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A Study on the Impact of Home Occupant Characteristics on Housing Renewal and Improvement in Management-type Residential Environment Improvement Project Areas in Seoul

: Focusing on the Moderating Effect of Home Occupancy Status

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Abstract

Housing improvement in Korea has typically involved the total demolition and redevelopment of apartment complexes. This study examines the hypothesis that a homeowner's occupancy status moderates the impact of homeowner characteristics on housing improvement. Management-type Residential Environment Improvement Project zones in Seoul, designed to encourage housing renewal and improvements within low-rise housing areas, were selected as the case study areas. Recently, challenges with this approach and the need for alternatives have emerged, although studies on low-rise housing renewal are limited. To verify the hypothesis, a t-test and a chi-square test were initially conducted to gain a comprehensive understanding of the fundamental characteristics of the housing renewal, improvement, and homeowners. A multinomial logistic regression analysis was performed using housing renewal and improvement type as the dependent variable, homeowner characteristics as the main explanatory variable, and occupancy status (owner-occupied versus non-owner occupied) as the moderating variable. The findings indicate that the age of the homeowner negatively influences the choice of new construction, and the duration of occupancy negatively affects smaller-scale improvements such as extensions and renovations. Additionally, non-owner-occupied homeowners respond more sensitively to the likelihood of opting for new construction compared to undertaking smaller-scale improvements. These results suggest that housing renewal and improvement policies should consider the diverse characteristics of homeowners to effectively stimulate housing enhancements.

Keywords Housing Renewal and Improvement, Homeowner, Occupancy Status, Moderating Effect, Management-Type Residential Environment Improvement Project

주제어 주택정비·개량, 주택 소유자, 실거주 여부, 조절효과, 관리형 주거환경개선사업

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Ⅰ. Introduction

1. Research background and purposes

The rapid and significant economic development in Korea during the late 20th century coincided with radical transitions in the country's housing supply strategies and policies. Specifically, in the 1960s, a series of land readjustment schemes reshaped the country's housing landscape, transitioning from naturally developed housing to a more planned and organized urban approach. This resulted in the formation of residential areas primarily comprised of detached houses (Ha, 2010; La Grange and Jung, 2004). A rising population within cities, coupled with increased density in detached residential areas, led to the widespread construction of illegal buildings and structures, such as unauthorized rooftop houses (Kim and Kwon, 2020). In response to the increasing population influx into the Seoul Metropolitan Area, housing development shifted its focus to apartment complexes in the 1970s (Green et al., 1994; Thomas and Hwang, 2003).

Furthermore, the execution of housing redevelopment projects as part of national policies since the 1980s, along with the emergence of various new housing types, such as multifamily houses and multi-unit houses (Jang and Kwon, 2017; Kim et al., 2005), resulted in a continuous decrease in detached dwelling residential areas. As a result, as of 2019, detached dwellings accounted for 23.6% of Seoul's entire residential areas (Lee and Nam, 2020).

Meanwhile, low-rise residential areas are often identified as land suitable for potential development, aimed at supplying mass housing for urban residents, due to their low population density and affordable costs. Consequently, these areas are prone to high levels of development pressure (Kim, 2021). However, low-rise houses hold significant importance as affordable housing options while also contributing to diversity in housing types (Hong and Ahn, 2013). Therefore, it is essential to devise effective plans and policies to proactively organize and manage them. Many local governments have thus far made efforts, such as management-type residential environment improvement projects, reshaping the paradigm of urban planning for aged low-rise residential areas from complete redevelopment to regeneration and small-scale development. The gradual execution of residential environment improvements, following this paradigm shift in urban planning, requires a primary focus on improving individual housing units rather than pursuing redevelopment schemes at the complex level.

Here, housing improvement refers to any specific actions undertaken to repair and enhance dwellings, aimed at addressing their physical deterioration over time.

While homeowners can control the pace of physical deterioration for their houses by investing in housing repair and maintenance individually, the costs required to maintain housing quality and services continue to increase as the houses age (O'Sullivan, 2004). Thus, homeowners choose housing improvement methods in a way that maximizes the benefit at the moment when the marginal cost becomes equivalent to the marginal benefit of housing improvement. In Korea, housing improvement encompasses any services required to be reported under the Building Act for detached houses, including new constructions, extensions, and major repairs, as well as those that do not require any legal procedures.

