 10.3% of the total)[3]. Specialization in tertiary industries is progressing.

(3) Finance

The Tokyo metropolitan government's general account budget for FY2020 was 7.354 trillion yen, second only to FY2019, which was a record high due to the budget for the 2020 Tokyo Olympics. Unlike other local governments, the Tokyo Metropolitan Government does not receive local allocation tax. However, corporate tax, which is susceptible to economic fluctuations, accounts for a high percentage of its revenue. In expenditure side, general expenditures for FY2020 was 5.5332 trillion yen and it spent on welfare and health care (23.1%), education and culture (21.8%), police and firefighting (16.7%), and urban development (15.7%). The welfare and health care category has increased for 16 consecutive years since 2005, becoming the largest ever, due to the declining birthrate and aging population[4].

(4) Policy Structure of Urban Planning

In 2019, the Tokyo Metropolitan Government formulated the “Strategic Vision for Tokyo’s Future,” which outlines the vision for Tokyo it aims to achieve in the 2040s, and the strategies that should be implemented up to 2030 to achieve that goal. The vision's basic strategies include a future vision created through a backcasting approach, the promotion of policies in collaboration with private sector companies and other various entities, and the realization of a “Smart Tokyo” through digital transformation. In particular, with regard to the realization of a “Smart Tokyo,” the city is accelerating its efforts by supporting smart city projects of the private sector.

As an urban planning master plan, the metropolitan government also formulated the “Grand Design for Urban Development” in 2017, with the goal of becoming a “highly developed mature city that is relaxing

[1] The islands have a total area of about 404 square kilometers. The island population is continuing to fall and currently stands at 26,000 (as of October 1, 2015), with a population density of 65 persons per square kilometer. The islands with no urban areas are not included in this study.
[2] There are 62 cities, wards, towns, and villages in Tokyo, of which the 23 wards are called “special wards.” Special wards have publicly elected mayors, assemblies, the right to enact ordinances, and the right to levy taxes, and are basic local governments just like ordinary municipalities.
[3] Annual Report on Tokyo Metropolitan Accounts for FY 2018
[4] Tokyo Metropolitan Government Finances, April 2020, pp. 2-8.

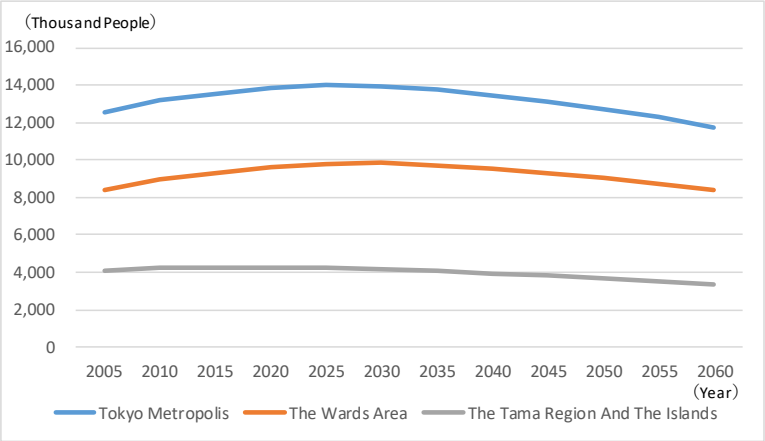
and full of vitality," as well as strategies and policies for realizing this vision of Tokyo in the 2040s. The plan presents a new regional classification to promote development that takes advantage of the unique characteristics of each region, and sets the city center as an "international business exchange zone" to strengthen international business and exchange functions.

Demographic Trends

(1) Population and the Number of Households

The population of Tokyo was 13,834,924 as of January 2020. Of this, about 70% was in the wards area. The total number of households was 7,298,694 as of January 1, 2020, with 1.90 persons per household. On an annual basis, the population of Tokyo has been on an upward trend since 1995, and is expected to peak at approximately 13.98 million in 2025 and decline thereafter, although this was estimated before the spread of COVID-19, as explained below. By region, the number of people in the Tama area and the islands has already begun to decline after peaking in 2020. The number of people living in the wards is expected to increase until 2030, after which it is expected to decrease.

It should be noted that, at least in the short term, the population of Tokyo has already begun to decline since July 2020 due to an increase in the number of people moving out of Tokyo to neighboring prefectures and other regions and a decline in the birth rate. This is also against the backdrop of a higher prevalence of teleworking triggered by the spread of COVID-19[5]. If this trend continues into the future, it will be necessary to revise the aforementioned long-term population forecast, so the situation must be closely monitored.



Source: Tokyo Metropolitan Government's Action Plan for 2020

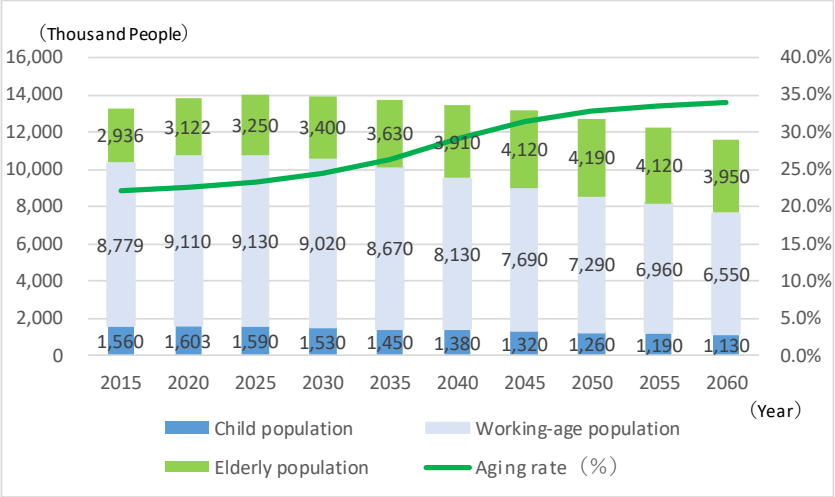
Figure 1. Population Change in Tokyo

(2) Population Distribution by Age Group and Aging Trends

As of January 2020, the population by age group and its composition were as follows: the child population (0-14 years old) was 1,603,044 (11.6%), the working-age population (15-64 years old) was 9,109,812

[5] Tokyo Metropolitan Government, "Summary of Population Estimates for Tokyo (as of March 1, 2021)" (https://www.toukei.metro.tokyo.lg.jp/jsuikei/2021/js213f0000.pdf); Ministry of Internal Affairs and Communications' Statistics Bureau, "2020 Annual Report on Internal Migration in Japan Derived from the Basic Resident Registers," published on January 29, 2021 (https://www.stat.go.jp/data/idou/2020np/jissu/youyaku/index.html#a2)

(65.8%), and the elderly population (65 years old and over) was 3,122,068 (22.6%). As the population ages further, the elderly population is expected to increase to 3.4 million with aging rate of 24.4% by 2030, with about one in four people being 65 or older.



Source: Deloitte, from Tokyo Metropolitan Government Action Plan for 2020

Figure 2. Population Distribution by Age Group in Tokyo

Main Challenges and Policy Responses

The population of Tokyo as a whole has been increasing due to net migration growth, especially in the wards area, but this concentration of people in Tokyo has led to issues such as congestion in transportation and a worsening living environment. The total population of Tokyo is expected to peak in 2025, after which the city will enter an era of population decline. It is necessary to improve the appeal and international competitiveness of the city, and to ensure a comfortable living environment, while promoting efficient urban management in preparation for the declining birthrate and aging population.

In response to these issues, the Tokyo Metropolitan Government, in its "Strategic Vision for Tokyo's Future," has set forth a vision for Tokyo in the 2040s that calls for the realization of a city that is "safe city", "diversity", and "smart city". The vision for a "safe city" includes efforts to streamline administrative services and reduce the burden on public finances, such as the creation of a one-stop portal for disaster information and the automatic detection of disaster information using AI. In the area of "diversity", the plan mainly focuses on efforts to realize an inclusive society through, for example, the digitalization of educational environments and furthering remote medical care. Initiatives for a "smart city" include efforts related to transportation and the urban environment, such as 3D digital maps and ICT-based urban environment development.

✧ Public Finance

In Tokyo, social security expenditures have been increasing year by year due to the aging of the population, reaching 1.2975 trillion yen (about 23.1% of general expenditures) in the FY2021 budget[6]. It is expected that there will be a massive demand for administrative services in the future, especially for welfare services. At the same time, the growth rate of metropolitan tax revenue is expected to decline due to the decrease in the

[6] Tokyo Metropolitan Government, "Outline of the Proposed Budget of the Tokyo Metropolitan Government for Fiscal 2020" (https://www.zaimu.metro.tokyo.lg.jp/syukei1/zaisei/20200124_reiwa2nendo_tokyotoyosanangaiyou/2 (yosanangaiyou.pdf)

working-age population. According to long-term estimates of Tokyo's fiscal balance, the deficit between revenue and expenditure is likely to increase between 2021 and 2040, and drastic expenditure reduction efforts may have to be initiated[7]. In addition, Tokyo has one of the largest populations of any major city in the world and is at high risk of earthquakes and other disasters[8], so it is necessary to manage its infrastructure efficiently within its limited financial resources.

(1) Sustainable Urban Development

The Tokyo Metropolitan Government has been promoting digital transformation and the use of new technologies such as AI and drones, with the aim of reducing the burden on public finances and achieving more efficiency in their administrative services. In addition, in order to respond to high disaster risks, the city is working to streamline administrative services with an eye to reducing the administrative and financial burdens through the use of one-stop disaster information and AI functions that automatically detect the occurrence of disasters in specific areas. In order to prepare for various risks including natural disasters, it is important to collect and disseminate information in real time; therefore, the government is focusing on the construction of an information and communication network as a foundation for this. It is also working on the early development of the 5G environment, the next-generation communication standard, and is operating smart poles equipped with 5G antenna base stations.

✧ Urban Environment

In Tokyo, the concentration of population in the city center during daytime hours causes congestion in the transportation system. In terms of the living environment, the total floor area per home is the smallest in Japan, and the housing situation is not favorable. The number of vacant houses in the suburbs such as the Tama area is increasing due to the decline in population. Overcrowding and the concentration of urban functions in the city center have resulted in a worsening of the urban environment, including a more pronounced heat island phenomenon and a decrease in parks and green spaces. Since the number of elderly people is increasing and the area is one that attracts people from all over the world, it is necessary to build an inclusive society and promote urban development based on the concept of universal design. The initiatives described below are being implemented to address these issues.

(1) Mobility

In addition to strengthening the existing transportation infrastructure, the Tokyo Metropolitan Government is working to build a transportation network that incorporates various means of transportation, such as promoting the use of bicycles, including bicycle-sharing services, and revitalizing boat transportation, in order to relieve transportation congestion caused by population concentration. In recent years, with the support of the Tokyo Metropolitan Government, mobility services provided mainly by the private sector and public transportation such as railroads, buses, and boats have been collaborating to propose optimal means of transportation. Additionally, a number of demonstration experiments have been conducted for multimodal services (e.g., MaaS) that allow payment, showing advancement in the creation of operational services.

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[7] Tokyo Metropolitan Government, "Long-Term Estimates of Tokyo's Fiscal Balance" (https://www.metro.tokyo.lg.jp/tosei/hodohappyo/press/2019/12/27/documents/04_01.pdf)

[8] It is predicted that there is a 70% probability that an earthquake will directly hit Tokyo in the next 30 years.

(2) Natural and Living Environment

The Tokyo Metropolitan Government is working on measures to counter the heat island effect by promoting energy conservation, increasing greenery, laying heat-shielding pavement and water-retaining pavement on prefectural roads, and creating "cool spots"[9]. The government is also working together with private companies on area development to improve the environment in terms of greenery and water, while also promoting the conservation and utilization of the existing natural environment. In addition to providing financial subsidies to municipalities that take measures to deal with vacant houses, the metropolitan government has also begun to take measures to deal with vacant houses by using remote sensing and AI to detect human movement and efficiently survey vacant houses. Databases called "vacant house banks" are also used to match owners of these houses with potential buyers or renters.

(3) Inclusive Community

The Tokyo Metropolitan Government is promoting urban development based on universal design, in order to create an inclusive society where all people can live comfortably and safely, including people with disabilities, the elderly, and foreigners. In order to make transportation systems and roads barrier-free so that all people can move around smoothly, the government is not only working on tangible infrastructure for accessible public transportation systems and tourist spots, but also developing intangible services for barrier-free facilities, such as ICT-based pedestrian mobility support services and the network data on pedestrian space. In addition, the government is creating an accessible information system that takes into account people with disabilities and non-Japanese speaking residents by installing pictograms and multilingual signs, as well as providing information in Braille and other languages, so that the visually impaired and foreign residents can live comfortably.

✧ Regional Economy

The declining birthrate and aging population in Tokyo will lead to a stagnation in production activities due to a shortage of labor, which may lead to a decline in socioeconomic activities such as personal consumption during the long-term population decline phase. In addition, compared to London and Singapore, the city as a whole is lagging behind in digitalization, open government, and the use of cashless payments.

In response to these issues, the Tokyo Metropolitan Government is working to support the introduction of teleworking to improve the productivity and diversity of corporate work styles, and to support the introduction of robotics and IoT in venture businesses and small and medium-sized enterprises, in anticipation of the ongoing population decline. As a metropolis that drives the Japanese economy, the city is also promoting the development of urban infrastructure and the revitalization of local economies through digital transformation. It is particularly important to improve infrastructure in a way that allows Tokyo to be an attractive city where people and companies from all over the world gather; working and living environments must be enhanced to increase international competitiveness. For this reason, the Tokyo Metropolitan Government aims to become a city for international economics and tourism by creating a "smart city" through public-private partnerships. This includes the construction of the Tokyo Data Highway, the world's fastest mobile internet network and the "Smart Tokyo" concept to achieve Tokyo's version of Society 5.0. For the Smart Tokyo concept, the following four areas were selected as smart cities for 2020: Daimaruyu (Tokyo Station area), Takeshiba, Toyosu, and Nishi-Shinjuku. The Takeshiba area will be described later as a use case of smart solution.

[9] Installation of equipment that sprays water in the form of a fine mist, etc.

Use Cases as Smart Solutions

The Tokyo Metropolitan Government has identified “safe city”, “diversity” and “smart city” as the three pillars of its vision for the city. In its medium- to long-term plan called the “Strategic Vision for Tokyo’s Future,” formulated at the end of 2019, one of the major proposals is the achievement of a “Smart Tokyo,” where Tokyo’s potential is harnessed through the power of digital technology, allowing Tokyo residents to lead high-quality lives. In July 2020, the Tokyo Metropolitan Government selected four areas for model projects in preparation for the creation of a “Smart Tokyo.” These projects are Smart City Takeshiba in the Takeshiba district, the Smart City Project in the Otemachi-Marunouchi-Yurakucho District, Toyosu Smart City, and Nishi-Shinjuku. This section introduces Smart City Takeshiba in the Takeshiba district and Tokyo Port City Takeshiba, an urban smart building developed as part of the project, which aim to both solve urban challenges and achieve economic development.

✧ Initiatives for building an urban OS in Smart City Takeshiba

(1) Overview of Initiatives

a. Characteristics and Challenges of the Target Area

The Takeshiba district is a business area where many companies are located, and with its convenient access to Haneda Airport, it is an internationally competitive hub that serves as the gateway to Tokyo. In addition, the Takeshiba Pier and Hinode Pier, which are used for passenger transportation, are located in the waterfront area and are used by many tourists. In the event of a disaster, it is positioned to become a base for marine transportation of goods. In 2012, the area was designated as one for specified urban renaissance urgent redevelopment areas, and urban development projects are expected to continue in the future. This area is becoming increasingly concentrated in terms of its urban functions, and in addition to the chronic problem of congestion during rush hour, the area is also at risk of having a large number of people becoming trapped in the event of a disaster. These risks make business continuity difficult for companies located in the area. Due to these regional characteristics, the area is in need of urban development that can simultaneously solve social issues and achieve regional development and revitalization.

Source: Deloitte, from Nikkei Business

Figure 3. Smart City Takeshiba's target area

b. Project Summary

Smart City Takeshiba (hereafter referred to as the "SCT Project") is a joint project by Takeshiba Area Management [10], Softbank Coporation, Tokyu Land Corporation, Kajima Corporation, and Contents Innovation Program (general incorporated association) in the Takeshiba district of Minato Ward, Tokyo.

The Project aims to solve urban issues through smart solutions by building the Takeshiba version of Urban OS, which implements services that uses cutting-edge technologies and real-time data. Urban OS is a data platform that can collect and analyze data related to various fields such as urban transportation, energy, finance, and education, and utilize it in collaboration with data held by local governments and companies. The Takeshiba version of Urban OS is being used to try to improve transportation, security, business and living environments through the collection and utilization of real-time data, and aims to provide cross-sectoral services in the Takeshiba area.

Source: Tokyo Port City Takeshiba

Figure 4. Concept of the Takeshiba version of Urban OS

(2) Progress of Initiatives and Future Challenges

Three phases are planned for the Project in the creation of an Urban OS [11]. The first phase is the implementation of various solutions in the newly constructed smart building Tokyo Port City Takeshiba in the Takeshiba district. The second phase is the provision of solutions for the entire Takeshiba area, and the third phase is the deployment of solutions through data linkage between the Takeshiba area and other cities.

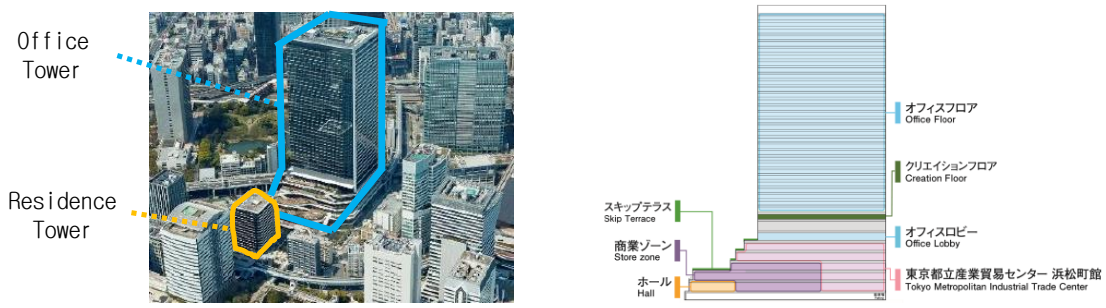
Currently, SCT project is in the middle of the first phase of the three phases mentioned above, with the opening of Tokyo Port City Takeshiba in September 2020, and the development of services using state-of-the-art technology is progressively underway. The next section describes the details of the various technologies and services implemented at Tokyo Port City Takeshiba.

[10] Takeshiba Area Management is an organization responsible for the management of projects related to urban development in the Takeshiba area, and is promoting this project in cooperation with the Takeshiba Area Urban Development Council, which is made up of local stakeholders and the government.
[11] Refer to the webpage related to Smart City Takeshiba on Softbank's website. (https://www.softbank.jp/biz/takeshiba/)

✧ Construction of a Smart Building to Solve Urban Challenges for Tokyo Port City Takeshiba

(1) Overview of Initiatives

Tokyo Port City Takeshiba is a large-scale complex (total floor area of approximately 200,000 m^2) consisting of a 40-story office tower and an 18-story residential tower. It is planned to construct smart buildings and implement various solutions using advanced technologies such as robotics, AR, and VR. This section provides an overview of the technologies and initiatives employed to address regional and social issues in the district, as well as respond to challenges presented by the recent COVID-19 pandemic. It covers the sectors of mobility, disaster preparedness, crime prevention, energy, and urban environment.



