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Study on the factors to transform underused land focusing on the influence of railway stations in central areas of Japanese Local cities

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ABSTRACT

The recent increase in underused land, such as outdoor parking lots and vacant areas, is a serious problem that has led to the decline of central areas in Japanese local cities. To develop these land lots, the distribution of underused land as well as factors to transform these areas must be analyzed. However, the secular changes in underused land are not understood quantitatively, and transformation factors have not been analyzed from the viewpoint of underused lot types.

In this study, we constructed a database of underused land using housing maps on GIS. Then we analyzed the relationship between the changes in underused land areas and commercial activity in the central areas of 37 core cities. Finally transformation factors from underused land to business-use and residential land were evaluated with an emphasis on the influence of the proximity to a railway station.

Between 1985 and 2005, the results show that small areas of underused land have decreased in central areas, but there is a net increase of underused land. Additionally, commercial activity and population have declined in central areas compared to national trends and the average of core cities. Analyses of transformation factors reveal that outdoor parking lots negatively impact the transformation, but the combination of constructing of railway stations close to central areas and adopting land-use zoning for business-use and residential land have a positive affect on the transformation of underused land.

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Introduction

Back ground

Currently, low-use and unused land lots, such as outdoor parking lots, material storing sites, vacant houses, and vacant areas, have increased due to suburbanization of urban functions in Japanese local cities. The increase in these areas, which are called underused land, is related to decreases in business-use and residential land, as well as the decline of central areas. Therefore, developing underused land is underscored in several cities of whole world (Adams et al., 2010). To develop underused land, it is necessary to understand the distribution and previous uses of underused land lots. To combat this problem, some municipalities have surveyed the use of underused land, but the data of underused land are not available in city level in Japan (Dixon et al., 2011).

Ideally, underused land would be assessed on a nationwide scale. Additionally, comparisons between local cities are necessary to clarify the transformation of underused land in central areas.

Review of literature on understanding of Japanese underused lands

Current investigations of underused land in Japanese cities have some issues. For instance, investigation items, such as area, number, and location of underused land lots are different in each city, and almost all investigations focus on one time period. Generally, studies on underused land focus primarily on outdoor parking lots. Many studies have investigated the state of outdoor parking lots in Japanese and foreign cities. Some studies, such as Lee et al. (1998) and Ikawa and Higuchi (2002), have researched not only outdoor parking lots, but also unused land lots in a Japanese city. However, almost of these studies were limited by study area.

A comprehensive city-to-city comparison has yet to be analyzed. A few studies have investigated outdoor parking lots between cities; Abe et al. (2011a) studied lots in 37 Japanese local cities, Mitsuda et al. (2009) studied 20 Japanese cities, and Davis et al. (2010b) studied 35 areas in the Upper Great Lakes Basin in the United States. Although these studies focused on changes in

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outdoor parking lots in multiple cities, they did not evaluate the changes over time.

Table 1 shows the investigations of underused land in previous studies. Most quantitative studies focused on one city or area, and studies with multiple cities were simply collective analyses. Thus, previous research has not focused on the changes in underused land.

An increase in underused land causes some well-known problems. For instance, the increase of underused land affects commercial activity in the central area because business-use land has been transformed into underused land. Past studies, which examined the relationship between business activity and underused land, focused on the development of parking lots. Motorization and suburbanization occurred in the 1980s, and the demand for parking lots soared. Back then, it was speculated that parking facilities were necessary to regenerate central areas (Ligocki and Zonn, 1984). Of course, outdoor parking lots have positive effect for central area by satisfying parking demands, especially in case of cities where urban public transportation play only a minor role. In other cases, outdoor parking lots supply is believed to be a pre-requisite to solving on-street parking problems in commercial streets (Barter, 2012), in addition, increase of parking capacity have positive impact for increase of riderships on railway stations (Merriman, 1998). However, some studies claimed commercial activity and parking lots have been negatively associated. Several studies have employed simulation models to investigate the impact of parking lots; Nakamura et al. (2004) clarified that there is not a commercial accumulation in the case of a policy to promote parking lots. On the other hand, in a study with quantitative data of land use, Oba et al. (2008a) compared the changes in outdoor parking lots and the total yearly retail sales in seven Japanese core cities in 1985 and 2005. Although many studies have analyzed the relationship between underused land and city characteristics, such as commercial activity, to our knowledge, a study to analyze the factors to transform underused land based on quantitative data and the relationship between the characteristics of multiple cities has yet to be performed.