On the domestic front, management-type residential environment improvement projects[1)], which were first introduced in 2012, have been supplemented by subsequent R&D initiatives and policies. These efforts aim to address the country's deteriorating housing environment resulting from the increasing number of aged houses.

The purpose of the management-type residential environment improvement projects is to supplement the infrastructure for low-rise residential areas in need while encouraging residents to voluntarily engage in housing renewal and improvement. However, these projects have not been highly effective in promoting voluntary housing renewal and improvement efforts due to their failure to consider regional characteristics and variations (Maeng et al., 2015). According to Maeng et al. (2017), although these projects are implemented under the Act on the Maintenance and Improvement of Urban Areas and Dwelling Conditions for Residents, the provisions of the act primarily prescribe methods for residential improvement when apartment complexes are built through complete demolition and redevelopment. The discrepancy between the purpose of the project and the specific provisions of the act has resulted in the initiative's failure to devise detailed action plans or strategies for housing environment improvement. Moreover,

despite the availability of loan programs for housing improvement, the lack of institutional systems to support and implement them limits the contribution of these projects to promoting voluntary housing improvement efforts.

Against this backdrop, it is essential to make R&D efforts and develop necessary policies that encourage residents to voluntarily engage in the improvement of their aged houses within the project locations.

Meanwhile, previous studies have reported that the decision for housing improvement is influenced by various factors, including the distinctive characteristics of homeowners, houses, and surrounding environments, as well as the nature of the housing market (Littlewood and Munro, 1996; Plaut and Plaut, 2010; Sari, 2014). However, there has been little research conducted on this issue on the domestic front. Unlike redevelopment projects for apartment housing, decisions regarding the improvement of individual houses are solely made by homeowners, regardless of whether they reside in them or rent them to tenants. For house owners, the purpose of housing improvement is either to enhance the quality of their own residence or to increase the value of their houses as part of economic activities. Under these perspectives, it is also necessary to consider whether homeowners themselves reside in the houses as a factor that may affect decisions for individual housing improvement, rather than defining all homeowners as a single category.

Within this framework, this study identified factors influencing the decisions of homeowners regarding housing renewal and improvement within the target areas of the management-type residential environment improvement projects, with special attention given to the nature and characteristics of homeowners. In addition, the factors proposed in previous studies were reinterpreted from the perspectives of homeowners.

Based on the results, this study aimed to identify factors that could further promote housing renewal and improvement efforts, while also providing relevant insights for future urban planning.

2. Research scope and methodology

The spatial scope of this study includes eight sites among the target areas of the management-type residential environment improvement projects in Seoul. These sites are of similar size and have already completed the public sector portions of the projects. During the selection of target sites, the project size was considered because factors beyond individual characteristics may influence decisions for housing renewal and improvement, particularly if each project varies significantly in size. The temporal scope of this study was set from 2011[2], when the management-type residential environment improvement project areas were first designated, to 2020. In this study, a broad definition of housing renewal and improvement encompasses even non-official housing repairs without validated records. However, among them, only those repairs that can be verified in building registers were counted due to difficulties in data acquisition. More specifically, housing renewal was limited to new constructions, while housing improvement included extensions, renovations, major repairs, and changes of intended usage[3].

Variables affecting decisions for housing renewal and improvement were identified and selected through a literature review. For the 874 land parcels within the selected eight management-type residential environment improvement project areas, a series of variables regarding the nature and characteristics of homeowners, parcels, houses, regions, and urban planning were derived. First, t-test and chi-square test methods were employed to gain insights into the fundamental characteristics of homeowners and their preferences for housing renewal and improvement, with a particular focus on whether they reside in the houses themselves. Subsequently, multinomial logistic regression models were used to analyze factors influencing their decisions regarding housing renewal and improvement.

A cluster analysis was conducted using SPSS Statistics 26, IBM's statistics software package, to identify target analysis sites. A logistic regression analysis, which is particularly useful when dependent variables constitute nominal scales, was then performed using Stata 17 SE, another statistics tool. A multinomial logistic regression model, used when there are three or more dependent variables, was employed as the regression model. For the housing renewal and improvement type as a dependent variable, "No change" was included as a reference category to derive individual probabilities for each provided option, including "Renewal (new construction)" and "Improvement (extension and renovation)." The analysis in the present study utilized a

series of data from the Ministry of Land, Infrastructure and Transport, including building registers, land ledgers, continuous cadastral maps, and officially assessed land prices.

