Development of technology for analysis and evaluation of urban structures based on diversifying daily support functions (Study period: FY 2017–2019)

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1. Background and objective of study

Cities are facing rapid changes associated with depopulation and the super-aging of society while the administrations are being limited by tight budgets. Thus, it is an urgent issue for Japan to improve the sustainability and productivity of cities. To promote the shift of cities to an integrated city structure (compact city) that will improve sustainability and productivity, the Act on Special Measures concerning Urban Reconstruction revised in May 2014 stipulated the specification of urban function induction areas and residence induction areas to introduce a location optimization planning system to facilitate urban integration. Systems and frameworks are thus being reinforced to accelerate the development of compact cities.

Cities around Japan that are in need of becoming compact cities exhibit various urban and regional characteristics associated with different population sizes, urban development processes, and other backgrounds. Thus, the direction of compact city development also comes with variations depending on the characteristics. It is therefore necessary to examine the evaluation methods that enable the selection of a proper urban structure based on the characteristics of individual cities and the distribution of essential facilities that provide the necessary daily support functions.

2. Densely inhabited district (DID) data analysis

The relationship between a densely inhabited district (DID) and population density etc. was analyzed using data from 2005 to 2015 to quantitatively identify actual conditions of compact city development. In the section below, an increase by 5% or more is described as an "increase," a change within ±5% is "unchanged," and a decrease by 5% or more is a "decrease."
- Among all 912 cities, 241 (26.4%) of them exhibited an increase in DID areas, while 582 cities (63.8%) remained unchanged, and 89 cities (9.8%) decreased.
- Among cities where DID areas increased, DID population density increased in 33 cities, remained unchanged in 142 cities, and decreased in 66 cities (Figure 1). It is highly likely that urban sprawl and "sponge" city formation are occurring in cities where the DID area

increased and the DID population density decreased.
- Among cities where the DID area decreased, the DID population density increased in 14 cities, remained unchanged in 30 cities, and decreased in 45 cities (Figure 2). In cities where the DID area decreased and the DID population density increased, it is considered that the population is becoming denser, and urban structures are becoming more integrated.
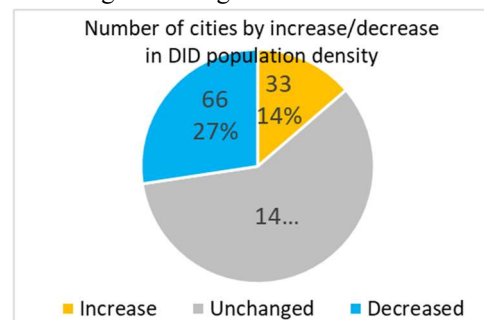

Figure 1: (Increased DID area) Number of cities by increase/decrease of DID population density
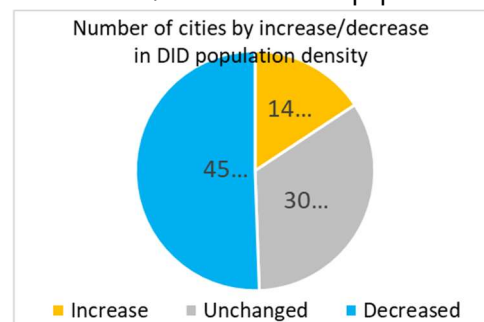

Figure 2: (Decreased DID area) Number of cities by increase/decrease of DID population density

3. Investigation of factors for selecting an area to live

To identify factors that form urban structures, a questionnaire was conducted with people who were

considering relocation to find out their residential conditions, factors for selecting an area to live, and other aspects. The outline of the survey was as follows.

<Outline of questionnaire survey>
    Subject: Householders or the spouse of a householder
         in Fuchu City, Tokyo, and Kanazawa City,
         Ishikawa
    Survey method: Web survey
    Number of responses: 500 each from Fuchu City and Kanazawa City
    Survey period: January to February 2019

The result of the survey in Kanazawa City indicated that 47.6% selected Area 1 - a central area of a region - as a desirable place to move to when there was no restriction (Figure 3). Compared to areas of current residence (Figure 4), the ratio was nearly three times the current conditions. High land and housing prices were the greatest factor in preventing residents from living in areas they liked (Figure 5), followed by inconvenience of the commute and shopping conditions. This finding indicated that many people wanted to live in a central area, but high real estate prices were preventing them from doing so.