To develop underused land and the appropriate policy for land use and transportation, the factors to transformation underused land must be analyzed. Although land use will change according to the intent of the landowners, it is extremely difficult to understand landowners' intent on a national scale. Therefore, a quantitative study, which focuses on multiple cities, is needed to clarify the general factors for land use changes and to discuss the development of underused land lots.

Previous studies on factors of underused land and focusing on the impact of railway station

Previously, factor analysis of land use changes in underused land has been based on a questionnaire investigation (Chujo and Higuchi, 2002). Some studies clarified transformation factors based on quantitative analysis; Yokobori et al. (2006) analyzed the relationship between transformation from underused land and the conditions of the surrounding land. Abe et al. (2012) showed the factors of transformation from underused land to residential land focusing on the changes in population in central area.

Additionally, aggregation of population and commercial activity, which are referred to as a compact city, are important for the central area in a local city because a local city has a low population density and declining commercial activity. Matsunaka et al. (2012), Nagao et al. (2009) and Oba et al. (2008b) reported that stations which have high frequency positively affect the increase in the population living in close proximity of the station. When thinking about the development of central areas, it is also important to consider the influence of transportation on the policy for the redevelopment of underused land. For instance, Matsunaka et al. (2007) found that after construction of a Light Rail Transit (LRT), a vacant building was transformed into many shops. Additionally, Ishikawa and Tsutsumi (2006) reported the downward trend of vacant lands on the area close to LRT stations. Furthermore, Dabinett et al. (1999) reported a positive change in unused houses and land after building public transport in Sheffield. Although public transportation is essential in the development of underused land, few studies have analyzed the influence of public transportation on the transformation of underused land. In recent years, role of railway stations in central area which is called Transit Oriented Development (TOD) is notable for land use policies, but there is a lack of precedent of focusing the difference of the location situation of station in central area on the factors of transformation from underused land depending.

Purpose

In this study, we built a database of underused land using housing maps on GIS in order to understand the land use changes in the central areas of 37 Japanese core local cities in October 2005. We also created databases using data from 1985 and 1995 to assess the land use changes cover time in a particular area. The main purpose of this study is following three.

- To understand the current situation of socioeconomic condition and transformation of underused lands in central area of Japanese local cities
- To estimate the factors of transformation from underused land to business-use and residential land
- To clarify differences of factors on the cities which is classified based on the coverage of railway stations

For these purposes, we analyzed the relationship between the changes in underused land and urban characteristics, which included commercial activity and population change. Then we estimated the factors of transformation from underused land to business-use and residential land in central area by each lot type. Finally, we focused on the influence of location situation of railway stations in central areas, and quantitatively clarified the transformation factors from underuse land.

Database

Time period and study area

In this study, we defined local cities as those with over 300,000 residents as of October 2005, excluding several large cities. Fig. 1 shows the selected 37 Japanese core cities. We focused on the central area because the increase in underused land is serious problem in this area (Abe et al., 2011a,b). The central area is defined as a circle with a 500-m radius where the center is the highest official land price in 2005. Targeting isometric areas allows a city-to-city comparison on a nationwide scale. To analyze the distributional change in underused land, we built an underused land database using data from 1985, 1995, and 2005. 2005 was designated as the present land use condition, while 1985 was considered the period of underused land due to suburbanization of commercial function. The 1995 distribution of underused land occurred at the end of the bubble economy in Japan, which had a moth-eaten appearance, and was a crucial period in the increase of underused land in Japanese central areas.

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