II. Literature Review

1. Factors influencing housing improvement decisions in low-rise residential areas

Since studies on housing renewal and improvement have predominantly been conducted by overseas researchers rather than domestic researchers, our literature review focused on overseas research cases. Oxley and Smith (1995) confirmed that decisions for individual housing improvement were affected by various factors, including housing investments and other financial reasons, demographic factors, and factors associated with economic growth. The researchers, however, noted the need for further specification of these factors by introducing microscopic parameters. Mendelsohn (1977), Pollakowski (1988), Ziegert (1988), and Bogdon (1996) examined microeconomic factors influencing decisions regarding housing improvement, particularly for homeowners residing in the houses themselves. Shear (1983) identified the characteristics of households, houses, neighborhood environments, and regions as factors that could affect the decisions of residents to either improve their detached houses or relocate. Montgomery (1992) utilized various datasets from the 1985 US Census of Housing to devise a probit model that includes the cost spent for housing improvement as a variable. With this approach, the researcher assessed how this cost was affected by different factors, including the characteristics of homeowners (such as income, period of ownership, marital status, and age), houses (including the level of deterioration, parcel size, and floors) and neighborhood environment (quality and available services).

Boehm and Ihlanfeldt (1986) revealed the noticeable effects of various factors, including crime rates, the presence of public schools, the quality of media reports, and rates of littering, on residents' decisions to improve their houses. Culp (2011) found that environmental factors influenced the decision regarding housing renewal and improvement, particularly among homeowners who moved in within the past five years. Clark and Kearns (2012) focused on the perspectives of individuals who actually reside in the houses, whether homeowners or tenants, revealing that a close homeowner-tenant relationship positively influenced decisions regarding housing renewal and improvement. Studies by Sternlieb (1966) and Porell (1985) reported that in the US housing market, the quality of housing was more effectively managed when homeowners actually resided in their detached houses or in apartments, serving as managers, rather than living in other regions as lessors. Davila-Ash (2002) also pointed out that the external appearance of houses appeared more poorly maintained when the homeowners did not actually reside in them, especially as the rental period grew longer. In addition, Lang et al. (2021) highlighted that financial factors were not the sole determinants of decisions regarding housing renewal and improvement from the perspectives of rental housing investors in Europe, Australia, and the US. These studies are significant in that they considered the type of ownership for individual homeowners in the analysis, despite that their interpretations cannot be directly applied to the Korean housing market due to significant differences between the markets.

In Korea, empirical research on housing renewal and improvement has only recently begun, resulting in a limited number of relevant studies.

Lee and Bae (2007) employed a housing value maximization model under the assumption that homeowners want to maximize the value of their houses. They used this model to determine the optimal timing for housing development with respect to economic growth rates through simulations for different development types, including maintenance, remodeling, and reconstruction. Specifically, in areas with low economic growth rates, housing development did not start on time, leading to rapid deterioration. In contrast, when economic growth rates were high, development occurred promptly within a short period of time, maximizing the value of houses. Hong and Ahn (2013) employed game theory to investigate the effect of rent regulations, density regulations, and homeowners' preferences on decisions regarding housing renewal and improvement. The researchers confirmed that suitable combinations of polices, such as rent regulations and gross floor area incentives, could be effective in promoting decisions for housing renewal and improvement. As an empirical study on housing renewal and improvement, Yim and Choi (2016) used

data from the Korea Housing Survey to assess individuals' intent for housing improvement. They also employed logistic regression and tobit models to examine the effects of the characteristics of detached house residents and their houses on both decisions regarding housing improvement and the cost that they would be willing to pay for such improvements.

As seen above, empirical studies using data on the execution or cost of housing renewal and improvement began among overseas researchers in 1980. In Korea, this approach has only recently started to gain momentum gradually. This shift aligns with the gradual establishment of methods for residential environment improvement, highlighting the necessity for more specific empirical research on this topic. Meanwhile, previous studies regarding factors affecting decisions for housing renewal and improvement (Mendelsohn, 1977; Pollakowski, 1988; Ziegert, 1988; Bogdon, 1996; Boehm and Ihlanfeldt, 1986; Yim and Choi, 2016) did not differentiate between homeowners who resided in the houses themselves and those who rented their houses to tenants. Most studies analyzed specific houses in which their owners resided themselves, regarding them as the primary decision-makers for housing renewal and improvement. Given that housing rent transactions represent a significant portion of the housing market, deriving determinants for housing renewal and improvement without considering ownership type is considered a limited approach. Notably, management-type residential environment improvement projects, which will be discussed later, often target low-rise residential areas, encouraging residents to actively engage in renewing and improving their individual houses. Consequently, it is crucial to accurately understand the nature and characteristics of residents, particularly concerning ownership type.

