

A CASE STUDY ON HOUSING LOCATION GUIDANCE IN A COMPACT CITY IN SAPPORO, JAPAN

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ABSTRACT

Structural reforms aimed at compact city development are underway in Japanese cities. Location normalization plans (LNPs) have been formulated to curb urban expansion, concentrate urban functions in the city centre, especially in areas centred on transportation hubs, and induce residential functions in the surrounding areas of transportation hubs. This study targets condominium locations, which are thought to have an enormous impact on urban residence, focusing on Sapporo City, the only city in Japan with a 'collective residential induced area' defined in its LNP. Our analyses cover several factors, including the scale of Sapporo City's urbanized area and the 'collective residential induced area'. Data was collected for all condominiums sold in a market and built in Sapporo City. We found that many condominiums are already located in 'collective residential induced areas', accounting for 67.0% of all condominiums. Furthermore, 93.4% of condominiums built after the LNP was formulated in 2016 are in 'collective residential induced areas'. Additionally, condominiums are concentrated in certain areas and are not distributed evenly throughout the 'collective residential induced areas', where they tend to have more floors and units. Finally, three-dimensional, more high-rise condominiums are being constructed than those with flat expanse layouts.

Keywords: urbanization, communal housing, condominium, kernel density estimation.

1 INTRODUCTION

Communal housing (the Japanese census defines a communal building as 'a building with two or more residences that share corridors and stairs, or a building with two or more residences built on top of each other'. Furthermore, 'a building with a shop on the first floor and two or more residences on the second floor or above' is also considered a 'communal building') is increasing throughout Japan; census results from 2000 to 2020 show that communal complexes have become the predominant form of housing, especially in urban areas (according to the 2020 Japanese census, of the total 54,953,523 households in the country (general households living in houses), 29,561,373 (53.8%) are detached houses, and 24,493,087 (44.6%) are communal buildings. This percentage has been consistently increasing since 2000, with detached houses increasing by 2.9% and communal buildings increasing by 11.1% between 2020 and 2000. This growth indicates that the proportion of households living in communal buildings is expanding. The proportion of 'detached houses' and 'communals' among general households living in their own homes is high in large cities, such as Tokyo (41.4%), Kanagawa Prefecture (32.6%), and Osaka Prefecture (28.5%)). Furthermore, the proportion of households in 'owner-occupied and condominium-type' (the Japanese census defines condominiums as follows: Owned home: A home in which the household head lives is owned. Apartment: A building with two or more homes that share corridors and stairs or two or more homes built on top of each other. Someone may own a home; however, it does not necessarily mean condominium ownership. Strictly speaking, this definition of a condominium differs from that given in Article 2, Paragraph 1 of the Act on Facilitating the Reconstruction of Condominiums and Article 2, Paragraph 1 of the Act on Promotion of Proper Condominium Management (Property Improvement Act) (i.e., a

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building with two or more condominium owners, and ii. a unit with exclusive areas used for residential purposes), communal buildings in densely inhabited districts (DIDs) is increasing (the proportion of communal buildings as a form of housing in DID is increasing; among them, the proportion of households living in condominiums is growing. The results of the 2020 census show that the proportion of households living in condominiums is 70.3% in large cities such as Tokyo). Moreover, with the declining birthrate and an aging population, Japanese cities are undergoing structural reforms to become more compact. In such cities, the expansion will be curbed by concentrating urban functions in the city centre (especially in areas centred on transportation hubs), and residential functions will be guided to the surrounding areas. This approach aims to ensure the sustainability of cities even in a society where the population and number of households decline. Specifically, Japan's Urban Renewal Special Measures Act was revised in August 2014, allowing local governments to create 'location normalization plans (LNPs)'. As a result, measures to make cities more compact are being implemented over a relatively long period.

As these policies are implemented, condominiums will be essential in providing appropriate locations for residential functions. Furthermore, ensuring the sustainability of condominiums is expected to become even more critical for urban local communities; therefore, understanding the location characteristics of condominiums that contribute to maintaining and promoting a sustainable urban society is essential for providing accurate guidance on the locations required. In cities of a specific size or larger, guiding the location of condominiums based on LNPs and taking planned measures to encourage the concentration of residential areas in the city centre can effectively make cities more compact.

Among cases where LNPs have been formulated, this study focuses on Sapporo City, which is implementing 'collective residential induced areas'. This study aims to clarify how the location of condominiums contributes to cities' compactification.

The remainder of this paper is structured as follows. Section 2 presents the methodology, Section 3 describes the analysis results and discussion, and Section 4 presents the conclusions of this study. Furthermore, this study is limited by its analysis being conducted only from the perspective of condominium location. It only sheds light on one aspect of urban compactness.