The survey also asked whether they knew about the compact city policy. Those who responded that they knew about it accounted for 16.8%, and 55.6% of them responded they "did not know about it at all," indicating the low recognition of the compact city policy.

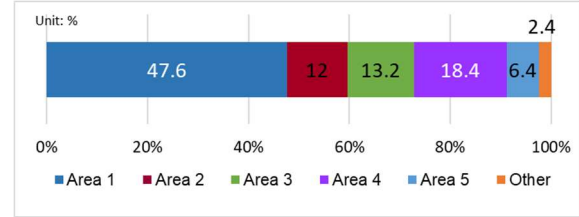4. Organization of urban structure evaluation indexes

Figure-3 Where to move to when there is no restriction in selecting an area to live
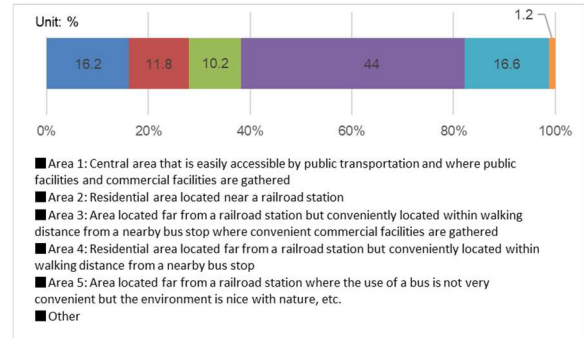

Figure 4: Current locations of residence

Twenty-five studies were reviewed to organize indexes used in the current urban structure evaluations. As a result, indexes were categorized as follows: i) indexes (such as DID) that used population density within an area larger than a certain size; ii) indexes indicating accessibility to urban functions and hub-like functions of transportation facilities (i.e. population coverage from a certain distance from a facility); iii) indexes indicating the convenience of daily support facilities (i.e. population coverage by such facilities); and iv) indexes that considered the shapes of cities (e.g., standard distance, indicating the distribution of densely populated areas).

5. Future activities

Simple and concise urban structure evaluation methods are being developed, and their practicalities are now being examined.
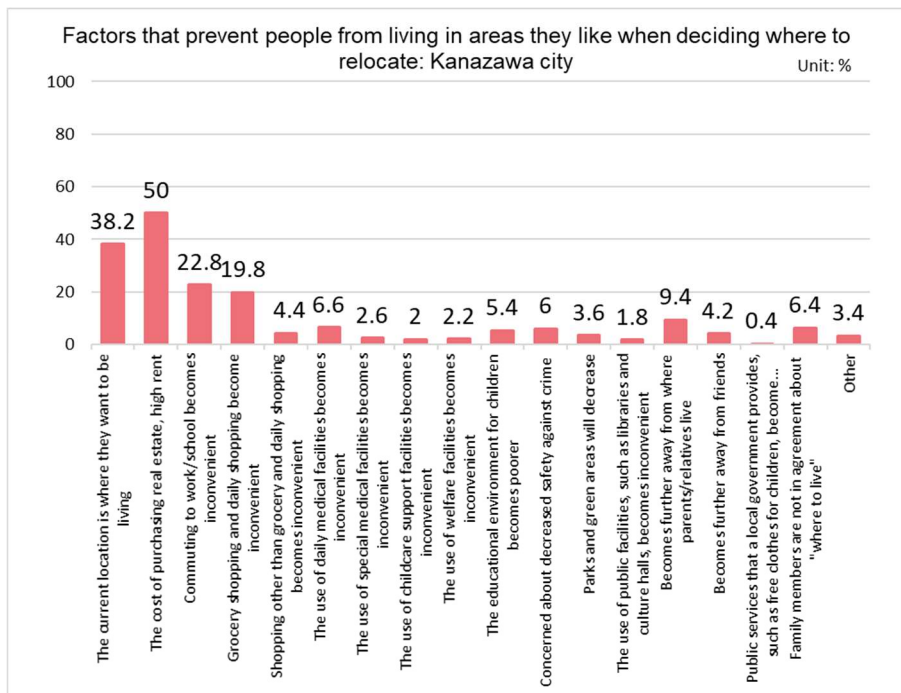

Figure 5: Factors that prevent people from living in areas they like