2. Management-type residential environment improvement projects

First introduced under the Act on the Maintenance and Improvement of Urban Areas and Dwelling Conditions for Residents in 2012, management-type residential environment improvement projects aim to promote public sector investments in improving the overall quality of infrastructure, including streets and roads. This, in turn, encourages residents to voluntarily make efforts for housing renewal and improvement. Creating this synergistic cycle is the ultimate goal of these projects. Although the public sector does not directly participate in housing renewal and improvement tasks, its efforts, such as infrastructure improvement, can effectively control the pace of deterioration while also encouraging residents' voluntary participation in housing improvement initiatives.

However, since the implementation of these projects, public-sector initiatives have been completed in some target areas, raising questions about the effectiveness of the projects in promoting decisions for housing renewal and improvement (Maeng et al., 2015). While private-sector investments directly lead to the renewal or improvement of individual houses, public-sector efforts are indispensable for attracting such investments (Smets and Weesep, 1995). Therefore, it is necessary to specify and accurately understand the characteristics of residents residing within the target areas of management-type residential environment improvement projects, which aim to promote voluntary participation in housing renewal and improvement initiatives.

Previous studies on management-type residential environment improvement projects can be largely divided into those focusing on understanding, assessing, and improving the projects and others conducting empirical research.

Yeo and Yang (2015) analyzed the Doil Traditional Market in Siheung to develop methods for addressing the limitations of the current form of the projects, particularly with respect to project execution, residential participation, and the activation of residential communities. Maeng and Baik (2017) also emphasized the activation of residential communities. They analyzed the current status of public policies, community organizations, and residential activities to identify the limitations of policies currently in place, as well as methods for improving them.

Kim and Shin (2018) focused on public facilities for residents within the target areas of management-type residential environment improvement projects. The researchers conducted a literature review and in-depth interviews to assess the impact of the presence and operation of these facilities on the competence of residential communities. They also proposed methods for improving efficiency in the operation of these facilities, thereby enhancing the capacity

of residential communities. A study by Bae and Park (2019) also examined residential communities and their public facilities, identifying sustainable methods for more efficiently operating these facilities. Kim (2019) evaluated residential satisfaction with management-type residential environment improvement projects. Despite residents recognizing the need for the renewal and improvement of aged houses, their actual participation was not as extensive. Thus, the researcher emphasized the necessity for more effective methods to promote voluntary participation in housing renewal and improvement initiatives.

Meanwhile, several empirical studies have been conducted within the target areas of management-type residential environment improvement projects.

Jeong (2015) argued that public-sector investments during management-type residential environment improvement projects would lead to an increase in land prices and rents, resulting in gentrification and potentially displacing existing residents. To support this notion, the researcher compared land prices and rents before and after the projects. Kim and Kim (2017) also analyzed Yeonnam-dong, one of the target areas of management-type residential environment improvement projects, to identify patterns in residents' decisions for housing improvement across each housing type, especially with respect to specific categories, including the age of owners, period of ownership, and ownership type. Their research holds significance in that it categorizes the characteristics of housing improvement decisions based on the age of land or building owners and the period of ownership, utilizing data available in building registers. However, the researchers only described the nature of land or building owners by dividing parcels within the target areas into those with changes and others left unchanged, failing to specifically identify the factors influencing owners' decisions regarding housing improvement.

Overall, a literature review of management-type residential environment improvement projects revealed that most previous studies have focused on residents, with earlier studies emphasizing the need to activate residential communities while also providing assessments and improvement methods.

In addition to the activation of residential communities, some studies have examined the operation of public facilities for residents, evaluating residential satisfaction with them through surveys conducted after the completion of public sector portions of the projects. However, all these studies were conducted from the perspective of public sector projects. There have not been many empirical studies conducted from the perspective of the private sector aimed at promoting housing renewal and improvement efforts.