Previous studies on condominium location and urban structure examine theories on the location of condominiums in cities, the actual situation regarding the location of condominiums, the characteristics of condominium residents, and the trends of developers who supply condominiums.

Research since the revised Urban Renewal Special Act implemented in 2014 includes the following four studies. Ohashi [1] investigated the residential structure of Japan's regional cities that contribute to essential information for compact city policies. This study analyses the characteristics of condominiums, which serve as housing destinations in terms of location, age, and resident attributes, uncovering the mechanisms of 'urbanization'. Takagi [2] focused on contrasting two periods. The first was around 1970, when large-scale development of housing complexes emerged as a significant social issue in Japan. The second was from 2000 onward, when housing complexes began to deteriorate, and the population aged. This study analysed communal complexes during high economic growth, particularly in Machida City, showing how public housing construction entities, such as the Japan Housing Corporation (later UR) and the Tokyo Metropolitan Housing Supply Corporation (JHK Tokyo), built communal complexes and how Machida City became a residential city through the accumulation of these complexes. Ohashi et al. [3] measured the characteristics of LNPs and their impact on urban space using a land price function. They clarified the land price function differences caused by each city's planning characteristics and differences. Nakano [4] analysed the urban centre of Saitama City, a suburb of the Tokyo metropolitan

area in Japan, focusing on super high-rise communal buildings. The study provides some insight into location conditions and the impact of location on surrounding areas.

In contrast, two articles deal with research on LNPs. First, Tanjo [5] analysed the status and characteristics of the formulation of LNPs. The report examined 66 municipalities that had formulated LNPs by August 2017, providing insight into compact city policies and LNPs. These insights included how current owners and new buyers of housing and other properties will act in the wake of population decline and what mechanisms will work to shape urban areas. Based on the results of the 2020 census, Tada and Touma [6] provided insights from the perspective of improving urban sustainability by analysing the relation between population indicators, such as population growth rate and population movement, and urban and housing elements on a municipal level for municipalities with DIDs. Their study considers that policies that increase resident inflow, sustain a high population density, maintain and improve the convenience of living, increase public transport convenience, and prevent an increase in vacancy rates could increase cities' sustainability. Their study examines their idea from the perspective of condominium location. Finally, Inagaki [7] discussed the background, history, and prospects of Sapporo City's LNP from the perspective of the person in charge of formulating the plan.

Considering the above, this research will supplement the existing research in the following points:

1. This study focuses on the locations of condominiums, which are thought to affect urban residences significantly.
2. This study examines Sapporo City, Japan's only city with 'collective residential induced areas' defined in its LNP.
3. This study covers the scale of Sapporo City's urbanized areas into the 'collective residential induced areas'.

2 METHODOLOGY

2.1 Data collection

This study aims to understand the impact of condominiums' location in 'collective residential induced areas' on urban compactness. Therefore, we obtained data on all condominiums built in Sapporo City and for which condominium ownership is being sold (those built between 1964 and 2022, including their location information, year of construction, number of units, and number of floors) from a private real estate sales information database (we used the database operated and published by Renewal Brokerage Co., Ltd. (CEO: Nishio Ken, address: 38F Shinjuku Center Building, 1-25-1 Nishi-Shinjuku, Shinjuku-ku, Tokyo) to collect details on all condominiums in Sapporo City (those with condominium ownership that are the subject of sale and purchase and those built between January 1964 and December 2022 that still exist). We visited the Sapporo City Urban Affairs Bureau Building Guidance Department on January 10, 2024, and March 4 and 5 of the same year and supplemented this by viewing the architectural plan outlines. We confirmed that all condominiums are within urbanized areas, and none are outside of urbanized areas.). Consequently, data was collected on 3,950 cases (buildings) and 221,515 units.

2.2 Subjects and methods of analysis

The author used the acquired data to analyse the number of units and floors by construction year, dividing them into those inside and outside the 'collective residential induced area'.