Source: Tokyo Port City Takeshiba

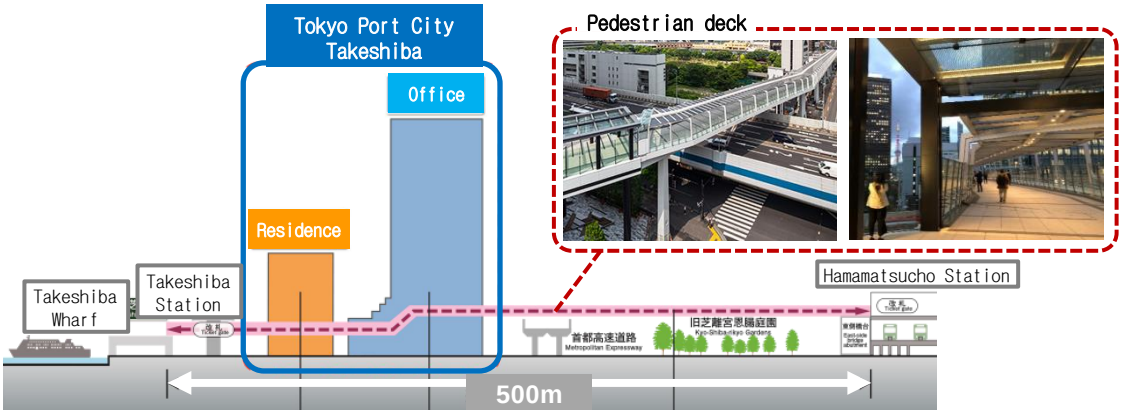
Figure 5. Exterior view of Tokyo Port City (left) and cross-sectional view of the office tower

(2) Initiatives by Sector

a. Mobility

Hamamatsucho Station and the surrounding area in the Takeshiba district is a congested area used by many commuters and visitors. As part of the construction of Tokyo Port City Takeshiba, a 500-meter-long pedestrian deck connecting the station to the building is under construction. This barrier-free pedestrian deck is directly connected to the office tower from Hamamatsucho Station. As of the end of 2020, about 80% of the deck has been completed, with the exception of the area between Hamamatsucho Station and the Metropolitan Expressway. Work continues so that the deck can be opened to traffic.

In order to improve mobility in the area, a demonstration experiment was also conducted for a boat transportation MaaS service for commuters using small boats[12]. This boat transport MaaS is a mobility service that combines boat transport from Kachidoki to Takeshiba and on-demand bus transportation from



[12] Conducted over four days from January 14 to 17, 2020.

Takeshiba to Hamamatsucho Station. A service that allows payment for the combined use of boats, on-demand buses, and trains was also tested. The population of the Kachidoki district is expected to increase further in the future amid the rush to construct tower condominiums, and demand for MaaS is anticipated. However, the small boats used in the demonstration experiment had a capacity of 90 passengers, which is not enough to alleviate the congestion of the morning traffic rush; therefore, capacity is an issue that needs to be addressed before the system can be put to practical use. In terms of pricing, it is expected that the individual fare for the boat, on-demand bus, and train will add up to a higher price than when traveling by subway, so a set-fare service and the sale of fixed-price, unlimited-ride tickets are being considered[13].

Source: Tokyo Port City Takeshiba

Figure 6. Pedestrian deck connecting Hamamatsucho Station and Takeshiba Pier

Source: Tokyo Port City Takeshiba

Figure 7. Boat MaaS for Commuters in the Takeshiba District

b. Security and Infectious Disease Control

As a way to ensure safety and security at Tokyo Port City Takeshiba, a contactless face recognition system has been installed at the office entrance gate. This authentication system is capable of facial recognition even when wearing a face mask, and is also equipped with a thermo-sensor that prevents the gate from opening if it detects a fever, making it effective in dealing with infectious diseases. This facial recognition system is linked to the ELE-NAVI system, which distributes building users by destination floor, allowing users to be guided to the elevator that will take them to their destination floor, and then to their office without having to touch anything. In addition to the above, a variety of advanced security and infectious disease countermeasures have been incorporated, including AI cameras that track suspicious persons found in the building, and self-propelled security robots that run in conjunction with the building.

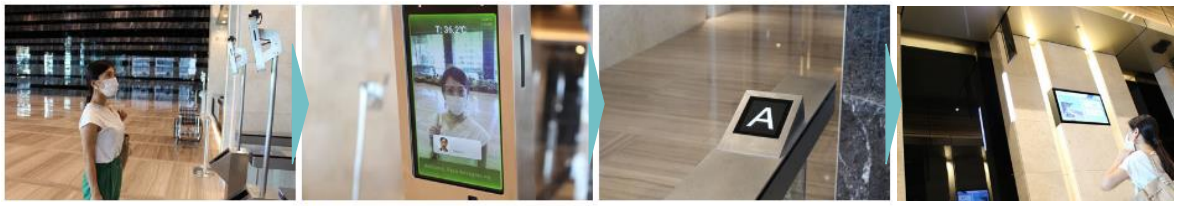
c. Building Management

About 1,300 sensor devices have been installed in Tokyo Port City Takeshiba to collect and allow the visualization of various data in real time, including energy usage, restroom availability, store and elevator congestion, status of trash cans, and the flow of people in the building. By utilizing this real-time data, building managers can optimize and streamline building management, including energy management and cleaning operations. In addition, as in the area of safety and security described above, cleaning robots equipped with autonomous driving technology are also being incorporated, which is expected to solve the labor shortage.

[13] WORKPORT Plus, “Monet Technologies: A Demonstration Experiment for “Boat Transport MaaS” to Transport Commuters by Small Boat,” January 16, 2020 (https://www.workport.co.jp/plus/articles/5374)

d. Comfortable Work Environment

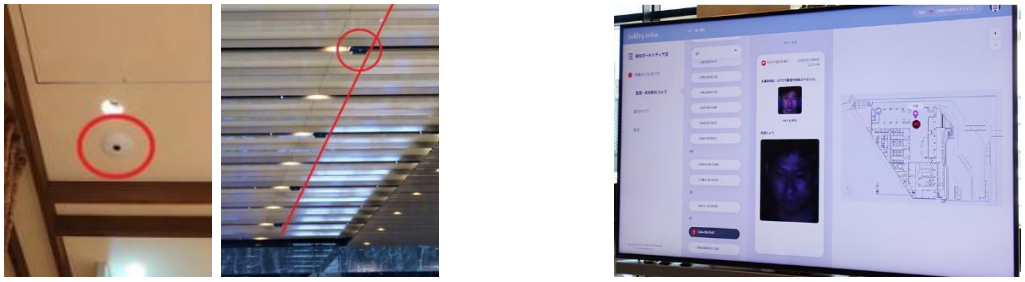
The office tower has been designed with water and greenery throughout the building in order to provide a comfortable working environment and to promote biodiversity conservation in the city. The outdoor “skip terraces” (graduated terraces) on the 4th to 6th floors have a variety of natural features such as rice paddies, vegetable gardens, and trees, and are equipped with Wi-Fi and electrical outlets for personal computers. These provides comfortable working environment outside of the building avoiding the crowd.



Facial recognition gate | Facial recognition is possible even when wearing a mask | Guide to the optimal elevator from employee data and congestion | It is possible to reach the destination without contact

Source: Tokyo Port City Takeshiba

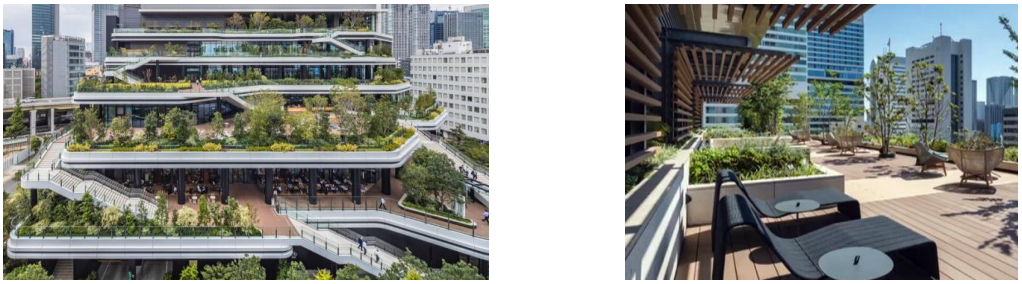
Figure 8. ELE-NAVI system linked to the facial recognition gate



Sensors installed on the ceiling of the building | System that visualizes real-time data

Source: Tokyo Port City Takeshiba

Figure 9. Building management system using sensors



Skip terrace of the office tower | Outdoor terrace with WIFI equipment

Source: Tokyo Port City Takeshiba

Figure 10. Skip terrace in the office tower

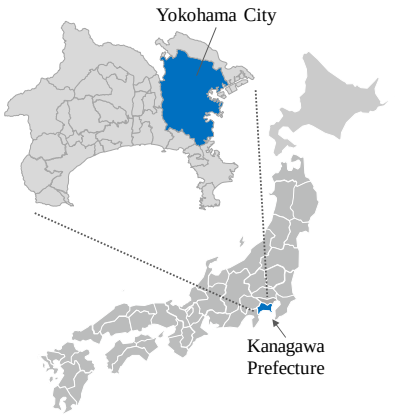
(3) Progress of Initiatives and Future Challenges

Tokyo Port City Takeshiba, which opened in September 2020, has already implemented a variety of functions, mainly within the building, such as a face recognition system to prevent infectious diseases, an energy management system using sensing devices, and a work environment equipped with water features, green spaces, and Wi-Fi. In the future, it is expected that mobility will be further improved, including in the area around the building, through the installation of a pedestrian deck connected the nearest train station and the implementation of MaaS using boat transportation. Tokyo Port City Takeshiba is a core project of Smart City Takeshiba, which aims to build an Urban OS, with plans to collect various data in the Takeshiba area and to study and develop infrastructure for data-linkage with other cities.

Yokohama City, Kanagawa Prefecture

General Information

(1) Geography of Yokohama City



Yokohama City is located in the eastern part of Kanagawa Prefecture, which borders Tokyo Metropolis to the north. The city is part of the Tokyo Metropolitan Region. Much of the city's area of 437 km^2 is hilly. It is situated on the shores of Tokyo Bay, and is thus positioned as one of the preeminent port cities of Japan.

(2) Economy

In FY2018, the gross city production was 13.9 trillion yen, and the economic growth rate was 1.4% (13.7 trillion yen and 2.1% in the previous year). The city accounts for approximately 40% of the gross production of Kanagawa Prefecture. In terms of the breakdown by industry, real estate was the leader (2.4 trillion yen, or 17.2% of the total), followed by wholesale and retail (1.5 trillion yen, or 11.0% of the total), and manufacturing (1.4 trillion yen, or 10.3% of the total).[14] As the preeminent international trading port of Japan, Yokohama City is the driver of many industries, including trade, commerce, marine transport, and shipbuilding. Additionally, the world-class industrial zone that stretches from northern Tokyo Bay to the eastern part of the city is a critical hub for manufacturing electronic equipment, machinery, automobiles, and more.

(3) Finance

Yokohama city's general revenue for FY2021 is 1.673 trillion yen, a 67 billion-yen decrease from the revenue in FY2020 (1.74 trillion yen).[15] This is because the COVID-19 pandemic is expected to produce negative impacts, including reduced tax revenue due to factors such as declining corporate revenues and a decrease in taxpayers caused by the deteriorating employment situation. Residence tax revenue accounts for 47.7% of the city's revenue, a figure characterized by the high component of individual residence taxes. According to the municipal government, this is due in part to the vast number of residents who work outside the city; the city expects residence tax revenue to decrease due to future population decrease. Yokohama City's general expenditures in FY2021 are trending high, particularly for childcare and education (592.9 billion yen) and welfare, healthcare, and medical care (516.7 billion yen). Expenditures on welfare, healthcare, and medical care are expected to increase as the population ages, increasing the importance of keeping finances in good shape.[16]

(4) Policy Structure of Urban Planning

Yokohama City has formulated a long-term vision, the Yokohama General Plan (Long-Term Vision), as well as a medium-term plan titled "Yokohama Medium-Term 4-Year Plan 2018-2021". As the most populous city in Japan,[17] Yokohama City is promoting a variety of economic, social, and environmental measures, and is characterized by its assistance for local companies through various platforms, and its regional economic revitalization strategies through efforts such as strengthening its functions as a host of global MICE. Additionally, the city formulated an SDGs Future City Plan to coincide with the duration of the

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[14] Fiscal 2018 Yokohama City Civic Economic Statistics, Yokohama City, https://www.city.yokohama.lg.jp/city-info/koho-kocho/press/seisaku/2020/0326_tokei-chosa_sna.html

[15] Fiscal 2021 Budget, Yokohama City, https://www.city.yokohama.lg.jp/city-info/zaisei/jokyo/yosan/r3/r3.html

[16] Fiscal 2021 Yokohama City Budget: Yokohama's Finances at a Glance, Yokohama City, https://www.city.yokohama.lg.jp/city-info/zaisei/jokyo/kohoshi/r3hitoyoko.html

[1717] Excluding the special wards of Tokyo Metropolis

aforementioned Yokohama Medium-Term 4-Year Plan 2018-2021, and with the target year set to 2030 to align with the Long-Term Vision. The municipal government is linking various initiatives based on its future vision under the plans, and making other efforts in an integrated approach, one of the basic tenets of SDGs.

Demographic Trends

(1) Population and the Number of Households

The population of Yokohama City, which is the most populous city in Japan, was 3,776,146 as of April 1, 2021[18]. The city's population has consistently trended upward; however, projections based on 2015 figures estimate that the population will decline gradually after peaking in 2020. Additionally, in 2020, given the COVID-19 pandemic and the state of emergency declared by the government of Japan, inward and outward migration was approximately 10% lower in April, and more than 30% lower in May than the previous year respectively.[19]

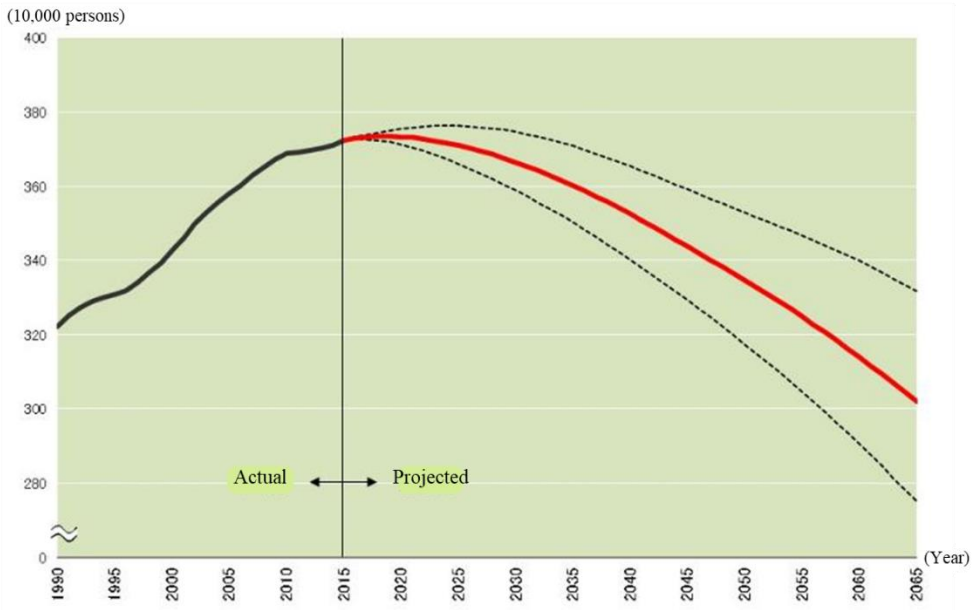
The total number of households has also trended upward; the figure was 1,762,920 as of April 1, 2021, but is projected to decrease after peaking in 2030.[20] In contrast, the number of people per household has consistently decreased; as of April 1, 2021, the figure was 2.14, and is projected to decrease to 2.07 in 2060.[21]

[18] Estimated Population and Number of Households, Yokohama City, https://www.city.yokohama.lg.jp/city-info/yokohamashi/tokei-chosa/portal/jinko/maitsuki/saishin-news.html

[19] Demographic Trends During 2020 (Overview of Results, Part 1 Demographic Trends (2020)), Yokohama City, (https://www.city.yokohama.lg.jp/city-info/yokohamashi/tokei-chosa/portal/kankobutsu/yokohamajinko/r2dotainenrei.files/1.pdf)

[20] Yokohama City Future Population Estimates, Yokohama City, (https://www.city.yokohama.lg.jp/city-info/seisaku/torikumi/shien/jinkosuikei.html)

[21] The number of people per household was calculated by dividing the total population by the total number of households based on Yokohama City Future Population Estimates.

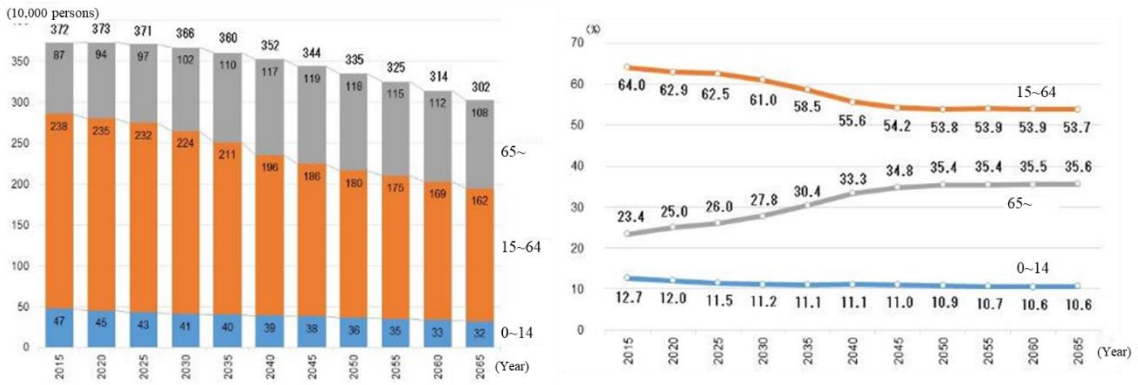


Source: Yokohama City Future Population Estimates (Medium Estimates)

Figure 24 Population Changes in Yokohama City

(2) Population Distribution by Age Group and Aging Trend

As of January 2020, the population by age group and its composition were as follows: the child population (0-14 years old) was 446,873 (11.9%), the working-age population (15-64 years old) was 2,358,120 (62.9%), and the elderly population (65 years old and over) was 922,408 (24.6%). The population aging rate continues to rise, and is projected to increase further to 35.4% in 2050.



Source: Yokohama City Future Population Estimates (Medium Estimates)

Figure 25 Left: Population by Age Group in Yokohama City, Right: Population Percentages by Age Group in Yokohama City

Main Challenges and Policy Responses

As a commuter town of Tokyo Metropolis, and given the population concentration of the Tokyo Metropolitan Region, Yokohama City has experienced consistent population growth. In response to this population growth, the city has improved its urban infrastructure and made progress on improving policy for social welfare, including assistance for childcare. As births continue to decrease and the population continues to age, the

working-age population supporting the city's finances is expected to decline; meanwhile, the city's elderly population is expected to grow to 1 million in 2025, further increasing demand for social welfare. Additionally, in the city center, where the daytime population is high, it is important to enhance the city's global competitiveness and revitalize its economy. In contrast, in the suburbs, the municipal government faces the same challenges as rural cities in that transit deserts have formed amid an increasingly elderly population.

In response to these challenges, the city is making progress on streamlining the implementation of public finances while also proactively providing assistance for companies in the city; enticing companies to relocate to the city; and stimulating tourism, MICE, culture, and the arts; in addition to making efforts to revitalize the regional economy, including efforts to actualize a vision for integrated resorts. Additionally, in order to maintain the city's status as a sustainable and appealing place in economic, social, and environmental terms, the city is using public-private partnerships to promote projects such as the Yokohama Smart City Project (YSCP) and the Minato Mirai 2050 Project for establishing a smart city model of large cities, and is also making other efforts, including establishing a regional energy management system and implementing demonstration experiments for mobility services capable of accommodating a super-aged society.