3. Unique aspects of this research

This research differs from previous studies in the following aspects.

First, this study examines cases of housing renewal and improvement, which have not been very common domestically. Notably, factors affecting decisions regarding housing renewal and improvement are analyzed with a primary focus on the characteristics of homeowners, which are known to be important determinants for housing renewal and improvement decisions. According to previous studies, homeowners tend to become more passive in engaging in housing improvement as they age, and as the length of their ownership period increases (Shear, 1983; Montgomery, 1992; Baum and Hassan, 1999; Yim and Choi, 2016; Kim and Kim, 2017). However, these results did not consider whether the houses were owner-occupied or rental properties, and nor did they account for the size of housing renewal and improvement projects. In general, for owner-occupied houses, housing renewal and improvement are aimed at enhancing housing services. In contrast, renewal and improvement efforts for rental properties, where owners rent the properties to tenants, are often made for investment purposes (Meijer, 1993). Thus, this study specifies the occupancy status of homeowners, determining how this distinction will affect the results compared to those of previous studies.

Second, most previous studies on factors influencing decisions for housing renewal and improvement were conducted through scenario analyses using theoretical models (Lee and Bae, 2007; Hong and Ahn, 2013). Despite employing empirical analyses, some studies failed to take a microscopic approach at the parcel level because they used national-level data, such as those from the Korea Housing Survey (Yim and Choi, 2016).

This study utilizes empirical data at the parcel level to conduct quantitative research, distinguishing its approach

from previous studies.

Finally, similar to the empirical research on domestic housing renewal and improvement initiatives discussed above, the present study also focuses on the target areas of management-type residential environment improvement projects. However, it extends the scope by considering additional areas where public sector portions of the projects have already been completed. These are the unique aspects of this research that differentiate it from previous studies.

Ⅲ. Framework of Analysis

1. Research problem and hypothesis

Does the occupancy status of homeowners affect the characteristics that influence their decisions for housing improvement? This question aligns with the intent to specifically identify the factors that drive homeowners' decisions in improving their houses from their own perspectives. This study proceeds under the common-sense assumption that the purpose of housing improvement may vary depending on the occupancy status of homeowners. With this notion in mind, our aim is to verify the moderating effect of occupancy status on the individual characteristics of homeowners.

Research problem: Does the degree of the effect of homeowners' characteristics on decisions for housing improvement vary depending on their occupancy status?

→ **Hypothesis: The occupancy status of homeowners has a moderating effect, influencing the impact of homeowners' characteristics on decisions regarding housing improvement.**

2. Subject of analysis

As of 2021, public-sector portions of projects had been completed in 28 sites among the target areas of the residential environmental management projects implemented by the City of Seoul. According to Niu and Han (2018), the construction of a building typically requires approximately three years from the completion of the land transaction. Thus, 20 sites where public sector portions were completed at least three years prior, specifically before 2018, were initially selected for analysis. Subsequently, IBM's SPSS Statistics 26 was employed to conduct a cluster analysis on the selected sites with respect to their area. As a result, a total of three clusters were identified. Among the sites within the three clusters, eight sites with an area close to 50,000 m2 were finally short-listed. The area of 50,000 m2 is a threshold considered appropriate for the projects by the City of Seoul (Maeng et al., 2015). The eight selected sites are as follows: Dolsam Haengbok Village, Hanminjok Village, Bakmi Sarang Village B, Onsu-gol, Woori Village, Sansae Village, Saedongnae, and Hwigyeong Village. The results of the cluster analysis and selected sites are summarized in 〈Table 1〉 and 〈Figure 1〉.

Next, the age of homeowners, period of ownership, and their occupancy status were examined by cross-referencing building registers and land ledgers.

During this verification process, parcels for which owners could not be properly identified due to the establishment of land rights for multi-owned buildings were excluded. As a result, a total of 874 parcels were selected for analysis.