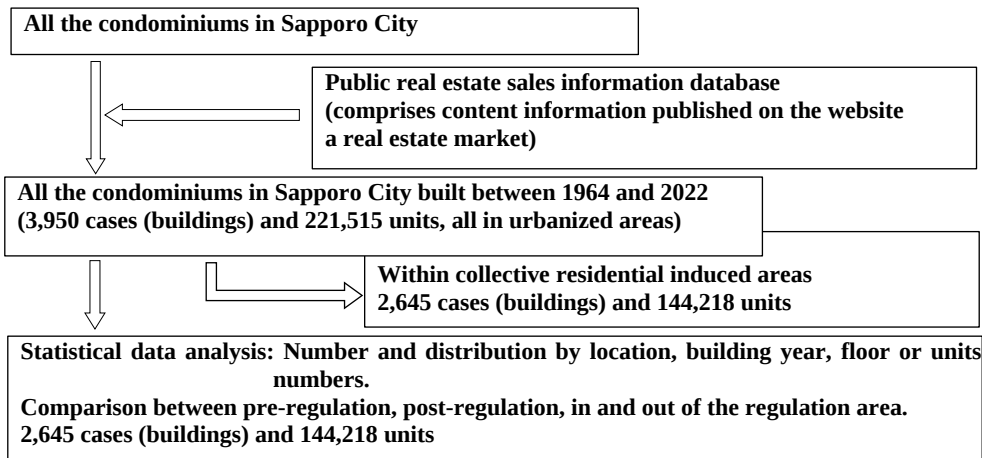


Figure 1: Data flow chart describing the methodological steps.

The author then created a heat map using kernel density estimation to visualize the distribution.

Sapporo City's LNP was established following the classification of the Second Urban Planning Master Plan, which was established in 2016. In other words, the same area as the mass mixed-use intensive urban area is designated as the 'collective residential induction area'. Sapporo City implemented the LNP in March 2016; no 'collective residential induced areas' existed before this.

This study will clarify at what point (from the past to present), where, and how many floors and units of condominiums were built in designated 'collective residential induced areas'. The analysis will be divided into two periods: up to 2015 and from 2016 onward.

3 FINDINGS AND DISCUSSION

3.1 Overview of Sapporo City's location and LNP

Sapporo City is the largest city in Hokkaido in the northern part of the Japanese archipelago (Fig. 2). The city measures approximately 42.30 km east to west and 45.40 km north to south, with a total area of 1,121.26 km². Sapporo City stretches from 140° to 141° east longitude and 42° to 43° north latitude. Other cities at the same latitude include Marseille, France, and Rome, Italy.

Sapporo has grown as a base for development since establishing the Hokkaido Development Commission office in 1868. Fig. 3 shows the trends in population and number of households from 1960 to 2023. As of 1 October 2023, the projected population was 1,958,000, and the number of households was estimated at 1,104,000. The population and number of households from 2024 onward are future estimates published by Sapporo. As of 2040, the population will be 1,851,000, 94.5% of the 2023 level, and the number of households will be 978,000, 87.6% of the same level. The city's population density will be 1,746/ km² in 2023 and 1,746/km² in 2040. The population is estimated to decline, falling to 1,589,000 by 2060, or 81.2% of the 2023 level. Sapporo's efforts to compact the city consider these population and household decline trends.



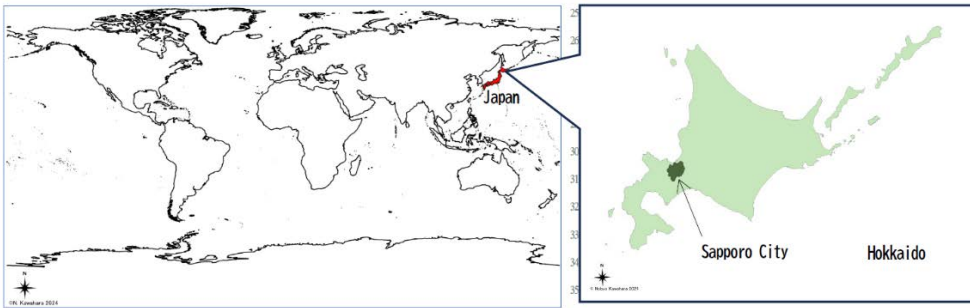


Figure 2: Location of Sapporo City.

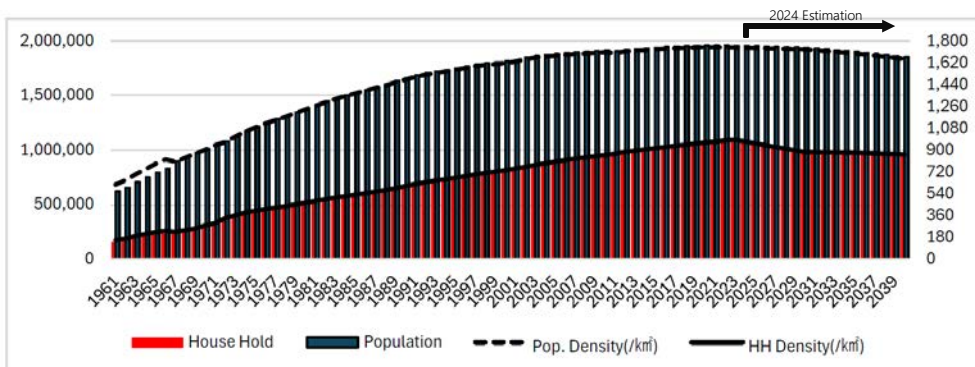


Figure 3: Population and households of Sapporo City (actual and estimated).