Public Finance

Although Yokohama City is in greater need of infrastructure development than other cities given its status as a port city and popular tourist destination, the city must undertake developing efforts efficiently amid projections of declining tax revenue due to depopulation. The number of elderly people is projected to increase through 2025, driving up social security expenses and welfare demand, and increasing the importance of keeping finances in good shape while responding to residents' need for government services. In response to these challenges, the city is promoting efforts to use ICT for establishing a regional medical care network, utilize existing building stock such as rental housing complexes as a regional medical care and welfare center, and more, all in an effort to establish efficient social systems capable of accommodating a super-aged society. Additionally, amid concern over the heightened risk of disasters due to climate change, as well as earthquakes, the municipal government is promoting targeted, effective countermeasures toward creating a safe, secure city, mainly in the coastal areas that drive the city's economy and cultural activity. The countermeasures include strengthening urban infrastructure and the disaster risk reduction functions of the port, and green infrastructure-based disaster reduction measures.

Urban Environment

Yokohama City has promoted the development of urban infrastructure in response to persistent population growth since the postwar reconstruction. Additionally, regarding the transportation network, the enhancement of expressways and railway networks around the city has been promoted; mobility in the city is expected to become more convenient. However, transit deserts have formed in the city's suburbs, and the number of transportation disadvantaged people is expected to grow due to factors such as an increase in the elderly population. Challenges also exist in large-scale housing complexes in the suburbs, namely progressive building deterioration and an increasing number of vacant units. Urbanization in Yokohama City brought a perpetual decline in agricultural land, forested area, and green coverage; the city faces the key challenge of forming an attractive urban environment featuring greenery and water. The municipal government is implementing the efforts outlined below in response to these challenges.

(1) Mobility

Yokohama City is working with private companies to remedy transit deserts in suburban areas through efforts such as operating community buses and on-demand transport, and conducting demonstration experiments for modes of personal transportation known as "green slow mobility."[22] Additionally, in urban areas, the municipal government is providing new mobility services such as MaaS and on-demand transport, which aim to alleviate congestion through more efficient transportation services.[23] The city is also working with private-sector transportation operators on efforts such as a demonstration project for short-distance mobility services to help elderly people and people with disabilities get around in urban areas.

(2) Natural and Living Environment

Yokohama City has been promoting resident-led housing complex revitalization activities, including the hosting of housing complex revitalization competitions in order to revitalize and reinvigorate suburban areas experiencing an outflow of young people and an increase in vacant dwellings. The city is also making efforts to preserve the green spaces remaining in river basins within city limits, establish and redevelop parks, and work with residents to create activity in parks, all in an effort to create a verdant, lively city.

Regional Economy

In order to respond to competition with other global cities and create employment opportunities in Yokohama City, it is important to further enhance the city's economic base by promoting efforts such as providing assistance for the sustainable growth and development of companies in the city, strengthening industrial hubs, enticing corporations to relocate to the city, and improving the business environment.

Therefore, to help companies in the city achieve sustainable growth and development, the municipal government is engaging in efforts such as business development through business platforms including I・TOP Yokohama[24] and LIP. Yokohama,[25] and the Y-PORT Project[26] aiming to provide solutions to urban challenges in developing countries and help companies in Yokohama provide overseas development aid. The city also set out Zero Carbon Yokohama—one of the earliest action plans for decarbonization among Japanese municipalities—and is working with the private sector to implement the Yokohama Smart City Project (YSCP), an effort to create a model for sustainable major cities. Additionally, in an effort to revitalize the regional economy, the municipal government is soliciting international conferences and the corresponding economic spillover effects, promoting the strengthening of MICE-related industries, and implementing initiatives to strengthen its functions as a host of global MICE and actualize a vision for integrated resorts. Furthermore, in an effort to create further appeals and activity in the city, the municipal government is devoting energy to hosting major sporting events and arts festivals with a distinct Yokohama City flavor.

Use Cases as Smart Solutions

Yokohama City's focus should be on the decline of economic activity associated with fewer childbirths and an aging population, and it is important to promote the revitalization of the regional economy and the

[22]Implementation of Suburban MaaS Proving Tests, Tokyu Group, October 31, 2018, https://www.tokyu.co.jp/image/news/pdf/20181031-1.pdf
[23]MaaS Initiatives to Begin Along the Coastal Area of the City Center!, Yokohama City, July 22, 2020, https://www.city.yokohama.lg.jp/city-info/koho-kocho/press/toshi/2020/yokohama_my_route.html
[24]A venue for collaboration between players with ambition in IoT business, open to all industries and companies of all sizes
[25]An abbreviation for Yokohama Life Innovation Platform, an innovation platform in the life sciences field
[26]A project for providing support for solutions to urban challenges in developing countries, and implementing international technical cooperation through civic collaboration, leveraging the resources and technologies of Yokohama

improvement of the urban environment while also strengthening the city's global competitiveness as a major city by stimulating local companies and enticing new companies to relocate to the city through efforts that leverage advanced technology, and also make other efforts such as improving means of transportation.

With an understanding of these challenges, and especially in consideration of the timely social issue of adapting into a decarbonized society, the city has set out the aim to become a decarbonized city earlier than other Japanese municipalities, and has worked with the private sector to promote the Yokohama Smart City Project (hereinafter, the YSCP) in order to realize that goal. The YSCP is an initiative to establish the world's first model for a smart city in Yokohama—a major city with a population of 3.7 million people—and export Yokohama-style solutions to cities around the world. Although Japan has been on the forefront of advancing global standards for individual underlying technologies for realizing decarbonized societies, there have been limited opportunities to connect the technologies to create systems that serve society at large. Yokohama City sees this as a challenge to overcome, and is implementing the YSCP with the aim of building a citywide system equipped with fully leveraged smart technologies. The project is expected to contribute to the development of companies in the city as well as the realization of the city's aim to become a decarbonized city, thereby leading to the revitalization of the city's economy and the improvement of its urban environment.

Additionally, in recent years, the municipal government has promoted the Minato Mirai 2050 Project focused in the Minato Mirai 21 District, which typifies the city center. The project adds advanced urban planning efforts in the green, eco-mobility, and activity sectors to the city's existing efforts in the energy sector. This chapter provides an overview and status of use cases in the YSCP and Minato Mirai 2050 Project.

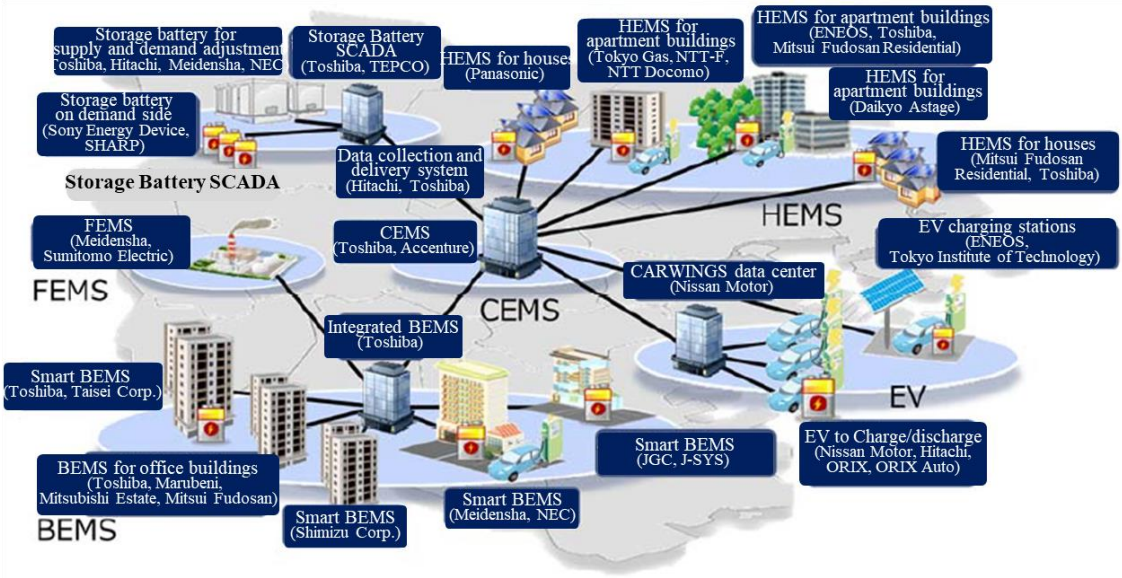
1-1-1. Yokohama Smart City Project (YSCP)

(1) Overview of Initiatives

The YSCP is an initiative to build a citywide system equipped with fully leveraged smart technologies in an effort to establish the world's first model for a smart city in the major city of Yokohama, and to export Yokohama-style solutions to cities around the world. The project also serves as a platform for public-private partnerships toward realizing a smart city; the platform is indeed used for public-private partnerships as well as collaborative efforts between private companies in a variety of initiatives.

The YSCP, which is spearheaded by Yokohama City, comprises the YSCP Demonstration Project, which was implemented from 2010 to 2014, and the YSCP Implementation Project, which was launched in 2015, and is scheduled to last until 2023. The YSCP Demonstration Project is positioned as YSCP 1.0. The portions of the YSCP Implementation Project from 2015 to 2018 and from 2019 to 2023 are positioned as YSCP 2.0 and YSCP 3.0, respectively. Project plans are formulated and the implementation status is monitored in each phase.

In YSCP 1.0, 34 companies including energy providers, construction companies, and electrical and electronic machinery manufacturers took part in efforts to introduce systems toward the optimization of the balance of energy supply and demand in existing urban areas.



Source: Yokohama City

Figure 26 Overview of Efforts of the YSCP Demonstration Project (YSCP 1.0)

In the YSCP Implementation Project in and after 2015 (YSCP 2.0 and YSCP 3.0), the municipal government and 23 private companies formed the Yokohama Smart Business Association (YSBA),[27] an organization for their public-private partnership, and have worked on various initiatives to apply the technologies and outputs of YSCP 1.0 in the transition from demonstration to implementation. A top example of these initiatives is the establishment of virtual power plants (hereinafter, VPPs).[28] VPPs are systems in which solar power generation systems, storage batteries, electric vehicles (hereinafter, EV), and household equipment with onboard energy management systems (hereinafter, EMS) are centrally managed and used to control power generation, storage, and demand within a given region in the same way as a single power station. The Yokohama-style VPPs the municipal government is striving to create not only optimize the balance of energy supply and demand during normal times, but also feature storage batteries installed at public facilities which serve as disaster prevention centers and evacuation centers to provide electricity for disaster risk reduction during emergencies. The energy measures implemented by the city are positioned as measures for decarbonization and contributing to the regional economy as well as measures for creating a safe, secure city. The municipal government is also moving ahead with the consideration of projects for creating, operating, and utilizing an urban EMS for gathering, analyzing, and evaluating energy data from the many different existing facilities in the city by promoting the introduction of EMS to those facilities.

(2) Progress of Initiatives and Future Challenges

Although various demonstration experiments for energy-related smart technology have been implemented in other areas of Japan, Yokohama City is promoting broader efforts to implement citywide smart technology by establishing promotion systems through public-private partnerships, and through cooperation and collaboration with numerous companies. The following is a summary of the results and progress of specific efforts under the YSCP. In YSCP 1.0, the project entities established an EMS centered

[27]Participating members of the YSBA (as of November 25, 2020) include eight managing members (Azbil Corporation, Taisei Corporation, Tokyo Gas, TEPCO Energy Partner, Toshiba Energy Systems, MM21 DHC, Meidensha Corporation, and Yokohama City) and 16 general members (IHI, e-Mobility Power, Orix, Shimizu Corporation, Takasago Thermal Engineering, Tokyo Gas Engineering Solutions, TTS, Nissan, NTT, Panasonic, Mitsui Fudosan, Mitsubishi Estate, Mitsubishi Hitachi Power Systems, Pacific Convention Plaza Yokohama (Pacifico Yokohama), Yokohama Toshi Mirai, and Yokohama Netsu Kyokyu). (See the Yokohama City website: https://www.city.yokohama.lg.jp/kurashi/machizukuri-kankyo/ondanka/etc/yscp/yscp05.html)

[28]Virtual power plants (VPPs) fulfill the same functions as power stations, with the owners of consumer energy resources and power generation and storage facilities directly connected to power grids, or third parties in control of those energy resources.

on community energy management systems (hereinafter, CEMS) in 2012, and subsequently implemented 16 projects with CEMS as well as in the home energy management system (hereinafter, HEMS), building energy management system (hereinafter, BEMS), and EV sectors. The results of these demonstration projects exceeded target values in many metrics, including HEMS and EV introduction and CO_2 emissions reduction.

Metric	Target	Actual
Number of HEMS* introduced	4,000 homes	4,230 homes
Scale of household solar power generation system introduction	27 MW	37 MW
Number of EVs introduced	2,000 vehicles	2,300 vehicles
CO_2 emissions reduction	30,000 tons	39,000 tons
CO_2 reduction rate	25%	29%

Source: Yokohama City

Figure 27 Target and Actual Values for the Main Metrics of YSCP Demonstration Projects

In YSCP 2.0, the project entities conducted studies on the feasibility of creating, operating, and utilizing an urban EMS, and discovered challenges in terms of profitability that remain under consideration. Other challenges exist in terms of gathering energy data, including the municipal government's need for cooperation in gathering data from private facilities, and the need to guarantee fairness with regard to the handling of gathered data (taking care to avoid granting privileges to specific private entities) and protect information in the course of transitioning to open data. Further matters to consider have been identified, namely the need to create a backup system with assistance from the national and local governments, and methods of guaranteeing the confidentiality of business in the YSBA.

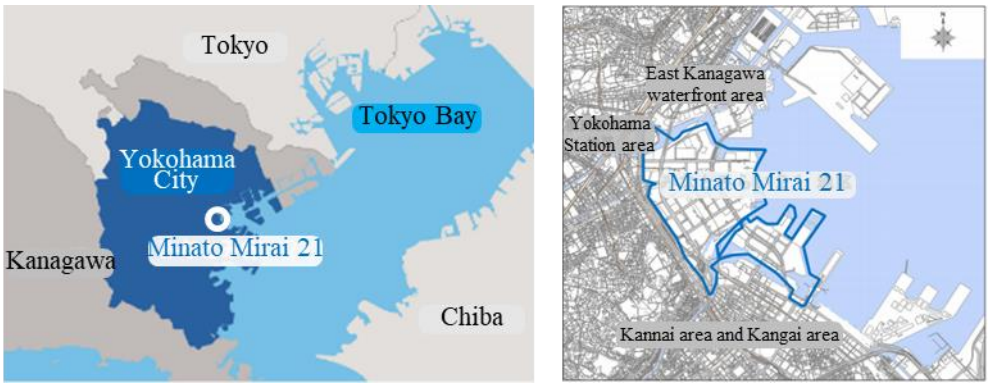
Efforts to establish VPPs under YSCP 2.0 include the installation of storage batteries at 36 primary and secondary schools in the city in a demonstration project from 2016 to 2017, and the sequential introduction of storage batteries to other primary and secondary schools in an ongoing implementation project launched in 2018. Plans exist to promote the consideration of urban VPP development through efforts such as utilizing public facilities other than primary and secondary schools, and private facilities as well as EVs, which are expected to become more popular in the future. Further implementation is expected in the future toward the municipal government's goal of contributing to a decarbonized regional economy and creating a safe, secure city.

1-1-2. Minato Mirai 2050 Project

(1) Overview of Initiatives

a. Project Overview

Development of the Minato Mirai 21 District began in 1965 as a way to create a new city center on the waterfront of Yokohama City. Since then, the municipal government has promoted the development of high-quality infrastructure and the formation of cityscapes to capitalize on the history of the area as well as its seaside location.



Source: Left: Minato Mirai Area Management, Right: Yokohama City

Figure 28 Location of the Minato Mirai 21 District

More than 30 years have passed since the start of projects in the Minato Mirai District; amid the emergence of new challenges associated with changes in social circumstances—for example, responding to the arrival of a super-aged society, declining tax revenue due to long-term depopulation, disaster risks, decarbonization, and climate change—the Minato Mirai 2050 Project was launched in 2015 to create a smart city capable of accommodating the needs of new generations. With a focus on the period lasting until 2050, the project sets out short-term goals (to have been achieved by 2020) and a vision and measures for urban planning through 2030 in four sectors: eco-mobility, green, and activity in addition to energy, a sector in which Yokohama City had previously made proactive efforts (see the figure below). Minato Mirai 2050 Project efforts have involved the implementation of measures and pilot projects for urban planning that considers elderly people, people with disabilities, and everyone else in society, including a sharing service using "WHILL", a personal mobility device (next-generation electric wheelchair) which helps elderly people get around, as described later in this section. The project is positioned as an initiative in the city center of Yokohama, an SDGs Future City, and is being implemented with a focus on sharing the knowledge gained from the initiative with the suburbs of the city, other municipalities, and cities around the world.

The creative city of art and culture with innovation and ingenuity

The human and environment-friendly city full of water, greenery and history

The safe and secure city resilient to disasters

< Yokohama's vision towards Smart City >

4 goals and initiatives

Safe, clean and economical energy
- Promotion of low carbon
- Strengthening the energy systems resilient to disasters
- Response to electricity liberalization

Green to secure a comfortable environment for the next generation
- Formation of a landscape integrating public and private green spaces
- Creation of a lively space with greenery

Activities to stimulate the creativity of citizens
- Development as a tourism and MICE center city and cultural art creation city
- Strengthening activities and disseminating information that contribute to improving global value

Eco mobility to secure free movement and revitalize the city
- Transit-oriented and walkable eco city
- Creation of an environment where anyone can move comfortably and enjoy with a variety of eco mobility

Policy for realization of 4 goals
- Building an organization in which various stakeholders participate
- Creating a new system including financing

Source: Yokohama City

Figure 29 Vision for the City and Approach of Efforts in Each Sector under Minato Mirai 2050 Project

b. Use Case of Minato Mirai 2050 Project Initiatives

One use case of Minato Mirai 2050 Project initiatives from the eco-mobility sector is demonstration experiments for sharing services conducted using the personal mobility device known as WHILL.

Although the high-quality infrastructure developed in the Minato Mirai District includes roadways, pedestrian walkways, and public transportation, there is a growing need for an environment that facilitates comfortable mobility for elderly people, people with disabilities, and others who have difficulty walking. To overcome these kinds of social challenges associated with mobility, and furthermore to create new value, Yokohama City is working with the company producing WHILL to create a viable sharing service based on the company's personal mobility devices. Two demonstration experiments were conducted in FY2019 as shown in the main points of the table below, and another long-term demonstration experiment toward creating a viable service has been conducted since September 2020.[29]

< Device>
WHILL Model C

Source: Yokohama City

Figure 30 A WHILL Personal Mobility Device

	1st experiment	2nd experiment
Duration	November 6-December 26, 2019 11:00-16:00	February 18-March 16, 2020 11:00-16:00
Area	Minato Mirai 21 District	Minato Mirai 21 District
Usage fee	Free	Free
Method of use	Same-day requests from WHILL stations, round trips (devices to be rented and returned at the same station)	Same-day requests from WHILL stations, one-way trips (devices can be returned at any station)

Source: Yokohama City

Figure 31 Summary of WHILL demonstration experiments in FY2019

(2) Progress of Initiatives and Future Challenges

During the demonstration experiments conducted in FY2019, 93 and 61 people used the devices in the first and second experiments, respectively. Users covered a wide range of ages, mainly between 20 and 69. The experiments produced definite results, including challenges to overcome in the transition to implementation. A long-term demonstration experiment began in September 2020 with the aims of

[29] Press packet, Yokohama City, September 2, 2020, https://www.city.yokohama.lg.jp/city-info/koho-kocho/press/ondan/2020/20200902whill.files/20200902whill.pdf

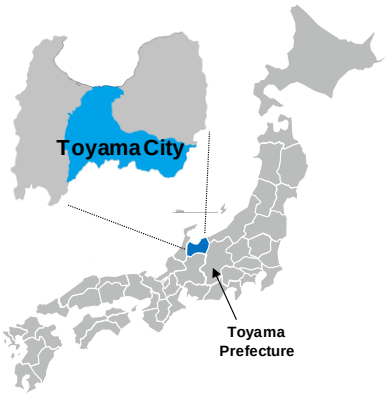
further improving recognition of WHILL devices and ascertaining users' needs. The regular use of WHILL devices should address mobility-related challenges faced by elderly people, people with disabilities, and others, and lead to new services and solutions to social challenges, such as hospitality for domestic and international visitors.