The Dolsam Haengbok Village is located at 306, Samseong-dong, Gwanak-gu. Among the selected sites, this village exhibits the highest average homeowner age and the longest average period of ownership. It has a grid road system, with most of its square and rectangular parcels situated on sloping land. The Hanminjok Village is at 1027-1, Daelim-dong, Yeongdeungpo-gu. This site includes a relatively large number of parcels, totaling 198 units. These parcels are mostly situated on flat land, with many of them being square, rectangular, and trapezoidal, while some are irregularly shaped. Bakmi Sarang Village B is situated at 957, Siheung-dong, Geumcheon-gu. This site has the lowest average homeowner age and a relatively short average period of ownership. It includes the smallest number of parcels subject to analysis. This is attributed to its distinct housing type, which is primarily composed of apartment housing, including multifamily houses. Onsu-gol is located at 67, Onsu-dong, Guro-gu. This site is characterized by the highest proportion of irregular-shaped parcels among all parcels subject to analysis.

In addition to these parcels for analysis, there are a number of apartment houses, such as multifamily houses and row houses within this site. The Woori Village is located

Table 1. Area of analysis selected by clustering analysis

Site	Location	Beginning year of project	Public sector project completion year	Area (m^2)	Cluster	Parcels used in analysis	Average owner age	Average occupancy year
Jangsu Village	300 Samseon-dong 1-ga, Seongbuk-gu	2012	2013	18,414	A			
Dolsam Haengbok Village	306 Samseong-dong, Gwanak-gu	2014	2017	42,715	B	51	69.00	20.31
Heukseok Forest Village	186-19 Heukseok-dong, Dongjak-gu	2011	2013	26,841	A			
Hanminjok Village	1027-1 Daelim-dong, Yeongdeungpo-gu	2012	2015	42,959	B	198	64.91	16.78
Bakmi Sarang Village A	957 Siheung-dong, Geumcheon-gu	2010	2013	43,560	B			
Bakmi Sarang Village B	957 Siheung-dong, Geumcheon-gu	2011	2014	49,282	B	23	61.35	11.78
-	111 Guro-dong, Guro-gu	2012	2015	45,676	B			
Ishimjeonshim Village	270 Gaebong-dong, Guro-gu	2012	2015	32,958	A			
Onsu-gol	67 Onsu-dong, Guro-gu	2011	2014	59,472	B	35	64.03	12.86
-	239-1 Yeonnam-dong, Mapo-gu	2010	2013	82,900	C			
Woori Village	330-6 Bukgajwa-dong, Seodaemun-gu	2010	2013	43,560	B	77	68.36	16.17
Sangol Village	31 Eungam-dong, Eunpyeong-gu	2012	2016	13,896	A			
Sansae Village	237 Sinsa-dong, Eunpyeong-gu	2012	2015	45,676	B	242	62.50	14.74
Saedongnae	280 Dobong-dong, Dobong-gu	2012	2014	42,365	B	71	63.39	11.68
Bang-a-gol	396-1 Banghak-dong, Dobong-gu	2011	2014	26,566	A			
Yangji Village	76-68 Mia-dong, Gangbuk-gu	2013	2017	22,080	A			
Samdeok Village	716-8 Jeongneung-dong, Seongbuk-gu	2013	2017	33,443	A			
Jeongdeun Village	372 Jeongneung-dong, Seongbuk-gu	2012	2017	35,150	A			
Sori Village	1170 Gileum-dong, Seongbuk-gu	2011	2013	26,566	A			
Hwigyeong Village	286 Hwigyeong-dong, Dongdaemun-gu	2012	2017	39,396	B	177	63.89	12.44

at 330-6, Bukgajwa-dong, Seodaemun-gu. The village is situated on completely flat land, with some of its parcels being trapezoidal and flag-shaped. It is the site where the management-type residential environment improvement project was first implemented, and its public sector portions were completed first among all selected sites. The Sansae Village is situated at 237, Sinsa-dong, Eunpyeong-gu, with over half of its area designated as Class I General Residential Area. This site has the largest number of parcels for analysis, totaling 242 units. This suggests that its housing type was primarily composed of detached houses and multi-unit houses in the past. Saedongnae is at 280, Dobong-dong, Dobong-gu, with all its parcels analyzed being situated on flat land. This site is characterized by its spatial structure composed of two separate zones. Finally, the Hwigyeong Village is located at 286, Hwigyeong-dong, Dongdaemun-gu. Most of its area is situated on sloped land, and similar to Hanminjok Village and Sansae Village, the site is predominantly composed of detached houses and multi-unit dwellings, both in the past and present.

Figure 1. Case study area

3. Variable derivation and data sources

In this study, variables were derived through a literature review, and data were prepared to match each selected variable at the parcel level. The selected variables are described in 〈Table 2〉.