Sapporo City's LNP is designed for urbanized areas (Fig. 4). Of this area, 'collective residential induced areas', which are urban residentially induced areas, comprise 5,831 hectares (approximately 10% of urban planning areas and 23% of urbanized areas). Within that area, 1,010 hectares have been designated as urban function-induced areas, of which 480 are 'city centres' and 530 are 'regional exchange hubs'. Furthermore, the outskirts of urbanized areas are positioned as 'areas for the formation of sustainable residential environments'.

3.2 Distribution of all condominiums

The oldest condominium in Sapporo (those still in existence and for sale) was built in 1964. Following 1964, the number of constructions increased yearly, with condominium construction peaking in the late 1990s. Fig. 5 presents a distribution map of all condominiums located within urbanized areas. Of these, 2,645 are in 'collective residential induced areas'.

3.3 Number and distribution by building year

Fig. 5 also shows the number and distribution of condominiums by year of construction. The 152 condominiums constructed after 2016 (when the LNP was formulated) are shown in red squares. Of these, 142 (93.4%) are in 'collective residential induced areas'.



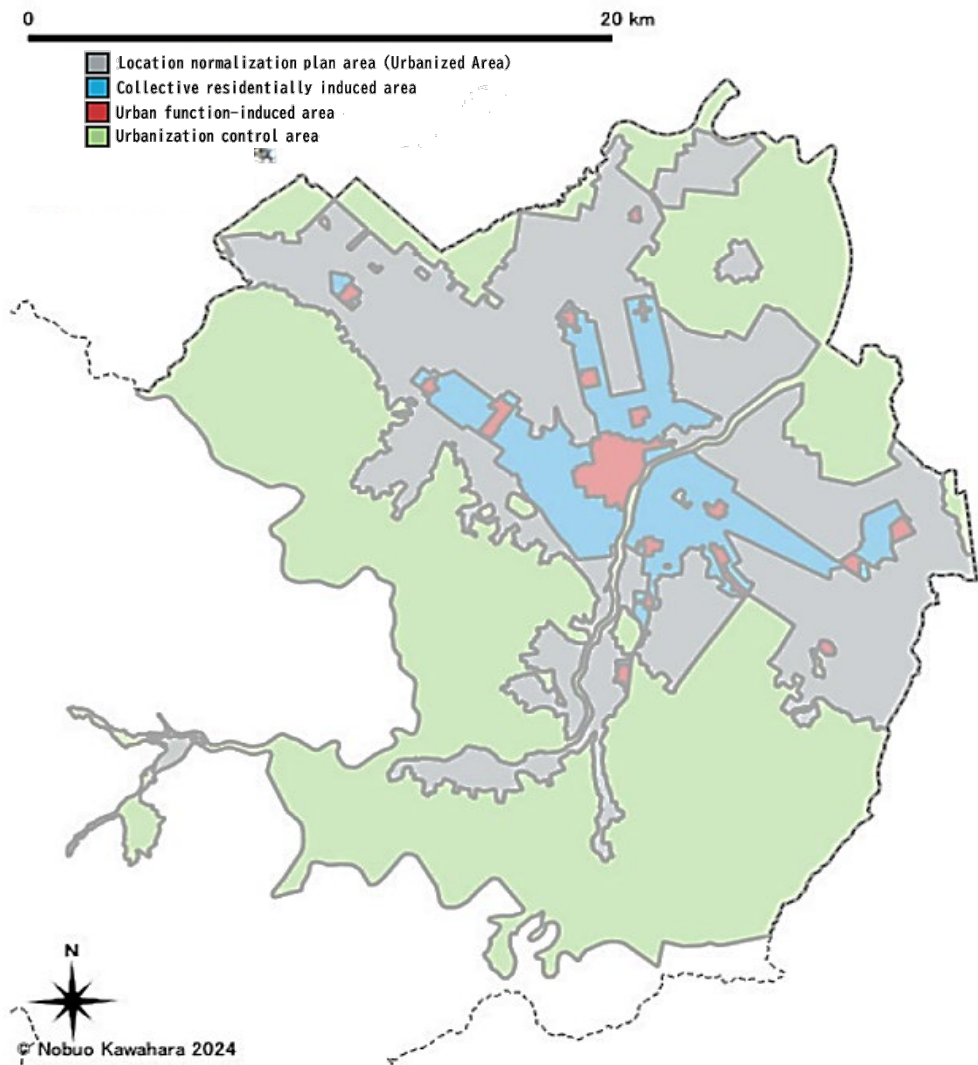


Figure 4: Sapporo City's LNP scope and promotion zone classification.