The Minato Mirai 2050 Project aims to create new value and overcome challenges over the medium and long term in the Minato Mirai 21 District, the driving force behind the economy and culture of Yokohama City. Future developments on initiatives in the other sectors of the project as well as WHILL are expected to serve as leading use cases of future cities, providing models for the other major cities of Japan.

i. General Information of the City

(1) Geography of Toyama City

Toyama City is situated in the center of Toyama Prefecture, and stretches toward the southeast part of the prefecture. With an area of 1,241.77 km^2, it occupies roughly 30% of the entire area of the prefecture. The city is bordered to the north by Toyama Bay and to the south by 3,000-m mountains, and features complex topography including gorges and swiftly flowing rivers. The present iteration of Toyama City was created by the 2005 merger of seven municipalities including the former Toyama City, and is the second-largest prefectural capital in Japan in terms of area.



(2) Economy

In FY2017, the gross city production was 1.9725 trillion yen, and the economic growth rate was 3.3% (compared to 1.9102 trillion yen and-5.2% in the previous year). In terms of the breakdown by industry, manufacturing was the leader (512.1 billion yen), followed by wholesale and retail (232.5 billion yen), real estate (171.3 billion yen), and health, sanitation, and social services (157.9 billion yen).[30] The city has developed into the preeminent hub of industry and commerce on the Sea of Japan coast, yet has also recently made efforts to cultivate environmental, bio, and IT-related industries and develop a tourism industry.

(3) Finance

Toyama City's revenue and expenditures over the past 10 years have stayed steady at around 160-170 billion yen. According to the municipal government, they have booked higher income than planned, in part because of financial aid from the national government when the municipal merger took place, and increases in municipal tax revenue associated with economic recovery. However, Toyama city expects securing financial resources to become more difficult in the future as a result of factors such as reduced municipal tax revenue due to fewer births and an aging population, and the reduction and discontinuation of the national government financial aid. Additionally, Toyama city has booked higher expenditures than planned due to factors such as improvements to public transportation and the development of the area around Toyama Station, and widespread infrastructure development, including the network of roadways connecting regions within city limits. Consequently, the municipal government is facing financial pressure.[31]

(4) Policy Structure of Urban Planning

Toyama City formulated the Toyama City Comprehensive Plan (2007-2016) and the Second Toyama City Comprehensive Plan (2017-2026) to function as the highest municipal plans, and is proceeding with urban planning with measures focused on creating a compact city with centralized services clustered around public transportation. In addition to this fundamental approach to urban planning, the city is also making proactive efforts toward sustainable city management, formulating plans to become an Environmental

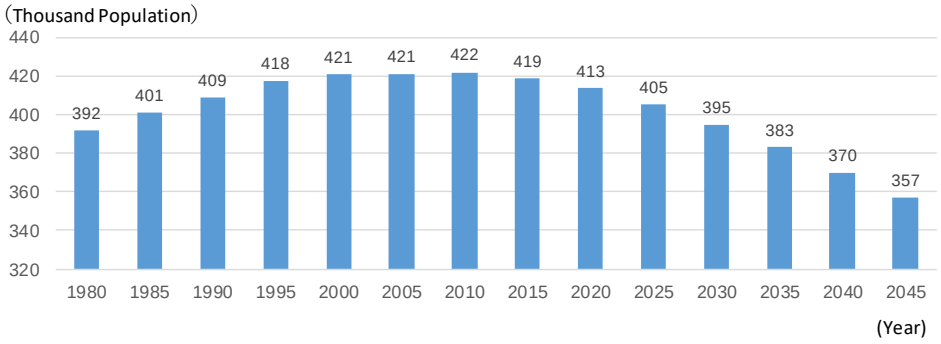
[30] Fiscal 2017 Toyama City Civic Economic Statistics, Toyama City, https://www.city.toyama.toyama.jp/kikakukanribu/johotokeika/tokei/shiminkeizaikeisan/kyushiminkeisan.html
[31] Second Toyama City Comprehensive Plan (2017-2026), https://www.city.toyama.toyama.jp/kikakukanribu/kikakuchoseika/sogokeikaku/toyamashisogokeikaku.html

Future City[32] aiming for sustainable urban planning in economic, social, and environmental terms, as well as a SDGs Future City aiming to realize a set of SDGs for the city.

ii. Demographic Trends

(1) Population and the Number of Households

As of March 31, 2021, the population of Toyama City was 412,901.[33] Population growth began to ebb in the 1990s; the population peaked at 421,953 in 2010 and began to decline in 2015. As of March 31, 2021, the number of households was 181,942, with 2.28 people per household. The number of people per household increased somewhat after Japan's first baby boom, but has trended downward since 1955, when there were 5.0 people per household.[34] The figure dropped below 3.0 in 2000. This trend has been driven by changes in the household structure, namely an increase in nuclear family households and households with a single elderly person.



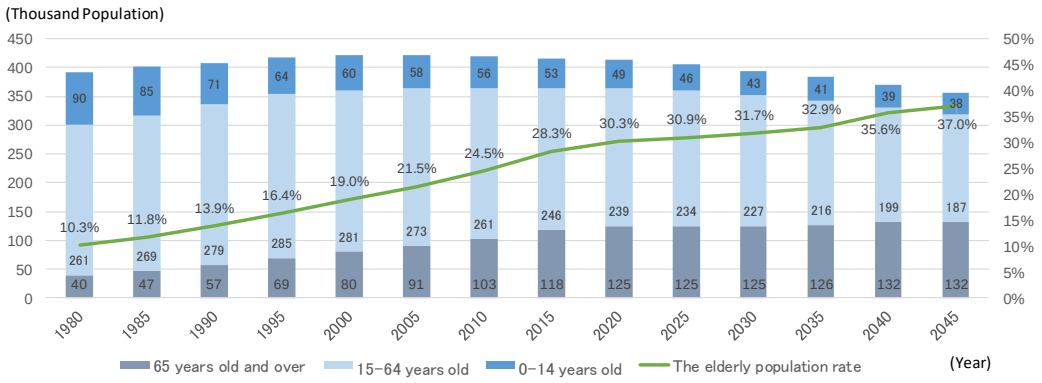
Source:National Institute of Population and Social Security Research

Figure 1 Population Change in Toyama City

(2) Population Distribution by Age Group and Aging Trend

The population by age group (categorized into three age groups) and composition ratio in 2020 was as follows: child population (0–14 years old) was 49,272 persons (11.9%); working-age population (15–64 years old) was 239,092 persons (57.8%); and elderly population (65 years old and over) was 125,070 persons (30.3%). The elderly population rate has risen from 10.3% in 1980 to 28.3% in 2015, and is expected to further increase to 37% by 2045.

[32]The Environment and Future City concept is a Japanese government (Cabinet Division) initiative aiming for urban and regional design to realize sustainable socioeconomic systems. (https://www.kantei.go.jp/jp/singi/tiiki/kankyo/)
[33]*Population and Households,* Toyama City, https://www.city.toyama.toyama.jp/kikakukanribu/johotokeika/tokei/jinkosetai/jinkosetai.html
[34]*Population Vision (Revised Version)*, Toyama City, March 2020, zinkouvisionkaiteiban.pdf (city.toyama.toyama.jp)



Source: National Institute of Population and Social Security Research

Figure 2 Population Distribution by Age Group and Aging Rate in Toyama City

iii. Main Challenges and Policy Responses

Challenges in Toyama City include a persistently increasing population aging rate, a natural decline in population that started around 2005, and the departure of young people to major cities in search of academic and employment opportunities. Additionally, the city's high dependence on personal motor vehicles for mobility is causing urban sprawl to progress, degrading the efficiency of government services as well as the convenience of public transportation due to decreasing ridership and profitability.

To address these challenges, Toyama City took the initiative to promote measures to form a compact city around public transportation, and did so before any other municipality in Japan. The city established the first full-fledged light rail transit (LRT) network in Japan, and is making efforts to encourage people to use public transportation. In recent years, the municipal government has also made proactive efforts toward ICT utilization in urban planning, and is also working to establish the Toyama City Sensor Network for gathering and utilizing data within city limits with aims such as improving the convenience of government services and reducing infrastructure maintenance costs. In response to long-term demographic trends, the city is making efforts to promote tourism involving longer stays and visits to wider areas, and to expand the exchange population and attract permanent residents from major cities through a city promotion program aimed at Japanese people and foreign nationals.

i. Public Finance

Toyama City's public expenditures are increasing as a result of rising social security costs for medical care, elderly care, and more associated with the progression of population aging, and initiatives such as improving public transportation in an effort to create walkable communities to serve people who do not own motor vehicles. Substantial demand for public finances is expected to fund this accommodation of administrative needs as well as maintenance for existing infrastructure. However, the city is also expected to face even more difficulty securing financial resources in the future because of reduced municipal tax revenue due to the decline of the working-age population, and the reduction and discontinuation of the national government financial aid associated with the municipal merger.

(1) Sustainable Urban Development

In an effort to efficiently maintain urban infrastructure and undertake disaster control measures while keeping public finances in good shape, Toyama City has undertaken conventional disaster control measures

such as earthquake-proofing infrastructure and creating hazard maps for tsunami, earthquakes, floods, and other disasters, and in recent years has also worked toward building a safe, secure city through the use of ICT. The city is also making efforts to establish the Toyama City Open Data Platform, a system for consolidating publicly and privately held data on roads, utilities such as electricity, gas, and telecommunications, and more to function as a system for expediting disaster recovery efforts and delivering optimal information to residents in a timely manner. The municipal government is also making efforts to establish and utilize the Toyama City Sensor Network, a system for consolidating and visualizing information within city limits to improve urban safety and provide more efficient government services.

ii. Urban Environment

Urban sprawl is progressing in Toyama City due to factors such as the high percentage of improved roads, high dependence on highly convenient personal motor vehicles for mobility, a strong desire for detached housing, and affordable land prices on the outskirts of the city.[35] Urban sprawl is linked to the deterioration of the city center and higher costs of maintaining urban infrastructure, yet further population aging is projected to produce a greater number of transportation disadvantaged people, and further population decline is expected to result in more vacant houses and land. Heavy snow accumulation and high disaster risk in the city have prompted concern over vacant houses collapsing, compromising public safety, and creating other problems. Toyama City is implementing the measures outlined below in response to these challenges.

(1) Creating a Compact City

In the early-2000s, Toyama City set out a policy for creating a compact city in response to challenges caused by urban sprawl, such as the deterioration of the city center and higher cost of maintaining urban infrastructure. Under the policy, the municipal government promoted the formation of a sustainable public transportation network—namely an LRT network—and the revitalization of the city center. LRT is a new type of tram system with outstanding energy-saving capabilities. As the first municipality in Japan to introduce an LRT system in earnest, Toyama City is producing results. In recent years, the city has also made efforts toward ICT-based mobility management—namely by implementing Toyama Smart Life Points, an initiative to reward people who use public transportation with points through a smartphone app—to further encourage people to modify their behavior toward walking-centered lifestyles and away from car-dependent lifestyles.

The city is also working to develop and improve urban spaces to encourage activity and exchange as part of efforts to promote the creation of a compact city. Specific efforts include the unification of the northern and southern parts of the city center previously separated by railway facilities, the improvement of station plazas, and the promotion of urban redevelopment projects in addition to the development and improvement of spaces for pedestrians intended to promote more walking-centered lifestyles.

iii. Regional Economy

With abundant water and electric power resources, and on the strength of proactive efforts to entice companies to relocate, Toyama City has developed into the preeminent industrial city on the Sea of Japan coast, with a focus on manufacturing machine and electrical components. Recent demographic trends,

[35]The population density in 2005 was 40.3/ha, making Toyama City the least densely populated prefectural capital in Japan. (Source: *Why Did Toyama City Aim to Become a Compact City?*, Third Research Seminar on Promoting Compact Cities, http://www.thr.mlit.go.jp/compact-city/contents/suishinkenkyuukai/index.html)

namely decreasing births, an aging population, and the departure of young people, have caused conspicuous aging of the workforce and shortages of industry leaders, making it difficult to cultivate new industries. Visitors to the city have increased in part due to the opening of the Hokuriku Shinkansen[36] and the improvement of international connections at Haneda Airport, and a resurgence of economic activity is expected in a wide range of fields, including industry, commerce, and services. However, as mobility and exchange infrastructure continue to improve, Toyama City will be exposed to more widespread competition with other areas, including other regions in the vicinity, thereby increasing the importance of the urban planning to visit the city seeks.[37]

(1) Industrial Development

Toyama City is working to counter the decline in the working age population caused by decreasing births, aging, and the decreasing urban population. The city's efforts include providing assistance for its leading manufacturing industry as well as creating next-generation industries that leverage ICT, and generating industrial innovation typified by the use of nanoparticulation technology. The city is also working to expand the exchange population and attract permanent residents from major cities with the aim of revitalizing the regional economy. As part of this endeavor, the city is responding to changes in the environment brought by the development of the expansive transportation network that includes the Hokuriku Shinkansen, proactively promoting tourism involving longer stays and visits to wider areas through such efforts as providing assistance for attracting inbound tourism and improving services for foreign travelers, and working with travel agencies to develop health tourism packages. In order to boost the popularity of Toyama City, the city is devoting energy to establishing a Toyama Brand by effectively disseminating information about the characteristics and appeals of the city.

(2) Regional Resources and Energy

Toyama City is moving ahead with efforts to leverage its expansive forested area, ample water resources, and other natural energy resources to become a model for rural cities in terms of regional revitalization through harmony with nature. The city's energy sector initiatives include promoting the introduction of biomass power generation, solar power generation, and other renewable energy, and considering the commercialization of a renewable energy-based regional energy management system. In the circular urban planning sector, efforts founded on the Zero Emissions Concept for eliminating waste, for example, selling products made from recycled materials, and waste-to-energy in the Toyama City Eco-Town Industrial Park, are under way, and are leading to the revitalization of the regional economy.

[36]The stretch of the Hokuriku Shinkansen between Takasaki Station and Nagano Station opened in 1997. The stretch between Nagano Station and Kanazawa Station opened in 2015.
[37]Urban planning to visit is covered on pages 193-194 of the Second Toyama City Comprehensive Plan (2017-2026).

iv. Use Cases as Smart Solutions

Toyama City became the first municipality in Japan to deploy a compact city strategy in order to respond to the detrimental effects of car-dependent lifestyles and urban sprawl on the city center. This chapter focuses on the application of smart solutions, and outlines the initiatives that typify the city's compact city strategy, namely efforts to improve the public transportation network around LRT and measures to promote the use of public transportation. The chapter also includes information about the municipal government's data utilization-driven urban planning efforts as a forward-looking strategy for producing even more results in the drive to create a compact city.

i. Creating a Compact City Around Public Transportation

(1) Overview of Initiatives

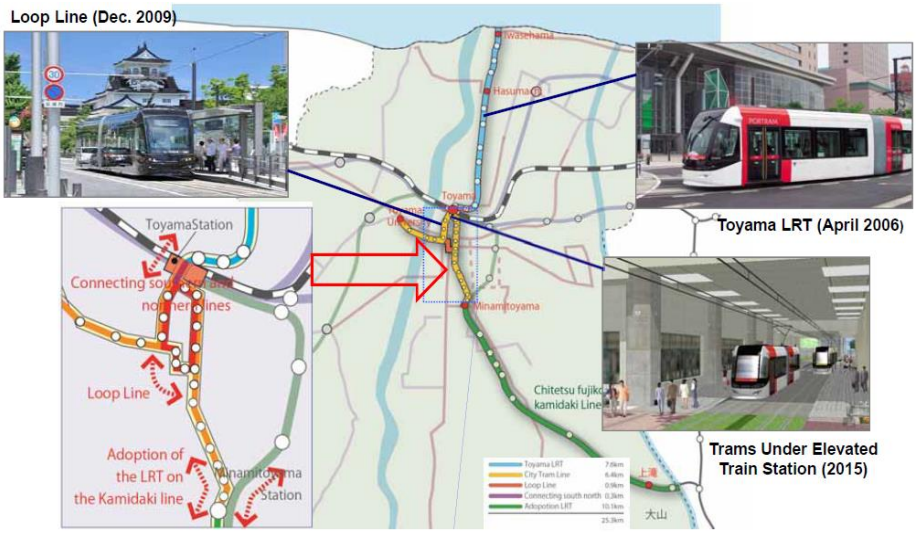
Toyama City aims to create a compact city with centralized services clustered around public transportation by revitalizing public transportation and intensively locating residences, businesses, and other civic functions in areas it serves. In order to create a compact city, the municipal government is focusing on key measures for revitalizing public transportation, encouraging people to live in areas served by public transportation, and revitalizing the city center.

An initiative that typifies the city's efforts to revitalize public transportation is the introduction of LRT, which is also referred to as a next-generation tram system. LRT tram systems feature compact, lightweight, low-floor rolling stock and improved tracks that deliver benefits such as ease of embarking and disembarking, reduced vibrations and noise, and increased transport capacity. Toyama City introduced Toyama Light Rail, Japan's first full-fledged LRT system, in 2006, and the Toyama City Tram Line loop opened three years later in 2009. A north-south tram link was completed in 2020 to establish and improve the convenience of the city's LRT network.

Project Name	Project Overview
Project to Convert the Toyamako Line to Light Rail	●Opened in April 2006 ●Total length of 7.6 km. 13 stops. Seven sets of rolling stock (two cars in each formation). ●The former JR Toyamako Line, which had seen decreased ridership, was rehabilitated into Toyama Light Rail (nicknamed Portram), Japan's first full-fledged LRT system
Project to Complete the Loop of the Toyama City Tram Line	• Opened in December 2009 • Total length of 0.9 km. Introduced three sets of new low-floor rolling stock • Extended part of the Toyama City Tram Line to create a loop line (nicknamed Centram) to revitalize the city center and enhance the walkability of the downtown area • Adopted a vertical separation arrangement in which Toyama City maintains the tracks and purchases the rolling stock as the track maintenance entity, and the private sector (the Toyama Chiho Railway) operates the rolling stock as the track operating entity.
Project to Complete a North-South Tram Link	• Opened in March 2020 • Completed a link under the Toyama Station Viaduct between the two tram systems operating in the northern and southern parts of the city, and began providing north-south through services. Now passengers can transfer between tramlines at Toyama Station without exiting the ticket gates, improving the convenience of the station

Source: Toyama City website

Figure 3 Overview of LRT Development Projects in Toyama City



Source: Fifth Chubu Conference on Global Warming, held by the Chubu Regional Environmental Office of the Ministry of the Environment, Documents from Toyama City, September 2016

Figure 4: Toyama City LRT Network

In order to create a compact city, Toyama City is making efforts to revitalize the city center and encourage people to live in areas served by public transportation. The city's efforts to encourage people to live in these areas involve establishing special zones for the purpose,[38] and implementing aid programs to grant subsidies for acquiring housing and constructing multi-family housing in these zones. The municipal government's efforts to revitalize the city center include promoting urban planning that integrates the areas north and south of Toyama Station through efforts such as a land rezoning project around the station. Additionally, in recent years, the city has created transit malls, areas open only to LRT trams and pedestrians, to coincide with community events as a way to promote the use of public transportation and create activity in the city center.

(2) Progress of Initiatives and Future Challenges

Toyama City's efforts to revitalize public transportation have produced a substantial increase in LRT passengers, particularly among elderly people, who have indicated that the improved access has given them more opportunities to go on outings. Toyama Light Rail (Portram) runs along the same right-of-way as the former JR Toyamako Line. Since the opening of the new line, daily ridership has increased roughly 2.1 times and 3.4 times on weekdays and holidays, respectively. The completion of the loop on the Toyama City Tram Line has also resulted in a 10% increase in ridership. In particular, the number of elderly passengers has increased 28% and 67% on weekdays and holidays, respectively. These changes in public transportation usage patterns have created visible benefits, namely residents of the city center opting to shop in the city center, and a greater number of people opting to walk instead of drive in their daily lives.

[38]Areas within a 500-m radius of a railway station, or a 300-m radius of a bus stop along a high-frequency bus line (generally at least 60 buses per day), and designated as special zones for encouraging people to live in areas served by public transportation (excluding industrial areas and exclusive industrial districts). (See the Project to Encourage People to Live in Areas Served by Public Transportation on the Toyama City website)

The city's efforts to improve the convenience and promote the use of public transportation is contributing to increasing population inflow and land prices.[39] Looking ahead, it will be important for the city to ensure that the compact city strategy takes hold by continuously implementing public education and awareness activities and creating a framework for promoting transitions to walking-centered lifestyles in conjunction with the infrastructure development efforts of establishing and improving the LRT network.

Item	Description of Impact
Average ridership on trams in Toyama City	Flagging ridership on trams in Toyama City rebounded in 2006, and increased from 9,779 passengers/day in that year to 14,422 passengers/day in 2019
Population inflow	The population outflow from the city center rebounded to a population inflow in FY2008. The net migration surplus was 56 person in FY2016, and 483 person in FY2019
Number of pedestrians in the city center	Passenger traffic in the city center was 46,638 in FY2019, a roughly 5.1% increase from FY2015.
Greenhouse gas emissions	From 2005 to 2018, carbon dioxide emissions in the transportation sector fell from 835,000 t-CO_2 to 822,000 t-CO_2, a 1.6% decrease[40]
Land prices in the city	The official listing of land prices in January 2016 showed Toyama City as the only municipality in Toyama Prefecture with increases in consecutive years. Prices rose in eight locations in commercial zones, mainly around Toyama Station and along the loop line, and in 11 locations in residential zones in the city. Most recently, land prices rose 0.7% from January 2019 to January 2020, and stayed steady from January 2020 to January 2021. [41]

Source: Fifth Chubu Conference on Global Warming, held by the Chubu Regional Environmental Office of the Ministry of the Environment, Documents from Toyama City September 2016

Fiscal 2019 Report on the Scheduled Follow-up on the Basic Plan for Revitalizing the City Center of Toyama City, Documents from Toyama City, May 2020

Figure 5 Impact of Creating a Compact City Around LRT and Other Public Transportation

ii. Data Utilization-Driven Urban Planning

(1) Overview of Initiatives

Against the backdrop of the rapid expansion of IoT in recent years, Toyama City formulated the Toyama City Advanced Information Vision in March 2019 to serve as a guideline for the city's aims to advance and streamline administrative affairs and revitalize the region by promoting the utilization of ICT.[42] One of the fundamental philosophies outlined in the vision is utilizing ICT as well as publicly and privately held data for

[39]See Fifth Chubu Conference on Global Warming, held by the Chubu Regional Environmental Office of the Ministry of the Environment, Documents from Toyama City, September 2016 (http://chubu.env.go.jp/earth/mat/data/post20-cs5-s5.pdf)

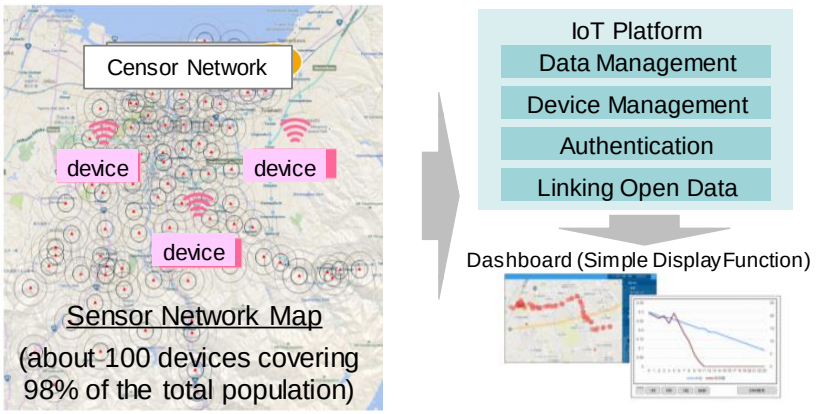
[40] *Fiscal 2018 Report on Greenhouse Gas Emissions, Toyama City*, https://www.city.toyama.toyama.jp/data/open/cnt/3/2503/1/H31_model_yoshiki3.pdf?20210310113035

[41]*Overview of the 2021 Official Listing of Land Prices*, Toyama Prefecture, https://www.pref.toyama.jp/documents/18112/r3sankou.pdf

[42]Toyama City Advanced Information Vision, Toyama City, https://www.city.toyama.toyama.jp/kikakukanribu/johotokeika/jyohokasuisin.html

improving urban planning and civic welfare; the city is establishing basic measures for initiatives such as promoting open data and utilizing ICT as well as official and privately held data in urban planning. The following is a summary of an example of the municipal government's efforts in recent years: utilizing the Toyama City Sensor Network promoted within the framework of utilizing ICT as well as publicly and privately held data in urban planning under the Toyama City Advanced Information Vision.[43]

In order to streamline government services and maintenance of urban infrastructure, Toyama City is working to establish the Toyama City Sensor Network, which gathers, analyzes, and utilizes data within city limits. The Toyama City Sensor Network is a data platform comprising a sensor network that covers 98%[44] of the living areas in the city and a system (platform) that manages data groups gathered from the wireless telecommunication network therein. Although the low-power wide-area (LPWA) wireless telecommunication network on which the system is based is slower than 4G and other conventional wireless standards, its coverage area is extensive (dozens of km), and operation is affordable and long-lasting (from several years to several decades); a growing number of Japanese municipalities are using LPWA, mainly to establish telecommunication networks that are accessible during disasters, to maintain infrastructure spread across wide areas, and for industrial purposes. Toyama City established the Toyama City Sensor Network in FY2018, and began demonstration experiments utilizing the system in 2019.



Source: Toyama City official website

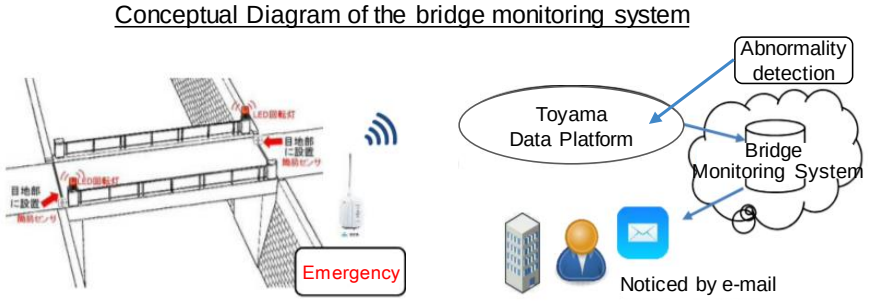
Figure 6 Image of the Toyama City Sensor Network

(2) Progress of Initiatives and Future Challenges

Regarding the utilization of the Toyama City Sensor Network, the municipal government solicited bids from private entities for demonstration experiments utilizing the system in FY2019; that year, 23 experiments were selected and conducted in various fields, including tracking passenger traffic around Toyama Station, testing a device for observing water levels in irrigation channels, and verifying an alert system for congestion in bicycle parking areas.[45] Additionally, in FY2020, 10 new demonstration experiments were additionally selected in fields such as remote monitoring of river discharge rates, traffic surveys using AI cameras, and visualization of waste collection operations.[46]

[43] Toyama City Sensor Network website, Toyama City, https://www.city.toyama.toyama.jp/kikakukanribu/johotokeika/toyamaSN.html
[44] Roughly 98% of the residential population of Toyama City.
[45] Fiscal 2019 public call for demonstration experiments utilizing Toyama City's smart city promotion platform, https://www.city.toyama.toyama.jp/kikakukanribu/johotokeika/toyamasc_koubo_R1.html
[46] Fiscal 2020 public call for demonstration experiment utilizing the Toyama City Sensor Network, https://www.city.toyama.toyama.jp/kikakukanribu/johotokeika/toyamasc_koubo_R2.html

The gathering and utilization of big data from the Toyama City Sensor Network is expected to have various possibilities; upcoming challenges include establishing new programs and providing government services to demonstrably improve residents' QOL starting in the demonstration experiment stage, and developing them into systems capable of continuous operation.

Demonstration experiment Name (example)	Verification of a bridge anomaly detection system[47]
Purpose	Bridge edge anomaly detection and monitoring systems were installed on bridges, and a system for detecting anomalies linked with the Toyama City Sensor Network was established for the purpose of assisting in remote bridge maintenance within Toyama City limits. 
Test results	1. The test confirmed the behavior of the monitoring system's function for alerting system users (through LED indicator lights) (The test also confirmed that the function also works when snow has accumulated). 2. The test confirmed the durability and stability of the connection throughout the year. 3. The ability to detect anomalies through monitoring makes it possible to reduce the workload of sending workers around to check in person. Additionally, the ability to quickly gain an understanding of anomalies makes it possible to respond swiftly.
Challenges and outlooks	Further modification of systems linked with Toyama City's IoT platform, and the addition of functions such as displaying the history of detected anomalies and notifying managers via email should further improve the convenience of the monitoring system.

Source: Prepared based on a report of the results of demonstration experiments for the Toyama City Sensor Network

Figure 7 Description and Results of Demonstration Experiments Utilizing the Toyama City Sensor Network (Example)

[47]The title of the test in the source document is "Verification of the Notification Function of a Bridge Girder Edge Anomaly Detection System," https://www.city.toyama.toyama.jp/data/open/cnt/3/21577/1/13seika.pdf?20200327143120

v. General Information

① Geography of Tama New Town

Tama New Town was developed as a commuter town in Tama Hills in the southwest of Tokyo. It has an area of about 2,853 hectares and stretches about 14 km east to west and about 2 to 3 km north to south, straddling the 4 cities of Hachioji, Machida, Tama, and Inagi.

② Economy

Tama City, which has the largest population in Tama New Town, does not disclose gross regional output. [48] However, the city has a total of 65,632 employees, with the largest number in the wholesale and retail industries at 14,473, followed by medical care and welfare at 9,911, and accommodation and beverage services at 7,581. Although the Tama New Town is positioned as a commuter town, commercial businesses around major stations are also active.

③ Finance

Regarding finance, this research takes up Tama City, which has the largest population in Tama New Town. Tama City's annual revenue and expenditure have been hovering around 55 to 57 billion yen. In the settlement of accounts of FY2020, the municipal tax revenue decreased by 90 million yen from the previous fiscal year, while the expenditure increased significantly with the implementation of large-scale renovations to sports halls, educational facilities, etc. and premium voucher project. According to the Tama City government, in the FY2021 budget, the municipal tax revenue is expected to further decline by 5.3% due to the effect of COVID-19 and have major impact on the city's finance. In the medium- to long-term, it is necessary to look ahead to the difficult future in which population will fall even more and the amount of tax paid per capita will decrease due to the aging of society. [49]It is necessary to establish efficient and sustainable public finance management in light of the growing financial burden, such as rising social security expenditures and need for measures against aging public facilities and urban infrastructures.

④ Policy Structure of Urban Planning

Tama New Town is one of the largest residential developments in Japan launched in 1966 by the Tokyo Metropolitan Government, Tokyo Metropolitan Housing Supply Corporation, and Urban Renaissance Agency (hereinafter referred to as "UR") in the form of new residential district development project and land readjustment project. The master plan is Tama City New Town Renewal Policy announced by Tama City in 2016. The policy aims for sustainable city, inflow and continuous residence of young households, and concentration and circulation of vitality. It claims to restructure Tama New Town to a compact urban structure in which stations and various small bases create a network and support the circulation structure of the region by utilizing neighborhood residential districts. In addition, the "Renewal Guidelines for Tama New Town Area" announced by the Tokyo Metropolitan Government in 2019 states that, based on the abovementioned renewal policy and with an eye toward social changes anticipated in the 2040s, the city aims to build a sustainable city where functions that support affluent lifestyles concentrate and diverse innovations are developed as bases that create a new value.

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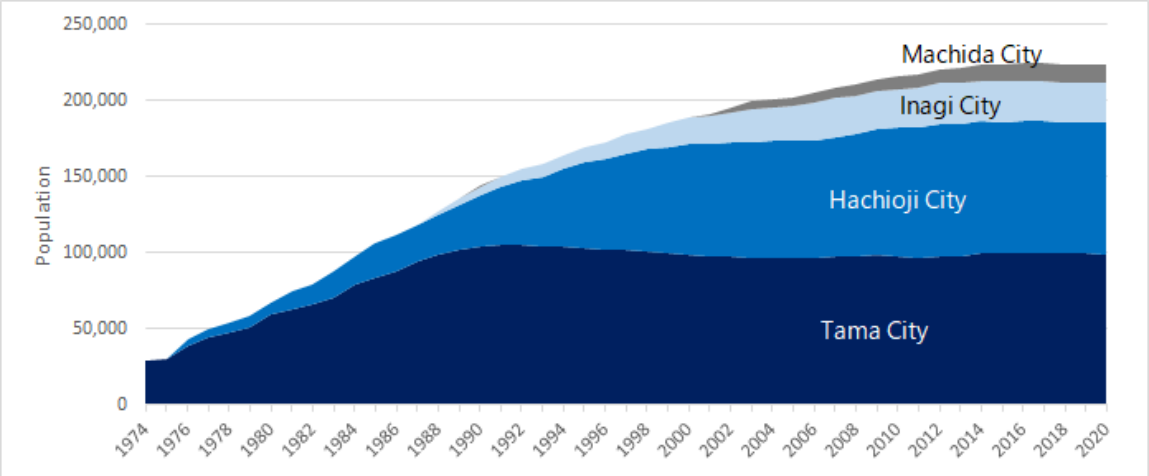
[48] Tama City. "Statistics of Tama 2020 Edition." Business Establishments and Employees by Industrial Classification (as of 2014). https://www.city.tama.lg.jp/0000001943.html.

[49] Tama City. "Outline of FY2021 Budgets." https://www.city.tama.lg.jp/0000012781.html.

vi. Demographic Trends

① Population and the Number of Households

The population of Tama New Town was 223,443 as of November 2020. By city, the population of Tama City was 98,680, Hachioji City was 86,605, Inagi City was 26,154, and Machida City was 12,004. The total population is declining since its peak at 224,879 in 2017. By city, Tama City peaked at 105,448 in 1992, Inagi City peaked at 26,721 in 2012, and Hachioji City peaked at 87,188 in 2013. The population of these cities shows no fluctuation since then. Machida City is still on a small but increasing trend. The number of households has consistently grown, reaching 100,000 for the first time in 2020. On the other hand, the number of people per household in 2020 was 2.2, falling from a peak of 3.5 in 1979.

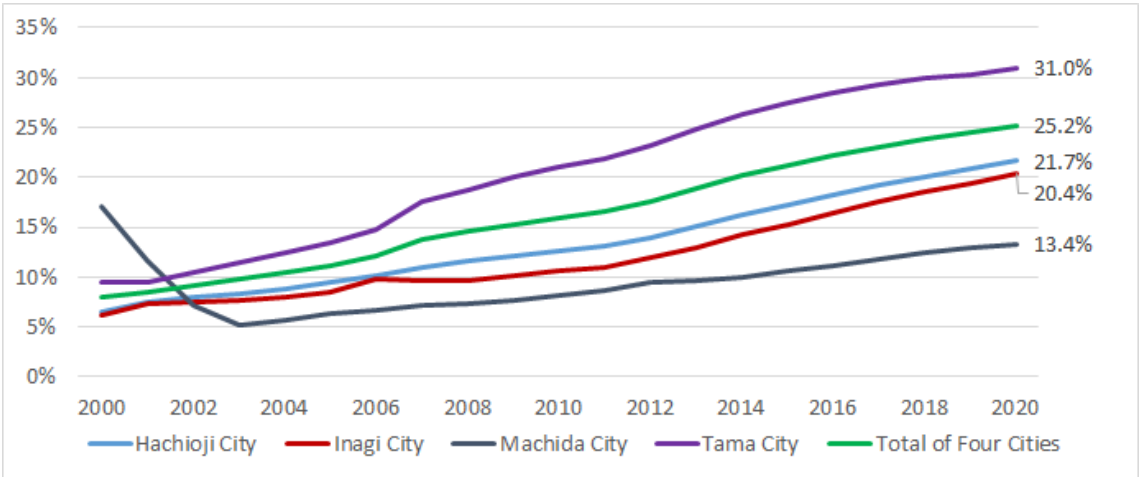


Source: Bureau of Urban Development, Tokyo Metropolitan Government. "Trends in Number of Households, Population, etc. in Tama New Town."

Figure 1 Population trends in Tama New Town

② Population Distribution by Age Group and Aging Trend

The rate of population aging in Tama New Town was 25.2% in 2020. The city with the highest rate was Tama City (31.0%), followed by Hachioji City (21.7%), Inagi City (20.4%), and Machida City (13.4%). This difference is influenced by the timing of residency. Tama City has a high figure because residents began moving in during the early development stage in the 1970s. The rate of population aging is expected to increase in the future.



Source: Bureau of Urban Development, Tokyo Metropolitan Government. "Trends in Number of Households, Population, etc. in Tama New Town."

Figure 2 Population distribution by age group and aging ratio of Tama New Town

vii. Main Challenges and Policy Responses

In the initial residential area (Suwa, Nagayama, Atago, Wada, Higashiteragata, Kaidori, Toyogaoka, etc.) of Tama New Town where more than 40 years have passed since residents moved in, the parent generation who has been living there from the beginning is aging, and children are leaving the area due to reasons of school, job, marriage, etc., resulting in a serious population decline. In particular, the fall in the number of children is severe to the extent that elementary, junior high, and high schools are shutting down. A super-aging population lies ahead for the initial residential area. By around 2040, approximately 40% of the population will be 65 or older and approximately 20% will be 75 or older. It is expected that there will be a shortage of housing suitable for the rapidly increasing older age population. The population of subsequent residential areas (Ochiai, Tsurumaki, Karakida, Minamino, Hijirigaoka, etc.) may also age in the future. Population decline will likely accelerate in all of Tama New Town, and vacancies in housing complexes and detached houses are expected to increase sharply. Facilities including housing complexes are aging, and the need for reconstruction and renovation is on the rise. In addition, because Tama New Town is located in a hilly area and has a large difference in altitude, the increase in residents facing difficulties concerning transportation, especially the elderly, has become apparent. Efforts must also be made to maintain local communities and enable the entire region to support the everyday lives of the growing elderly population.

Based on the recognition of the abovementioned issues, the Tokyo Metropolitan Government and Tama City are making joint efforts toward renewal. The Renewal Guidelines for Tama New Town Area formulated by the Tokyo Metropolitan Government stipulate nine approaches geared to the needs of communities from the viewpoint of urban development for renewal: renewing the basic infrastructure, promoting the renewal of housing blocks, responding to the declining birthrate and aging population, maintaining and managing public facilities closely related to local residents, strengthening disaster preparedness, creating innovation, responding to the environment, enhancing wide-area transportation infrastructure, and responding to technological innovation.

i. Public Finance

In Tama New Town, tax revenues are expected to decrease due to the declining birthrate and aging population, and social security costs are expected to rise further. Furthermore, the level of infrastructure and public facilities, such as roads and bridges, is high in both quality and quantity. Although the national government and the Tokyo Metropolitan Government provided support during construction, the local government must take on the financial burden of maintenance, renovation, and renewal. Many infrastructures, public facilities, housing complexes, etc. are approaching the timing for renewal, and countermeasures that take the financial burden into consideration are required. In response to these challenges, Tama New Town is concentrating its urban functions around public transportation locations and making them more compact in order to improve convenience and reduce maintenance and management costs.

ii. Urban Environment

Tama New Town is located in an area of hills. Many areas have a difference in altitude between the arterial roads with bus stops and the housing complexes where the residents live, which hinders the elderly from going out. Many housing complexes also face difficulties in welcoming cars for nursing care, mobile retail

services, etc. due to the lack of parking space and rules restricting the entry of vehicles from outside the premises of the housing complexes. There are many properties that have passed more than 40 years since the start of tenancy, including medium-rise housing complexes without elevators from the early ages of the city, and aging and obsolescence of functions are progressing. Many of these aged housing complexes conform to the old earthquake resistance standards and do not meet the needs of young families. In addition, as the age distribution of residents varies by area, there are imbalances in the demands of the community such as child care-related facilities. The following efforts are being made to address these issues.