3.4 Number and distribution by floor

Fig. 6 shows the condominiums by number of floors in Sapporo City. The minimum is two floors, the maximum is 41 floors, the median is 10, and the third quartile is 11 floors. These numbers indicate that 75% of buildings have 11 floors or less. There are three main groups: floors 2–7, 8–13, and 14 and 15. Some condominiums have more than 15 floors; however, they are a minority and do not significantly impact residential concentration in the city.

Fig. 7 shows the number of buildings constructed by number of floors since 2016 in the 'collective residential induced areas'. The minimum is four floors, the maximum is 31 floors,



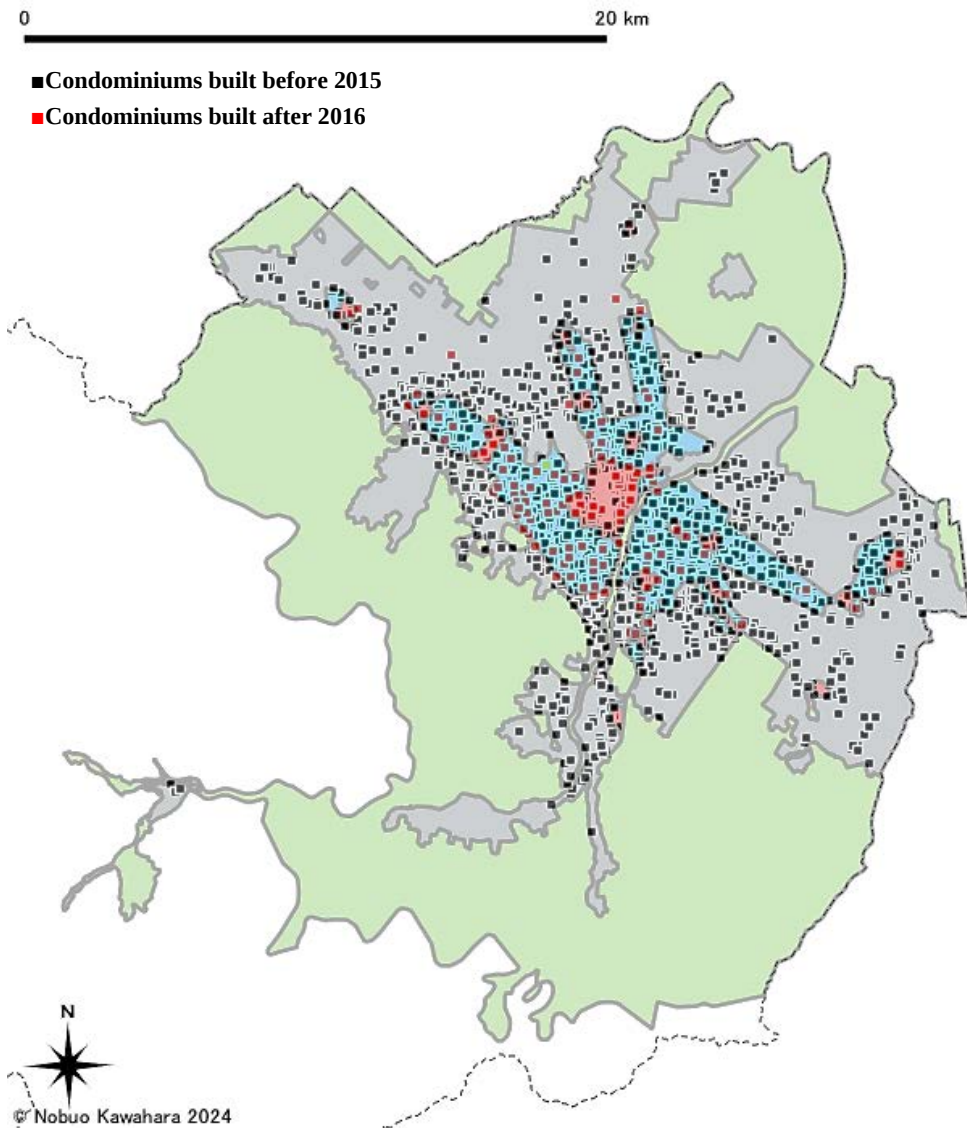


Figure 5: Distribution of all condominiums in Sapporo City.

the median is 13, and the third quartile is 15; 75% of buildings have 15 floors or less. In 'collective residential induced areas', buildings tend to have more floors after formulating LNPs.

3.5 Distribution by number of units

Fig. 8 presents a distribution of the number of condominium units in Sapporo. The minimum is four units, the maximum is 1,040 units, the median is 42, and the third quartile is 67. These numbers indicate that condominiums with 67 units or less account for 75% of the total.



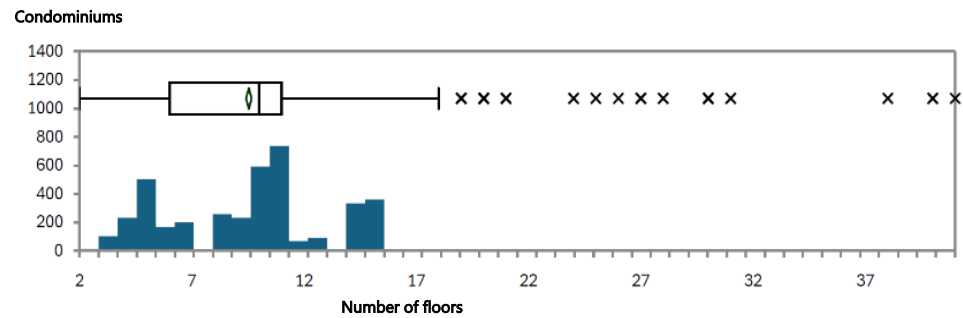


Figure 6: Distribution of all condominiums in Sapporo City by number of floors.

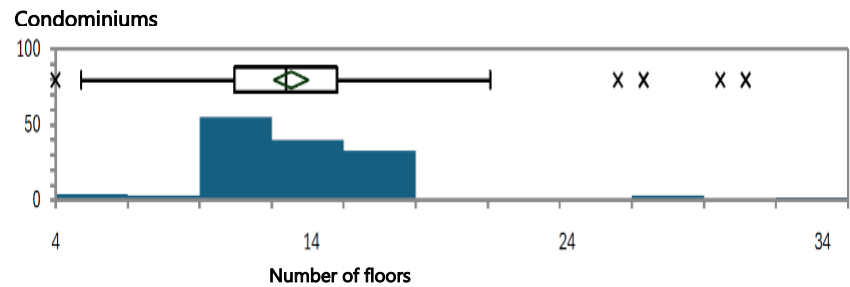


Figure 7: Distribution of cases by the number of floors within 'collective residential induced areas'.

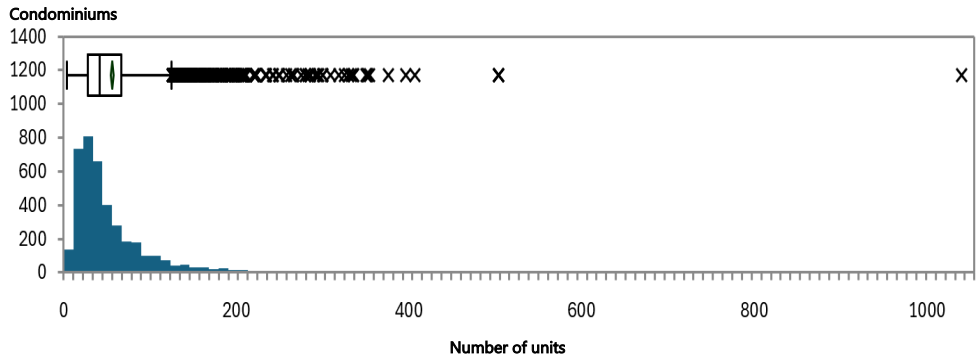


Figure 8: Distribution of all condominiums in Sapporo City by number of units.

Fig. 9 shows the results for the 142 properties constructed since 2016 in 'collective residential induced areas'. The minimum is 15 units, the maximum is 407, the median is 53, and the third quartile is 72. Condominiums with less than 72 units comprise 75% of the total. In 'collective residential induced areas' where LNPs have been formulated, the number of housing units tends to increase.



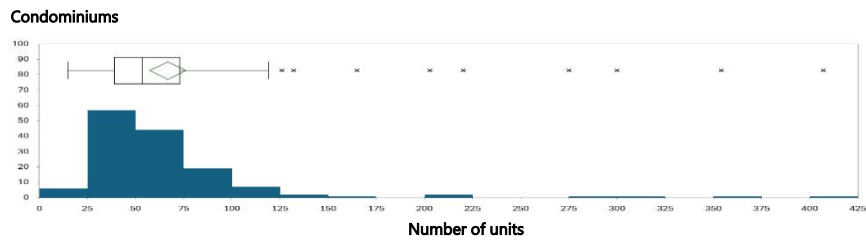


Figure 9: Distribution of condominiums by number of units in 'collective residential induced areas'.