- **Mobility**

  Tama City formulated the "Mobility Master Plan" and the "Regional Transportation Reorganization Implementation Plan." These documents suggest the ideal way of transportation in Tama New Town and aim to realize a city full of energy by promoting the maintenance and expansion of road and traffic networks, such as arterial roads and public transportation, in Tama New Town and neighboring areas. In addition, taking into consideration the regional characteristics of differences in altitude and the population composition with many elderly people, Tama City is making efforts to secure means of everyday transportation through maintenance and consideration of on-demand transportation between housing complexes and commercial facilities, last mile transportation between housing complexes and bus stops on arterial roads, and green slow mobility.

- **Urban Infrastructure and Regional Design**

  Tama City promotes urban development that enables various generations to live with peace of mind. It promotes reconstruction of aged houses and housing complexes and town development, which renovates existing housing, etc. In reconstructing aged housing, the city gives consideration to the conservation of greenery, strengthens disaster prevention measures that make use of the rich nature and open spaces such as parks and urban green space, and promotes barrier-free homes to ensure safe homes for elderly people and families with small children. Tama City aims to create a community where such people can have close bond with other local residents and live with peace of mind by equalizing the unbalanced age distribution and responding to the diversification of lifestyles. In addition to developing a community-based integrated care system for the elderly and disabled, the city is working to enhance basic services for households with small children.

✧ Regional Economy

There are many shopping arcades on the premises of housing complexes in Tama New Town and had supported the lives of the residents. However, many of the stores in the arcade are closing as shoppers are now going to large shopping malls nearby. A line of vacant stores is sometimes referred to as a shuttered shopping arcade. Not only do the commercial activities in the housing complex premises stagnate, but the city loses its uniqueness and opportunities for employment as well as face increase in the number of residents having difficulty shopping for necessities. The convenience of the local community declines, and it is also an issue in terms of maintaining local communities. The Tama New Town area is positioned as the Tama Innovation Exchange Zone. The aim is to invigorate regional economies through industry, government, and academia by promoting exchanges inside and outside the region especially based on the accumulation of universities, companies, and research institutes by utilizing roads and traffic networks, such as the Linear Chuo Shinkansen Line, the Metropolitan Intercity Expressway Network, and the Tama Toshi Monorail Line. In the future, it is necessary to promote concrete invitation of enterprises and research institutes and establishment of international exchange bases. The following efforts are being made to address these issues.

4. Revitalization of Regional Economy

The city aims to create functional and lively bases by restructuring and concentrating various urban functions such as commercial, medical, welfare, educational, cultural, and administrative services at its main stations, shopping arcades, housing complexes, bus terminals, and other nearby bases. In addition, efforts are being made to address social issues of the time and revitalize local commercial industry, such as making use of vacant stores on the premises to provide co-working and remote work spaces suited for the new normal.

5. Creation of Innovation

Tama City aims to establish a base for Tama Innovation Exchange Zone by inviting commercial and industrial facilities to fairly large sites of low or no use and sites made available due to reconstruction of housing complexes. [50] The Tokyo Metropolitan Government established the Tama Innovation Ecosystem Executive Committee in FY2020 and plans to begin matching events and leading projects in FY2022 upon formulation of the basic policy on Tama innovation in FY2021. [51]

viii. Use Cases as Smart Solutions

The important themes of "Tama New Town Renewal Project" promoted by Tama City are reconstruction of the entire new town into a future urban structure, reconstruction of housing and alteration of living environment that enables diverse generations to live long, and reconstruction and strengthening of the town infrastructure and various bases for a more compact structure. Through such themes, the project aims to realize a lively city where various generations can live an abundant life. This section will take up restoration and renovation projects of housing complexes that will serve as the foundation for revitalizing local communities and realizing an inclusive community as well as initiatives implemented to support the livelihood of the elderly using IoT as examples of smart solutions adopted in these communities.

i. Housing Complex Reconstruction Renewal Project

(1) Overview of Initiatives

This project is said to be one of the largest reconstructions in Japan. It is a massive project in which 640 units were collectively reconstructed due to aging of Suwa 2-chome housing complex. The large-scale reconstruction was decided in 2010 when the building was 40 years old. Under the leadership of the reconstruction association, business operators and rights holders as well as Tama City supported the project, and in 2013, the Suwa 2-chome housing was reborn as Brillia Tama New Town. The 23 housing complexes, all 5-stories tall and without elevators, were reconstructed into 7 high-rise condominiums that are 14 stories tall. The number of dwelling units doubled from 640 units to 1,249 units. This project also attracted public attention because the reconstruction cost was covered by the profit on sale of additional units.

Project overview	Before reconstruction	After reconstruction

[50] Tama New Town Renewal Promotion Council. "Tama New Town Renewal Roadmap." February 2020. https://www.city.tama.lg.jp/0000010597.html.

[51] Tokyo Metropolitan Government. "Strategy 12: Tokyo with Earning Power and Innovation Strategy, Strategy 11: Tama Innovation Park Concept." *Tokyo of the Future Strategy*. March 2021. https://www.seisakukikaku.metro.tokyo.lg.jp/basic-plan/choki-plan/.

Address	2-chome, Suwa, Tama City, Tokyo	
Construction period	Completed in 1971	Completed in 2013
Developer	Former Japan Housing Corporation (present: UR)	Tokyo Tatemono Co., Ltd.
Site area	64,399.93 m^2	
Standard building coverage ratio	10%	60%
Allowable floor area ratio	50%	200%
Gross floor area	34,037.13 m^2	124,904.05 m^2
Number of buildings	23 buildings, 5 floors	7 buildings, 14 floors
Number of units	640 units	1,249 units (including 684 additional units)
Unit floor space	All units 48.85 m^2	43 to 101 m^2
Floor plan	All units 3LDK	2DK to 4LDK

Source: Excerpts from materials published by Tokyo Tatemono

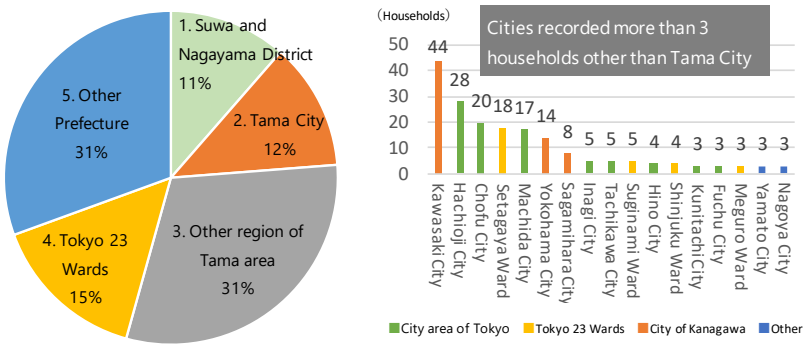
Figure 3 Changes in building specifications before and after reconstruction

Source: Condominium Renewal Council

Figure 4 Changes before and after reconstruction

(2) Progress of Initiatives and Future Challenges

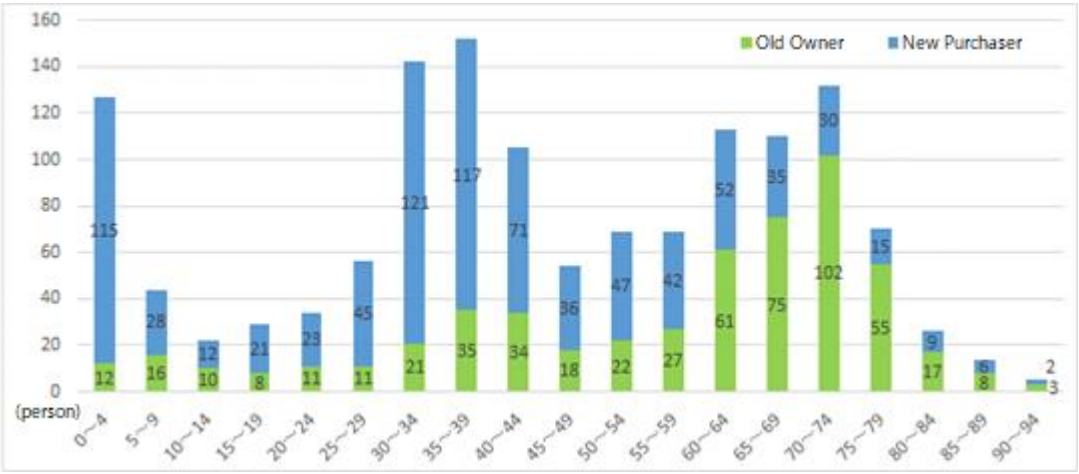
Reconstruction has a great effect in terms of coexistence of diverse generations. A survey of right holders conducted by NPO Tama New Town and Urban Development Expert Meeting revealed the composition of old owners and new purchasers of Brillia Tama New Town. About 20% of new purchasers moved from the same area (Tama City, Suwa and Nagayama districts) and about 30% moved in from cities in Kanagawa, a neighboring prefecture, such as Kawasaki, Sagamihara, and Yokohama.



Source: Materials of NPO Tama New Town and Urban Development Expert Meeting

Figure 5 Location of residency of new purchasers before moving in

With regard to the age distribution, the imbalance in residents' age improved dramatically as many of the new purchasers were young couples with children. In particular, there has been an increase in the population of households raising children (many of which are married couples in their 30s with children under 5). On the other hand, the population of old owners has high numbers of people aged 60 and over. However, the overall age distribution is balanced by the young and new purchasers, creating an environment for coexistence among diverse generations. Such efforts have made significant impact on stopping the aging of the Suwa district. The rate of population aging in the Suwa district has dropped from 32% to 24%.



Source: Materials of NPO Tama New Town and Urban Development Expert Meeting

Figure 6 Age distribution of old owners and new purchasers of Brillia Tama New Town

Future challenges include the burden of costs for reconstruction and renewal of housing complexes and the difficulty of developing consensus. Although Tama City regards reconstruction as a necessary option, only a limited number of reconstructions have been performed due to the scale of costs and issues concerning development of consensus. To address these issues, Tama City is promoting activities to raise awareness of reconstruction and renewal of buildings while encouraging seismic retrofitting on housing complexes that are built before 1981 when the old quakeproofing standards were enforced. In addition, Tama City and Tokyo Metropolitan Government's subsidy systems[52] are also available for activities that contribute to the development of consensus on reconstruction and renewal of housing complexes.

ii. MUJI × UR Housing Complex Renovation Project

① Overview of Initiatives

UR, the main developer of Tama New Town, is carrying out a housing complex renovation project nationwide with MUJI HOUSE Co., LTD, a company that takes on the living space business of Muji. The project began in 2012, and in 2021, it maintains and runs more than 600 renovated dwellings across Japan. In Tama New Town, the renovation project is carried out at Nagayama Housing Complex and Belle-Colline Minami Osawa. The concepts of the MUJI × UR housing complex renovation project is to make use, to change, and to be free. Based on the idea of saving things that can be used, housing is renovated upon supervision of design by MUJI House and confirmation of performance standards by UR. The greatest feature of the renovated housing is that the partition walls that make the room feel smaller are taken down, and residents have the freedom of changing the layout of the dwelling unit. Originally, each dwelling unit of the Nagayama Housing Complex had 3 Japanese rooms in a space of 40–50 m^2 and was old-fashioned. This was the major reason why it was shunned by the younger generation. Therefore, the partition walls were removed in the renovation process, and sliding doors made of cardboard developed jointly by MUJI and UR were used. By using a light sliding door that can be easily removed, the project was able to create a spacious modern-style home. The renovated housing has rents that are 10–20% higher than ordinary housing complexes, but are highly popular and have no vacancies.

Project overview	Result
Number of renovated units	• 19 units
Number of vacancies	• 0 units *As of February 2021
Floor plan	• 2LDK (approx. 57 m^2): 11 units have been made available since 2015. Advertised rent is about 10% higher than regular dwelling units of the same size. Room with balcony. • 2DK (approx. 54 m^2): 8 units have been made available since 2017. Advertised rent is about 9% higher than regular dwelling units of the same size. The sliding doors are removable and allows residents to enjoy changing the layout.
Rent	• 10–20% higher than regular housing complexes

[52] Subsidy for support projects aimed to achieve consensus concerning condominium renewal in Tama City: The subsidy is offered by the government for activities necessary for examination of housing complex renewal and development of consensus. The maximum expense covered is 10 million yen per year, and half of the activity expense is subsidized by the government, and maximum granted period is in total of 8 years.

Photo	

Source: Prepared based on interviews published on MUJI HOUSE website

Figure 7 Details of UR × MUJI Renovation Project (Nagayama Housing Complex)

② Progress of Initiatives and Future Challenges

Renovated dwelling units are popular among families with young children and young business people. The young generation moving into the housing complexes is contributing to the change in age distribution. The value of the property is also high for companies that manage the property because the vacancy rate is low. UR will continue to promote similar efforts in other housing complexes. One of the issues of this project is that businesses have to bear the renovation cost, and a greater cost is required to restore the dwelling units to the original condition after the tenants move out because the units are outfitted with special interiors.

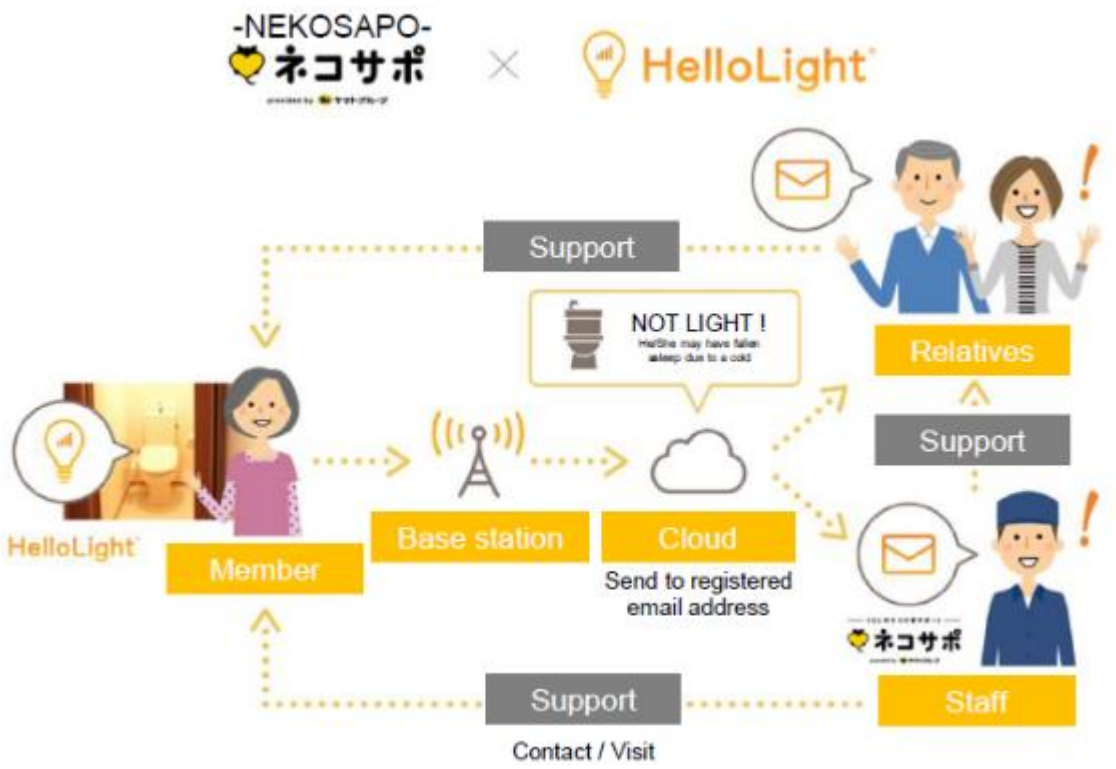
iii. Livelihood Support for the Elderly Using IoT

① Overview of Initiatives

Yamato Transport, a Japanese delivery services company, opened Nekosapo Stations in Tama New Town in cooperation with UR and Tama City in 2016[53]. Since then, the company has provided services to support the livelihoods of local residents. In addition to services for residents, such as grocery shopping services and housekeeping assistance, it also holds social events and contributes to the formation of local communities[54]. In June 2020, the company began a demonstration experiment of an elderly monitoring service that uses IoT light bulbs with a communications system. Yamato Transport has been making efforts aimed at utilizing smart solutions to support the livelihood of elderly people living alone. This service automatically sends e-mail notifications to families and friends of the user as well as staff at the Nekosapo Station when the IoT light bulb installed at the user's home does not turn on or off for a certain period of time. If no one can get hold of the user, staff at the Nekosapo Station will visit the user's home upon request from family and friends.

[53] Yamato Holdings Co., Ltd. "Supporting livelihoods by using community bases." 2016. https://www.yamato-hd.co.jp/csr/higlights/2016highlights01.html.

[54] Yamato Transport Co., Ltd. and HelloLight, Inc. "Nekosapo Stations begin demonstration experiment of senior monitoring service that uses IoT light bulbs." June 1, 2020. https://www.kuronekoyamato.co.jp/ytc/pressrelease/2021/news_210205.html.



Source: Yamato Transport news release

Figure 8 Elderly monitoring service using IoT light bulbs

② Progress of Initiatives and Future Challenges

Against the backdrop of the growing demand for elderly support services due to the declining birthrate and aging population, the local governments' system for providing such services is tight. Efforts to support elderly's lives throughout the region from community bases led by private corporations have effectively complemented the elderly support services provided by local governments. In addition, the ease of installing IoT light bulbs at home makes it easier for the elderly to use the service, leading to the promotion of the use of the service. [55] In light of these needs, Yamato Transport plans to expand its services to other regions outside Tama New Town as they were able to confirm the effectiveness of the service. [56]

[55] Isaji, Ryu. "Kuroneko provides safety net for the elderly living alone! Yamato Transport begins senior monitoring service." September 16, 2020. https://emira-t.jp/topics/16083/.
[56] Yamato Transport Co., Ltd. "Yamato Transport begin senior monitoring service that uses IoT light bulbs and Yamato's management resources." February 5, 2021. https://www.kuronekoyamato.co.jp/ytc/pressrelease/2021/news_210205.html.

Shimokawa Town, Hokkaido

ix. General Information

(1) Geography of Shimokawa Town

Located in the north of Hokkaido, Shimokawa Town has a total area of 644.2 km^2, of which roughly 90% is covered by forest. The town is formally designated as a heavy snowfall area[57] as well as an underpopulated area.[58]

(2) Economy

Shimokawa Town created an interindustry relations table in 2012, and it shows that the local production output at that time was 21.5 billion yen. In order from highest to lowest, the breakdown by industry is as follows: construction (3.62 billion yen), forestry (2.76 billion yen), and agriculture (2.63 billion yen).[59] The town's key industries are agriculture and forestry.

(3) Finance

In terms of the revenue of the town, tax revenue is increasing due to the population inflow. In FY2020, the primary fiscal balance achieved a surplus in light of the fiscal management reference set out in the Sixth Master Plan of Shimokawa Town.[60] According to the town administration, a decrease in revenues is projected for FY2021, including town tax and local tax transfer, because of low economic activity resulting from the impact of COVID-19. Population decline is also of concern for the town, as it may adversely affect the tax revenues. As for the expenditure, the situation is expected to remain severe due to accumulating public debt expenditure from past investments in major construction projects. In addition, the town is expecting increased financial demands related to the maintaining of aging public facilities and the implementation of measures against COVID-19.[61]

(4) Policy Structure of Urban Planning

As its highest municipal policy, Shimokawa Town has developed the "Shimokawa Town Sixth Master Plan 2019-2030," which envisions a "resilient and sustainable town where no one is left behind, and where people can live happily." The town is striving to develop its ideal townscape with six major areas of focus (welfare and healthcare, education, living environment, industry, local governance and inter-community connection, and public finance). It should be noted that thanks to an active advocacy of the former town mayor, Shimokawa Town has been selected as an "SDGs Future City" and "Environmental Future City." The town has excelled over other municipalities across Japan in developing a municipal policy structure putting SDGs into practice. In earnest consultations with residents, the town has blueprinted the ideal, SDGs-driven townscape to be achieved in 2030.