The number of units was weighted, and heat map contours based on kernel density estimation were displayed to visualize the characteristics of the distribution of condominiums in 'collective residential induced areas'. Fig. 10 presents an enlarged view of areas with high-density distribution within the 'collective residential induced areas'. The densest area is

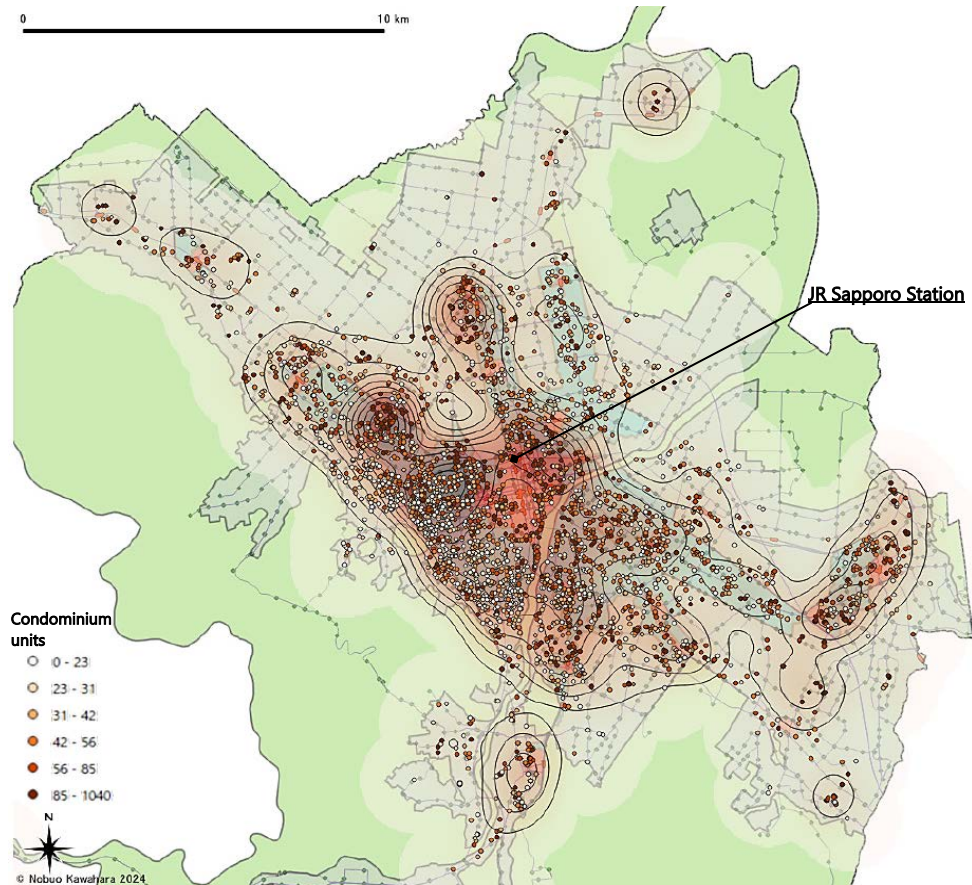


Figure 10: Heat map of condominiums in 'collective residential induced areas' (weighted by number of units).



located southwest of JR Sapporo Station, around Maruyama Koen Station. In contrast, the area around the south exit of JR Sapporo Station is home to a concentration of urban functions; however, the concentration of residential functions (condominium unit density) is low.

3.6 Correlation between number of floors and number of units

Fig. 11 presents the correlation between the number of floors and units for all condominiums in Sapporo City (magenta: within ‘collective residential induced areas’ and constructed after May 2016; orange: within ‘collective residential induced areas’ and constructed before 2015; blue: outside ‘collective residential induced areas’).