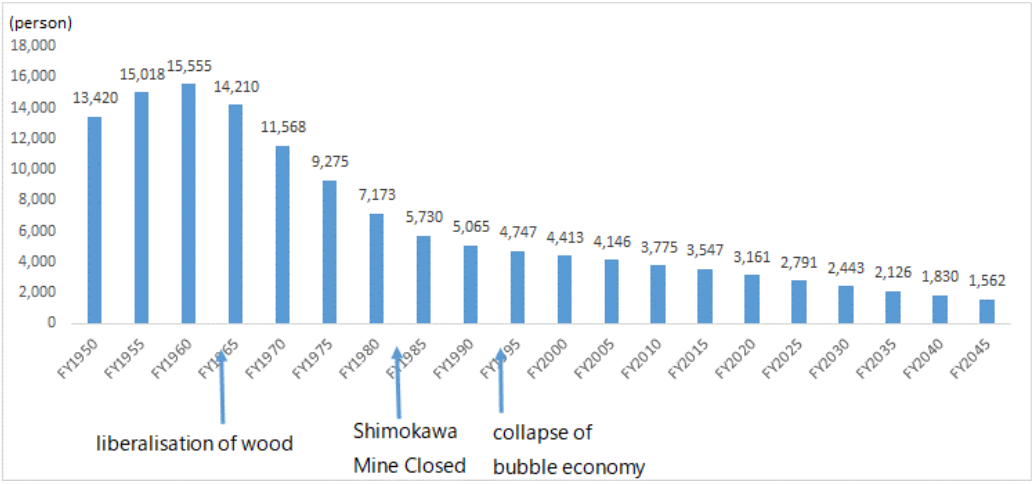
x. Demographic Trends

(1) Population Change

The population of Shimokawa Town was 3,202 as of November 2020, consisting of 1,713 households in total.[62] The town's population peaked at over 15,000 people in 1965. Due to the industrial shift which then

[57] Designated pursuant to the Act on Special Measures concerning Countermeasures for Heavy Snowfall Areas
[58] Designated pursuant to the Act on Special Measures for Promotion for Independence for Underpopulated Areas
[59] Figures from the Interindustry Relations Table in the "Shimokawa Town Create Forest and the Future," the reference material prepared by the Study Group for Resources and Energy Strategy
[60] FY202 Shimokawa Town General-Account Balance Sheet
[61] Budgetary Drafting Policy of Shimokawa Town for FY2021
[62] "Population and the Number of Households in the Town" on the Shimokawa Town website

followed, the population rapidly decreased to 3,547 people in 2015. Since 1990, the sharp population decline has slowed down as a result of successful sustainable forest management. Nonetheless, it is predicted that the population will continue to decrease.

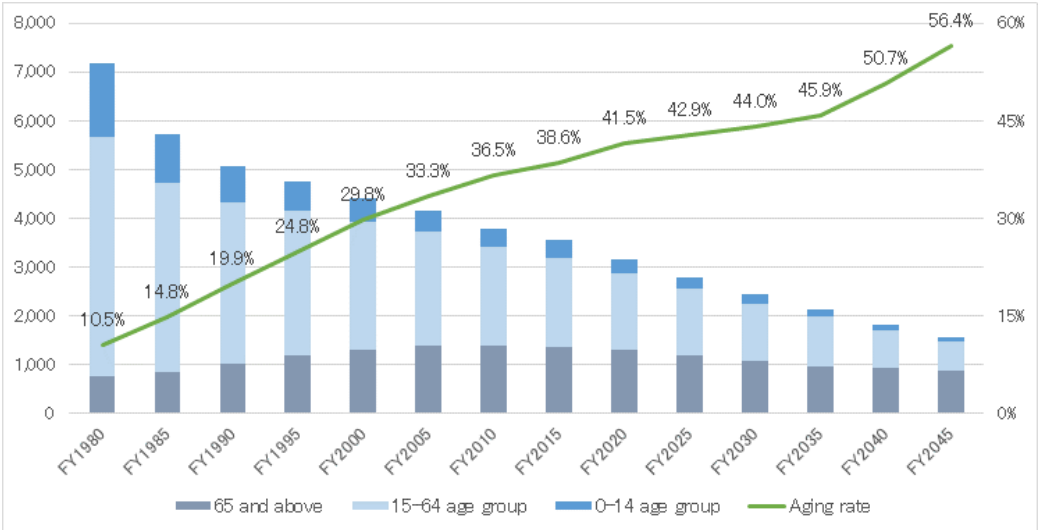


Source: National Institute of Population and Social Security Research

Figure 1 Population Change in Shimokawa Town

(2) Population Distribution by Age Group and Aging Trend

The population composition ratio by age group (categorized into three age groups) in 2020 was as follows: child population (0–14 years old) was 9.2%; working-age population (15–64 years old) was 49.3%; and elderly population (65 years old and over) was 41.5%. The aging rate has increased from 10.5% in 1980 to 41.5% in 2020, and this is projected to rise as high as 56.4% in 2045. The aging rate of the town is higher than the national average estimate (36.8%)[63] for 2045.



Source: National Institute of Population and Social Security Research

Figure 2 Age Group Distribution and Aging Rate in Shimokawa Town

[63] Medium projection (2017 projection): Future Population Projections for Japan, National Institute of Population and Social Security Research

xi. Main Challenges and Policy Responses

Since its settlement in 1901, Shimokawa Town had developed with such key industries as agriculture, forestry, and mining. While the town was populated by over 15,000 people in the 1960s, these industries have since declined due to changes in Japan's industrial structure. Followed by the closure of the copper mine, downsizing of regional forest offices, and the abolishment of JR railway services, the town recorded the highest rate of population decline in Hokkaido in the 1980 Census, and the fourth largest in all of Japan. Such rapid depopulation has eroded the vitality of the community. The aging of the town's population is also accelerating, with the aging rate estimated at 41.5% in FY2020. Although the town's rich natural resources have served as the foundation of agriculture and forestry, depopulation and an aging population have forced local businesses into closure. Instead of spending their money in town, people have turned to large urban shopping centers in the neighboring cities, leading to an outflow of consumption. All these factors have contributed to the growing economic disparity between the town and the major cities.

To address the above challenges, Shimokawa Town has worked to create a unique regional characteristic different from other municipalities. In line with the 2001 conceptual plan for "sustainable community development in harmony with the economy, society and environment," the town has been implementing a range of programs to revitalize the local economy, as exemplified by circular forest management and agriculture. Part of its efforts is dedicated to facilitating business entry and settlement in the town. The town has been promoting innovative practices to achieve a sustainable municipality and was selected as an Environmental Model City in 2008, an Environmental Future City in 2011, a Regional Revitalization Model Community in 2014, and an SDGs Future City as well as a Municipal SDGs Model Project in 2018. Furthermore, in 2017, the town was awarded the first Japan SDGs Award by the Prime Minister. As a result of these efforts, the number of outward migration has declined over the last decades, and in 2012, the number of inward migration exceeded those moved out. This trend of population inflow continued in 2013, 2015, 2017, and 2018.

i. Public Finance

Population decrease and aging have led to an increase in social security expenses such as healthcare and nursing care, which is imposing a severe strain on municipal finances. The shrinking working-age population has caused a reduction in tax revenues. A streamlined management scheme is therefore needed. Shimokawa Town has been developing an IT-based efficient administrative system and ICT-based snow removal arrangement to ensure people's safety and well-being, while keeping fiscal expenditure down.

ii. Urban Environment

While roughly 80% of the population is settled in the urban area in Shimokawa Town, access to essential shopping facilities and snow removal services is increasingly becoming an issue. Going forward, the number of people experiencing difficulty in meeting their daily needs (for snow removal, mobility, shopping, housekeeping, and home maintenance etc.) will further increase as the population continues to age. The urban area has a particularly high rate of population decrease, with some sub-areas facing difficulty in maintaining the community. As people in Shimokawa Town are dependent on automobiles for getting around, the public transit system, including buses on regular routes, has reduced in size. As the aging rate increases, so does the number of people with insufficient access to transportation and there is a growing service gap. The town is facing a challenge in providing a means of transportation to the elderly and the transportation disadvantaged without cars. The initiatives described below are being implemented to address these challenges.

(1) Mobility

National route 239 is an extensive main highway that runs east-west, on which many of the communities in Shimokawa Town are located. The town is reorganizing municipal buses and offering reservation-based shared taxi services to ensure that residents have better access to each other's communities, and to meet the mobility needs of underserved groups and fill a service gap by securing feeder transit services providing connectivity to/from the Shimokawa Line and Okoppe Line main local bus routes.

(2) Urban Infrastructure and Regional Design

To develop communities where the residents enjoy a high level of well-being, Shimokawa Town is promoting a high-quality living environment to meet the needs of the elderly (living and public transportation, housing, and snow removal etc.) and families with children (housing and playgrounds etc.). Consolidated urban functions and infrastructure are being developed for coming generations to create an inflow of people who will want to make the town their permanent home.

Furthermore, the town is focusing on community ties to enable all residents to live happily and vibrantly, while receiving necessary childcare, medical care, nursing care, and self-reliance support services. Lifetime learning and weekend schools are offered in public facilities. The town is also dedicated to preserving valuable cultural heritage and resources.

✧ Regional Economy

Besides supplying its own energy to be locally consumed, Shimokawa Town is developing a scheme to use locally grown food, and to create jobs in agriculture. Agriculture is a key industry of the town, and the engine of growth increasing production output. However, the aging of farmers and a shortage of successors are posing challenges. It is essential for the town to develop a sustainable foundation for agriculture by securing successors to take over farms, boosting productivity, and through capacity improvement in management and technology. In addition, more than 50% of students in Shimokawa Town out-migrate after graduation. In order to stimulate the local economy, this situation must be addressed through measures to enable young people to continue their studies and find employment in the town. To address these challenges, the initiatives described below are being implemented.

(1) Circular Economy

The town is aiming to build autonomous and self-reliant communities where people, natural resources (e.g., forests and water), and money circulate in a sustainable and lasting manner, where industries (e.g., agriculture and forestry) can continue growing, and local products (e.g., food, wood, and energy) are consumed locally. The above effort is intended to increase the "earning capacity" of agriculture, forestry, commerce and industry, to attract people and money from outside the region into the town, while producing food, wood, and energy to be consumed locally. This allows out-of-town money to circulate within the town and create new industries and jobs, reducing the vulnerability that comes from depending on the outside. As for the agricultural sector, the town is striving to create jobs by supporting new farmers and introducing a livestock farm helper scheme. Furthermore, local energy sources, mainly forest resources, are used to develop eco-friendly, disaster-resistant communities with energy self-sufficiency underpinned by the integrated biomass industry. A notable initiative is the Ichinohashi Bio-Village where a decarbonized community model is being developed.

➢ Use Cases as Smart Solutions

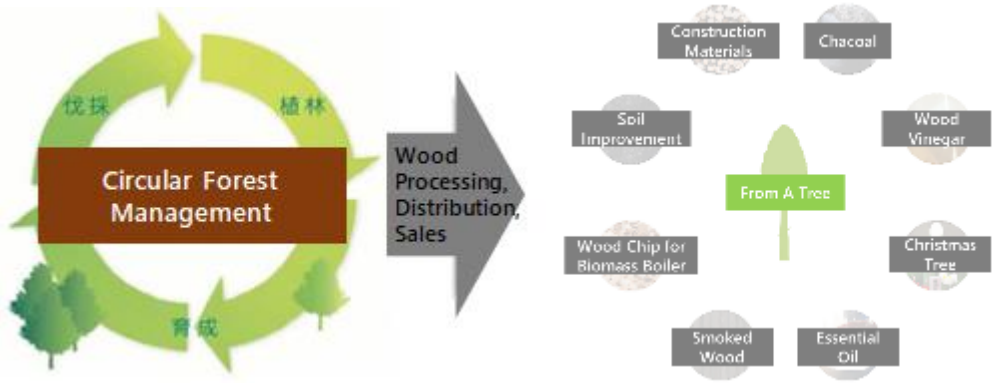
With 90% of its land area covered by forest, Shimokawa Town has historically been a forestry community.

Since 1953 when the town purchased about 1,213 ha of national forest, it has been acquiring national forest whenever the opportunity to do so has arisen. Currently, the town owns roughly 4,500 ha of municipal forest, (3,000 ha of artificial forest and 1,500 ha of natural forest), of which 50 ha are cut annually at the age of 60 years of stands to achieve "circular forest management." With this practice, the town is the first in Hokkaido to obtain the FSC Forest Certification.[64] Smart solutions such as the installation of woody biomass boilers to heat public facilities are also being implemented. This section describes "circular forest management," a pillar endeavor of Shimokawa Town, and the "Ichinohashi Bio-Village Initiative" which aims to utilize woody biomass in the development of a sustainable society and a model community for coping with a super-aging population.

5.1.1. Circular Forest Management

(1) Overview of Initiatives

Circular forest management was initiated in 2014 and the town is practicing systematic forest management including private woodland. It rotates cutting, planting, and cultivation, and forest resources are produced ceaselessly by cutting 50 ha of stands annually, at the age of 60 years. Timbers logged from the forests are put to a wide range of uses according to size and condition. Thick, good timbers are used for construction, whereas thinner ones are cut in round pillars and used for civil engineering and tree planting projects. Other wood residues are made into charcoal. New products are being developed, such as barbeque fuel, deodorants, and humidity control materials. Wood vinegar, used in gardening products, is extracted from smoke generated during carbonization. Furthermore, branches and leaves, which are usually rejected, are collected and distilled to produce essential oils. Timbers from forest thinning and remnants are chopped in pieces and used as biomass pellets for heating.



Source: Created from materials released by Shimokawa Town, Asahi Shimbun Newspaper, and other materials

Figure 3 Circular Forest Management

Snowy and cold Hokkaido is dependent on fossil fuel for heating in the winter, and is therefore a large emitter of CO_2, with household CO_2 emission rates higher than in other parts of Japan. To substantially reduce CO_2 emissions, the town installed a wood pellet biomass boiler in a local *onsen* (hot spring bath) facility in 2004, a first in Hokkaido. Since then, biomass boilers have been operated at 10 sites as of January 2021, including a child center (nursing facility for preschool children), a laminated wood plant run by a

[64] FSC refers to Forest Stewardship Council.

forest cooperative, and agricultural facilities. The biomass project is being developed by Shimokawa Town, commissioned to Shimokawa Energy Supply Cooperative under the Designated Administrator System.

Source: Information released by Shimokawa Town

Figure 4 Wood Pellet Biomass Boiler and Pellet Manufacturing Plant

(2) Progress of Initiatives and Future Challenges

The woody biomass project of Shimokawa Town launched in 2004. For the first five years, it was using 600 tons of manufacturing residue produced from timber plants annually. Since 2009, the fuel supply increased as the project started to source from municipal forests. From 2010 onward, the project has been reporting a profit. The forthcoming challenge is the replacement of existing boilers, most of which will reach the end of their service life between 2030 and 2035. As a next step, the project is trying to consolidate its energy plants to increase the energy density.

Item	Achievements
Production	• 3,500 tons of wood pellets are produced annually.
Annual sales	• Wood pellets generate sales roughly 45 million yen per year, with a net profit of roughly 20 million yen. • Under the contract, the net profit is equally split between the Designated Administrator and Shimokawa Town.
Energy efficiency	• Roughly 68% of the heat demand for public facilities and 56% of that for the entire town is supplied by woody biomass boilers.
Cost-cutting effect	• Compared to fossil fuel, biofuel is saving roughly 38 million yen of expenditure per year • Part of the money saved from biofuel is reserved into a fund for parenting support to provide free healthcare services and reduce school meal costs for children enrolling in compulsory education.

Source: Interview with Shimokawa town

Figure 5 Achievements of the Woody Biomass Project

1-4-2. The Ichinohashi Bioenergy Village Initiative

(1) Overview of Initiatives

Ichinohashi area of Shimokawa Town is located in a suburb roughly 12 km from the town center. This small community was populated by 95 people in 2009, and the aging rate exceeded 50%. Thriving on forestry, the community consisted of 2,058 people in 1960, but in recent years a lack of shops and a hospital has

had residents request support to meet shopping needs and help with snow removal issues. Other issues include aging housing, and the community is facing severe challenges to remain sustainable. Under these circumstances, the municipality of Shimokawa started to deliver a range of services in 2010 to sustain and stabilize the daily life of Ichinohashi residents. Through public consultation, the Ichinohashi Bio-Village Initiative was developed, which hosts local vitalization cooperators as well as people moving into the community. Subsequently, a communal residential area known as the "Collective House" was constructed in 2013, replacing the older municipal housing that was to be rebuilt. This housing complex is energy self-sufficient to meet the needs of the super-aging society.

Source: Shimokawa Town official website

Figure 6 Ichinohashi Bio-Village

The housing complex has six residential buildings that accommodate 26 units. The individual residential buildings are connected to each other via an indoor corridor, reducing the need for snow shoveling around entrances. A woody biomass boiler supplies hot water and heating across the community. The underground pipe network supplies the heating to the housing complex, the adjacent community center and post office, as well as the neighboring support facility for persons with disabilities and a seedling greenhouse.

Item	Achievements
Collective facilities	• Collective House (26 units) • Accommodation hosting prospective permanent residents (2 units) • Resident center, community center, police patrol sites • Post office • Public dining room • Support facility for persons with disabilities • Biomass-fueled heaters (2 boilers) • *Shiitake* mushroom cultivation facility
Aging	• The aging rate has decreased from 52% in 2009 to 29% in 2015. Note: The decreasing aging rate is attributed to the natural decrease in population and young people becoming permanent residents.
Job creation	• About 30 new part-time workers are employed for full-year production of *shiitake* mushroom. • A private company was invited to the community to set up an R&D institute on medical herbs. This created 13 new jobs. • NPOs and startups are being founded.

Source: Shimokawa Town official website and interviews

Figure 7 Achievements of the Initiative

(2) Progress of Initiatives and Future Challenges

In revitalizing a marginalized community through energy self-sufficiency and collective housing system, Ichinohashi Bio-Village has successfully pioneered an innovative model in Japan and the project has achieved tangible impacts, including the attracting of new businesses to the area and job creation. The initiative will need to continue its efforts to sustain and strengthen the community through hosting more people moving there from other regions and expanding local business.

Minamiyamashiro Village, Kyoto Prefecture

xii. General Information

(1) Geography of Minamiyamashiro Village

Minamiyamashiro Village is the only village situated in the southernmost tip of Kyoto Prefecture, and borders Nara, Mie, and Shiga Prefectures. The village, which has a total area of 64.11 km², was designated as an underpopulated area in 2017.[65]

(2) Economy

In FY2017, the gross village production was 6.31 billion yen, and its economic growth rate was -13.4% (versus 7.29 billion yen and 19.9%, respectively, in the previous year). In order from highest to lowest, the breakdown by industry is as follows: agriculture, forestry, and fishery industry (990 million yen), real estate (950 million yen), construction (610 million yen), and accommodation, food, and beverage services (520 million yen)[66]. Traditionally, the region's principal industry has been the processing of tea leaves.

(3) Finance

The annual revenue and expenditures of Minamiyamashiro Village are balanced in general, hovering around 2.6 billion yen. In FY2021, According to Minamiyamashiro's city administration, on the revenue side, it is expecting a decrease in revenue from individual residential tax due to economic damage from the COVID-19 situation, a decrease in working population, and also a decline in the assessed values of residential land. Overall village taxes are also expected to decrease slightly against the FY2020 budget. On the expenditure side, in recent years, the village has withdrawn significant funds from its fiscal adjustment fund and sinking fund. Thus, it is reevaluating administrative costs and taking measures such as reducing running expenses.[67]

(4) Policy Structure of Village Planning

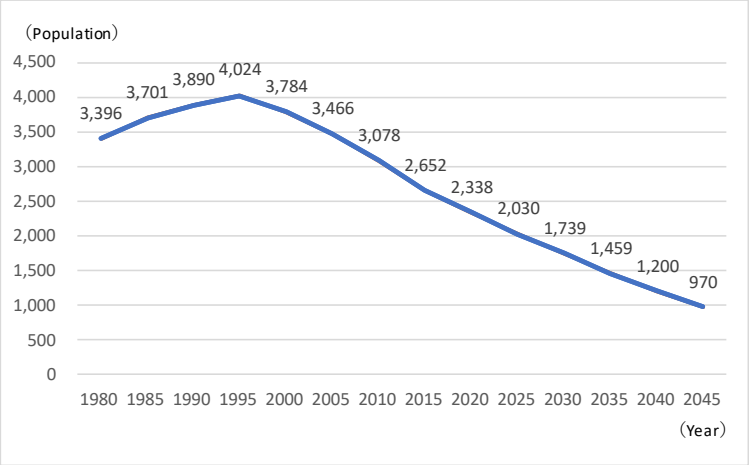
Minamiyamashiro Village has formulated its "4th Comprehensive Plan for Minamiyamashiro Village (2012–2021)" as its highest municipal plan. The plan sets a vision to realize a "Minamiyamashiro Village that is self-sustaining, has fragrant nature, and has strong community bonds," and is implementing village development under the basic themes of "coexistence and utilization of nature and history," "creating vitality through exchange and cooperation," and the "creation of good living and culture" with people living in the village playing leading roles. The village has formulated a "2nd Comprehensive Strategy for the Realization of Minamiyamashiro's Community, People, and Livelihoods" and is implementing strategic measures to deal with the declining population. Jointly with neighboring Iga City in Mie Prefecture and Kasagi Town in Kyoto Prefecture, the village has also formulated a "Cooperation Vision for Settlement and Coexistence with Iga and Yamashiro Minami (FY2017–2021)." By partnering and collaborating across regional divisions to share responsibilities with each other in utilizing the urban features of the "central city" and charm of the "connected municipalities," this vision aims to make the region a place where all residents can enjoy happiness while also promoting permanent settlement.

[65] Designated pursuant to the Act on Special Measures for Promotion for Independence for Underpopulated Areas
[66] Kyoto Prefecture, "Statistical Table of Municipal Accounts for FY2019"; http://www.pref.kyoto.jp/tokei/yearly/shicho/shichotop.html
[67] Minamiyamashiro Village, "FY2021 General Account Budgeting Policy"; http://www.vill.minamiyamashiro.lg.jp/contents_detail.php?frmId=2131

xiii. Demographic Trends

(1) Population and Number of Households

The population of Minamiyamashiro Village was 2,582 as of the end of March 2021[68]. Population decline started sometime around 1995, and there is no end in sight for it. There were a total of 1,210 households in the area with an average of 2.14 persons per household. Based on future estimates, the population is forecast to decrease to 1,200 people by 2040, roughly half the current level. As for reasons behind the declining population in Minamiyamashiro Village, in addition to its low birth rate, which is the worst in Kyoto Prefecture, there is also natural population decrease as well as excessive outward migration, especially among women aged 20–39 which is estimated to be one of the direct causes for the declining birth rate. The most recent Total Fertility Rate (TFR) in Minamiyamashiro is 1.05, which is significantly below the desired fertility rate of 1.8[69] which was set as a target in Japan's long-term vision.



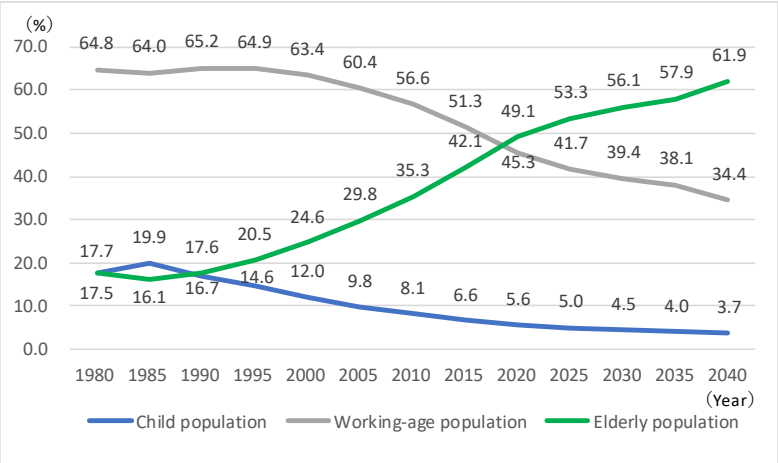
Source: "2nd Comprehensive Strategy for the Realization of Minamiyamashiro's Community, People, and Livelihoods"

Figure 1 Population Change in Minamiyamashiro Village

(2) Population Distribution by Age Group and Aging Trend

The population by age group (categorized into three age groups) and composition ratio in 2020 was as follows: child population (0–14 years old) was 131 persons (5.6%); working-age population (15–64 years old) was 1,059 persons (45.3%); and elderly population (65 years old and over) was 1,148 persons (49.1%). The elderly population rate has risen from 17.5% in 1980 to 49.1% in 2020, and is expected to further increase to 61.9% by 2040.

[68] Minami Yamashiro Village website, Population and Households (March 2021); http://www.vill.minamiyamashiro.lg.jp/index.php
[69] "Japan 100 Million Total Active Plan/Achieving the Desired Birth Rate of 1.8", Cabinet Secretariat, Cabinet Decision, June 2, 2016; https://www.kantei.go.jp/jp/singi/ichiokusoukatsuyaku/



Source: "2nd Comprehensive Strategy for the Realization of Minamiyamashiro's Community, People, and Livelihoods"

Figure 2 Population Distribution by Age Group in Minamiyamashiro Village

xiv. Main Challenges and Policy Responses

Minamiyamashiro Village is a semi-mountainous area with 10 wards/residents' associations interspersed across the area. In some districts, it takes around 30 minutes by car to travel to a train station or town hall, which makes it highly difficult for the elderly to leave their home or go shopping, and this situation is expected to worsen along with the declining birthrate and aging population. Since the region also lacks an attractive employment base, the region's limited job opportunities are also contributing to the trend of excessive outward migration.

To address these issues, the village is focusing on helping revitalize its economy through variety of efforts such as measures to help the transportation disadvantaged, promotion of business development using "o-cha (green tea)," the village's specialty, and promotion of tourism by taking advantage of the area's natural and cultural heritage sites. Because Minamiyamashiro is mostly mountainous and hilly with a natural environment rich in water and greenery, and has moderate weather and a cool climate, it is able to produce very high-quality tea, which is the village's specialty. Given that the village also has several historical and cultural assets, it aims to preserve and nurture its history and traditional culture while widely spreading information to build up a valuable tourism industry. Minamiyamashiro is located on a prefectural border that adjoins Iga City in Mie Prefecture to the east, Koka City in Shiga Prefecture to the northeast, and Nara City to the south. Being the connecting point between the four prefectures of Kyoto, Nara, Mie and Shiga, one of Minamiyamashiro's unique characteristics is the fact that it carries out village development activities in cooperation with several neighboring cities and towns.

i. Public Finance

According to Minamiyamashiro Village administration, the financial situation continues to be difficult due to the ongoing decline of revenues from individual residential tax caused by the decline of farmers and working population, as well as the decline of the residential land assessment values. Meanwhile, there are many required expenditures[70] such as those to address the aging infrastructure which includes water supply, bridges, and waste disposal facilities, as well as the establishment of a new information communication infrastructure. As a response to these challenges, to provide efficient administrative services under limited

[70] "Minamiyamashiro Village Underpopulated Area Self-Reliance Municipal Plan"; September 2020 revision, http://www.vill.minamiyamashiro.lg.jp/contents_detail.php?frmId=1609

financial resources, the government is promoting initiatives that include more efficient damage prevention by using IoT to monitor the increasing number of harmful birds and animals, and creating a database of disaster history.

ii. Urban Environment

Being located in a remote mountainous area, the area not only lacks adequate public transportation, but also has limited urban amenities such as government offices, medical facilities, transportation hubs, educational facilities, and commercial facilities, which make it difficult for people without cars and elderly people living alone to go shopping or to a clinic/hospital. There has also been a growing number of vacant houses in recent years, a trend that is expected to further increase as the population continues to decline. To address these issues, the initiatives described below are being implemented.

(1) Mobility

Minamiyamashiro Village has been implementing measures to help the transportation disadvantaged with the goal of "creating an attractive Minamiyamashiro Village that has a regional framework that suits the times, and where people can live with peace of mind." As part of this, in collaboration with private-sector transportation companies, the village conducted a demonstration experiment of MaaS for underpopulated areas that uses a MaaS app (route search, reservation, and payment app that seamlessly connects existing public transportation with the on-demand transport being introduced on a trial basis) that utilizes on-demand transport. Currently, an on-demand shuttle service is being offered for a fee.

(2) Urban Infrastructure and Regional Design

While promoting the development of an unique environment that expresses the unique comfort of Minamiyamashiro while achieving balance with its rich nature, Minamiyamashiro Village is striving to boost the appeal of the village to increase satisfaction among residents while simultaneously communicating this to people outside the village to revitalize the area. The village administration is also working to improve the local infrastructure and road network, and bring a sense of unity to the village, which tends to be fragmented. It is also promoting a variety of exchanges and collaborations with neighboring cities and towns to realize a village with a wide circle of good relationships.

iii. Regional Economy

While tea production is the key industry of the area, due to the aging of tea growers and lack of successors, the number of growers continues to decrease with each year. However, because the village's key industry is so singularly-focused on tea production, its other industries have not been sufficiently developed. One of its challenges, therefore, is to secure new pillars of economic revitalization. To address these issues, the initiatives described below are being implemented.

(1) Industrial Development

Minamiyamashiro Village is focusing efforts on the revitalization of industries that leverage the region's uniqueness and resources. While placing the focus on agriculture, particularly tea, the village is aiming to revitalize the local economy by promoting roadside stations as a sales base for local products and tourism. In another initiative, implemented to bolster the forestry industry through biomass-related business, the

village has developed a biomass utilization base whose resources are the waste wood from forest maintenance and driftwood from the Takayama Dam lake, and this is providing new services such as the sale of wood pellets. Through these efforts, the village aims to promote a virtuous cycle of economic growth and waste reduction, while also reducing CO_2 emissions and creating job opportunities.

xv. Use Cases as Smart Solutions

Advocating the goal of being a place where people can live long term, Minamiyamashiro Village is promoting four projects themed "Industrial Revitalization," "Minamiyamashiro Village Conservation," "Fostering Leaders for the Next Generation," and "Creating Bonds." These aim to establish an industrial system that will contribute to realizing a circular economy, which is one of the elements of smart cities. This chapter describes in detail the efforts of MaaS and on-demand transport in underpopulated areas, which are being promoted as measures to help the transportation disadvantaged in mountainous regions, and also describes industrial revitalization efforts that utilize the "Ocha no Kyoto Minamiyamashiro Village" roadside station as a regional hub for realizing a circular economy.

i. MaaS for Underpopulated Areas and On-demand Transport

(1) Overview of Initiatives

As a social experiment to resolve the transportation needs of the transportation disadvantaged and to reorganize public transportation, Minamiyamashiro Village conducted a MaaS demonstration experiment in collaboration with Willer, utilizing the New Mobility Service Promotion Project of MLIT (Ministry of Land, Infrastructure, Transport and Tourism). Specifically, the experiment used a MaaS app from Willer to assess the feasibility of a system that provides on-demand transport within the region and enables reservations for transportation services on the "Tsukigase New Town". The MaaS app makes it possible to search routes, make reservations, and issue digital tickets.

Item	Results
Implemented content	• On-demand transport • "Tsukigase New Town" line
Implementation period	6. February 13, 2020 to March 31, 2020
App	• Uses a MaaS app from Willer, Inc. • The app is capable of route searches, reservations, and digital ticket issuance
On-demand transport	• There are two types of transportation services: one service for travel outside the village that connects the roadside station and JR Kizu Station, and another service for travel within the village where riders can embark and disembark freely. • The service operates on Mondays, Wednesdays, Fridays, and Saturdays. • Reservations must be made by 17:00 the day before. • The service was free of charge during the demonstration experiment.
"Tsukigase New Town" Line	• A regular (fixed-time fixed-route) transportation service that connects Tsukigase New Town, the roadside station, and JR Tsukigaseguchi Station. • Operates on Tuesdays and Thursdays.

	• Reservations are not required for regular service. • The service was free of charge during the demonstration experiment.

Source: Willer's official website

Figure 3: MaaS Demonstration Experiment Details

Source: Willer's official website

Figure 4 Operating Area

(2) Progress of Initiatives and Future Challenges

According to an interview with Minamiyamashiro Village officials, one of the problems discovered during the demonstration experiment was the low percentage of smartphone use among the elderly. As using a mobile app as the interface is in itself problematic, information sessions and such were provided to teach one how to use the app. Still, likely due to the limited time of the demonstration experiment, the elderly people found it difficult to get accustomed to using it. After the testing period, the service became fee-based with "Mura-Taku (Village Taxi)" taking over on-demand transport through the same Willer MaaS app. The number of users declined from 7–8 people/day during the demonstration experiment to around 3 people/day when the service became fee-based. There have been more cases of people utilizing on-demand transport as a means to travel to the roadside station in the village (described later), and it is expected that more widespread use of the app among elderly residents will prove beneficial to the transportation disadvantaged.

ii. Roadside Station "Ocha no Kyoto Minamiyamashiro Village"

(1) Overview of Initiatives

The "Ocha no Kyoto Minamiyamashiro Village" opened in 2017 as a roadside station that specializes in tea to take advantage of regional characteristics. As a way to "realize a mechanism to support long-term living in the village," this initiative develops products that use Minamiyamashiro Village tea, the local specialty, also aiming to establish a "circular industrial system within the region" that contributes to realizing a circular economy, which is one of the elements of smart cities. Of the facilities owned by Minamiyamashiro Village, this roadside station has an extremely high ability to attract customers and has led to job creation in the region. Another unique feature of this roadside station is the fact that it is operated by a private company (Minamiyamashiro-Mura Co., Ltd.) which is independent from the local government.

Source: https://www.sbbit.jp/article/cont1/37513

Figure 5: Exterior of the Roadside Station

The roadside station also has a "villager department store" that functions as a convenience store. In the past, when people living in Minamiyamashiro wanted to buy groceries, etc., they would either get home delivery via a consumer cooperative, or go to neighboring Iga City (Mie Prefecture). This initiative was born from the need to help vulnerable populations such as the shopping disadvantaged and transportation disadvantaged. To enhance the selection of available items, including milk, eggs, handmade boxed lunches, and daily necessities, a product supply agreement was entered with the Kyoto Consumers Cooperative Association. The store is also open later than the roadside station to provide service during nighttime hours, and also started offering delivery services for a fixed charge to support the transportation disadvantaged.

Source: Interview material

Figure 6: Exterior of the Village Department Store

(2) Progress of Initiatives and Future Challenges

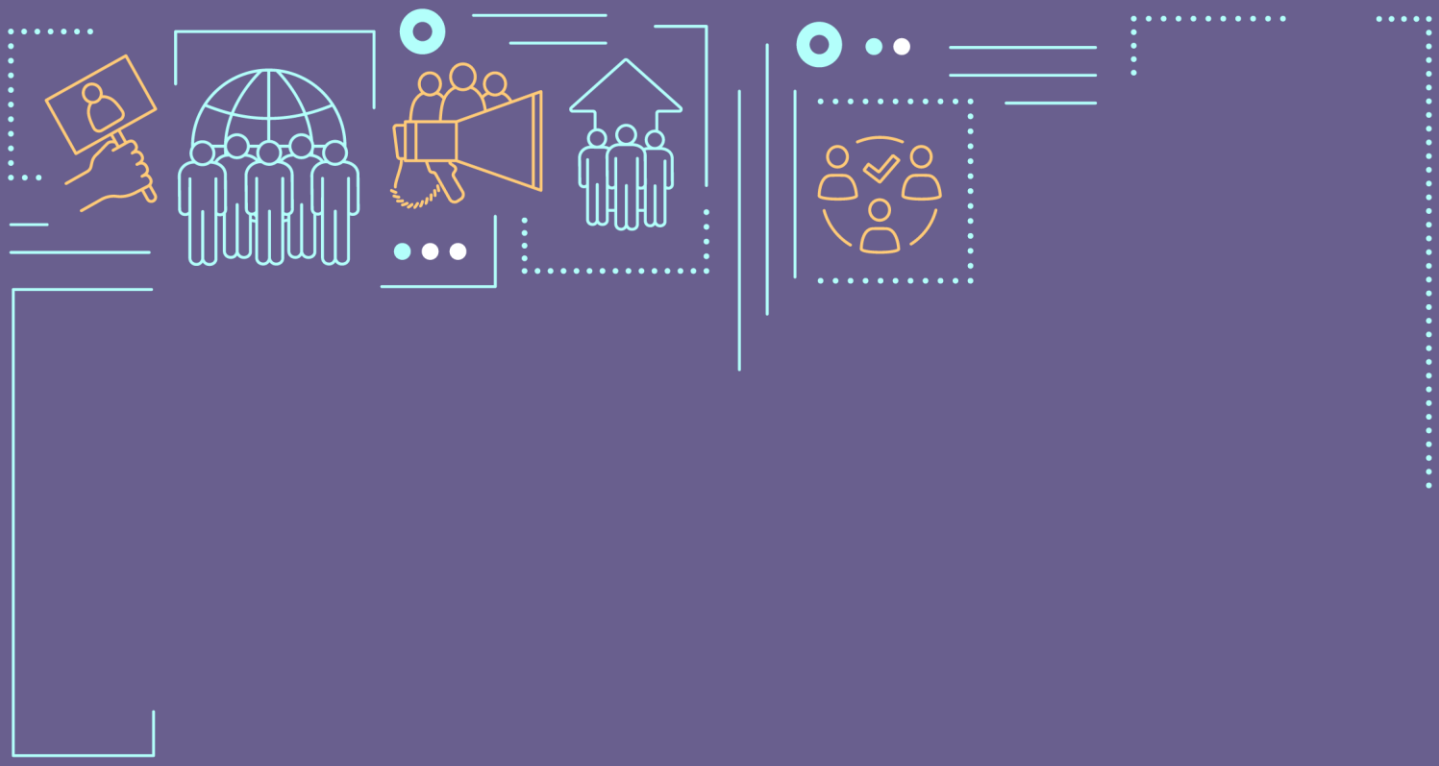
The roadside station initiative in Minamiyamashiro Village has been steadily growing, and making a significant contribution to industrial development of the village and expansion of job opportunities. Even amid the COVID-19 situation, sales have remained at a similar level to the previous year.

Future growth challenges will include the intensification of initiatives related to tourism and primary industries. With regard to tourism, the Marriott Hotel has plans to open as a roadside station-type hotel. The development of tourism products such as agricultural experiences are also being promoted while utilizing a Kyoto Prefecture subsidy for local community support projects involving "agriculture and tourism." Also, with regard to primary industry, the village is promoting "sixth-order industrialization" by making use of abandoned farmland for planting high value-added and branded crops, and efforts for further growth are also being implemented.

Item	Results
Effect of attracting visitors	• Approximately 408,000 visitors were recorded in FY2017; 385,000 in FY2018; and 408,000 in FY2019 (pre-opening target was 120,000 visitors per year)
Net sales	• Growth has been steady at approx. 390 million yen in FY2017; 380 million yen in FY2018; and 420 million yen in FY2019 (surpassing the pre-opening target by around 100 million yen) • Despite the impact of COVID-19, sales for FY2020 are expected to be around the same level as the previous year
Employment effects	• The initiative resulted in the direct employment of approx. 50 people, as well as approx. 200 related producers
Visitor attributes	• Many of the visitors come from neighbouring large cities such as Osaka, Kyoto, and Nara, or from neighbouring municipalities such as Iga, Uji, and Koka. • During weekdays, most of the visitors are senior citizens who live within 1.5 hours of the facility, and during weekends and holidays most of the visitors are families who live within 2.5 hours.
Other	• The Marriott Hotel is scheduled to open in the adjacent area as a roadside station-type hotel.

Source: Prepared based on interviews, etc.

Figure 7: Achievements of the "Ocha no Kyoto Minamiyamashiro Village"



This project is funded by
the European Union