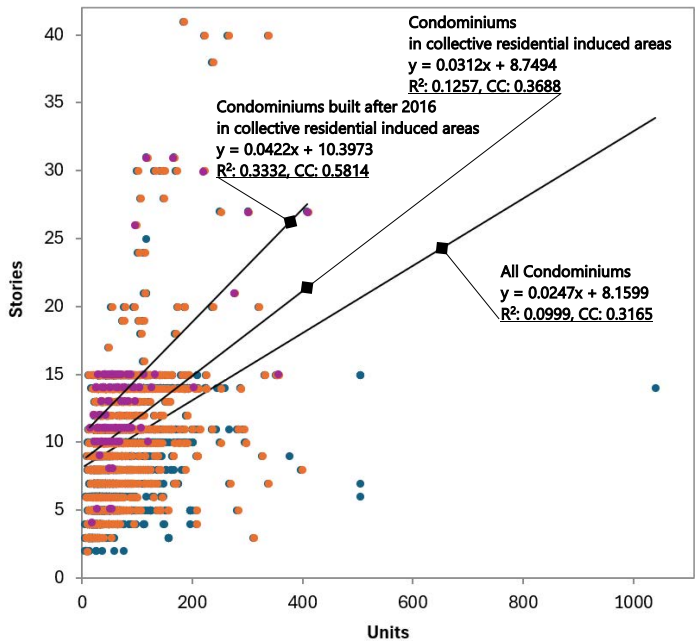


Figure 11: Correlation between number of floors and number of units.

The correlation coefficient shows that the value for those built-in ‘collective residential induced areas’ after 2016 is 0.5814, indicating a strong positive correlation. In contrast, the correlation coefficient between the number of floors and units for all condominiums within the ‘collective residential induced area’ is low (0.3688). Therefore, after formulating the LNP, a higher number of floors in condominiums in ‘collective residential induced areas’ indicates more units. Additionally, three-dimensional, high-rise condominiums are being constructed more than those with flat expanse layouts.

3.7 Discussions

This study examines the situation (effects) of condominium concentration in Sapporo, where condominium construction is systematically induced in the city centre through legal planning.

Sapporo is unique in that it systematically guides the construction of high-rise apartment buildings, including condominiums, in specific city centre areas.

Rosen and Walks [8] reveal how 'condominiumism' is characterizing significant changes in the urban environment in Toronto and Vancouver. Since private investment dominates condominiumism, it is particularly suited to the social situation of austerity measures by local governments. The population is expected to decline, and the city's finances will become tight; therefore, this point could contribute to the city's financial stability by reducing the number of condominiums. Although outside the scope of this study, condominium construction in Sapporo could potentially contribute to the city's financial stability – one of the effects predicted in Toronto and Vancouver.

Furthermore, Rosen and Walks [9] use a case study of Toronto, showing that urban intensive use, centred on condominiums, is transforming the physical and social landscape, thus redirecting investment patterns in the form of capital and people to the most accessible urban nodes. In this process, the relationship between the city and the suburbs and their everyday meanings is reshaped. They reveal that condominium construction enhanced the city centre's primacy, transforming the old CBD into a diverse and mixed residential space; however, such construction draws development and capital away from the older suburbs where workers live. This situation exacerbates the polarization of social classes by creating a class divide between high-end condominiums in the city centre and suburban low-cost condominiums. Furthermore, in Sapporo, a divide may occur between areas favoured by high-income earners and those not; however, unlike the rapid condominium construction in Toronto, Sapporo is experiencing a gradual accumulation.

Harris [10] investigated the phenomenon of condominiums being concentrated in some regions of downtown Vancouver, indicating that condominiums will persist in the long run because they increase the density of private interests in the land. Moreover, he suggested that the concentrated location of condominiums was a central part of downtown Vancouver's dramatic restructuring. Furthermore, the opportunity to own a condominium lot led residents and investors to move to Vancouver, leading to a population recovery. Although a population decline is predicted for Sapporo, the condominiums' location may attract people to the city.

4 CONCLUSION

Our findings show that the location of condominiums in Sapporo contributes to the city's compactness, and many condominiums are already in 'collective residential induced areas'. Their concentration is expected to continue to increase by promoting LNPs. Additionally, condominiums are not evenly distributed throughout the 'collective residential induced areas' but are concentrated in certain areas. In this study, the density of household distribution was visualized on a map, making the trend more precise; however, we did not clarify the reasons or background for this concentration. This information is necessary for stakeholders to guide the location of condominiums within 'collective residential induced areas', thus further analysis is needed.

The study suggests that local city planning authorities need to take further measures, such as installing a district-detailed plan to control more precise or detailed liveable urban areas. Additional measures include promoting collective housing within the designated area and comprehensively considering connectedness among those urban areas, as Harris suggested [10]. As Tang [11] theoretically proved, condominiums are located near urban functions, including transportation hubs; thus, it is natural that the location of condominiums is controlled not only by the road network but also by the accessibility to the public transportation system like well urbanized Kyoto City. Also, developers or investors shall be keen to promote condominium life in well urbanized cities.



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