Data for the housing improvement type, as a dependent variable, were sourced from the building permit data available from the Ministry of Land, Infrastructure and Transport. According to the data, the housing improvement type was initially categorized into New construction, Extension, Large-scale improvement, and Change of intended usage[4] and further refined into New construction and Small-scale improvement[5] for further analysis. Although previous studies (Yim and Choi, 2016; Kim and Kim 2017) have varied in their categorization of housing renewal and improvement types, this study adopted the categories of New construction and Small-scale improvement for variation derivation. This decision was made considering that the City of Seoul provides its housing improvement subsidies differently based on this categorization. Parcels, in which no construction works had been undertaken since the commencement of the management-type residential environment improvement project, were categorized as No change.

The homeowner characteristics, considered a key variable in the analysis, were sourced from the building registers and land ledgers available from the Ministry of Land, Infrastructure and Transport, specifically regarding their age and period of ownership. Generally, older homeowners are less likely to undertake renewal or improvement projects on their houses, and they tend to spend less on such improvements (Shear, 1983; Montgomery, 1992). Additionally, the longer they reside in their home, the less likely homeown-

Table 2. Variables utilized in the analyses

Variable		Description	Unit	Data source
Housing Improvement Type		The improvement type of Individual house	0 = No change 1 = New construction 2 = Small-scale improvement	https://open.eais.go.kr/ https://www.gov.kr/
Control Variable	Occupancy status	Individual homeowner's occupancy status	0 = Non-owner occupied 1 = Owner occupied	https://open.eais.go.kr/ https://www.gov.kr/
Homeowner characteristics	Owner's age	Individual homeowner's age	constant variable (year)	
	Years of ownership	Individual homeowner's period of home ownership	constant variable (year)	
Parcel characteristics	Parcel form	Parcel form of individual house	0 = Square 1 = Rectangle (Horizontal) 2 = Rectangle (Vertical) 3 = Trapezoid 4 = Sack 5 = Triangle 6 = Irregular	https://www.data.go.kr/
	Parcel area	Parcel area of individual house	m^2	
	Slope	Slope status of individual house	0 = Flat ground 1 = Mild slope 2 = Steep slope	
	Relative land price increase rate	Increase rate of individual land price / Average increase rate of land price within neighborhood	constant variable (%)	https://kras.seoul.go.kr/
House characteristics	House type	House type before improvement	0 = Detached housing 1 = Multi-family/shop	https://open.eais.go.kr/ https://www.gov.kr/
	House deterioration	House age at the time of improvement	constant variable (year)	
Neighborhood characteristics	Neighborhood deterioration	Average house age within neighborhood at the time of improvement	constant variable (year)	
Urban planning characteristics	Zoning	Zoning regulation of individual house	1 = Class 1 general residential area 0 = Class 2 general residential area	https://www.eum.go.kr/

ers are to undertake housing renewal and improvement projects (Montgomery, 1992; Baum and Hassan, 1999). Accordingly, in the present study, the age of homeowners and the period of ownership were selected as variables to represent their characteristics. Furthermore, homeowner records specified in the building registers and land ledgers were cross-referenced to enhance accuracy.

Montgomery (1992) employed a wider range of variables, including household incomes and marital status. However, adopting this approach directly in our study was challenging because the researcher utilized data available from the Census of Housing. Moreover, other previous studies have utilized the age of homeowners and the period of ownership as variables representing homeowners' characteristics. Consequently, in this study, both the age of homeowners and the period of ownership were defined as independent variables.

Meanwhile, the occupancy status of homeowners was selected as a moderating variable. Homeowners who reside at the same address as their houses were categorized as "Owner-occupied," while those who reside elsewhere were categorized as "Non-owner-occupied." While the occupancy status may be considered part of homeowner characteristics, previous studies have reported almost no cases where the occupancy status serves as an independent variable.

This can be attributed to the unsuitability of this variable for use in the modeling process or difficulties in obtaining the required data. Based on our hypothesis that preferences for housing renewal and improvement may vary between owner-occupied and non-owner-occupied cases, the occupancy status of homeowners was categorized as a moderating variable in this study.

Parcel characteristics, house characteristics, neighborhood characteristics, and urban planning characteristics were also selected as control variables. Parcel characteristics have frequently been employed as variables in previous studies on housing renewal and improvement, often represented by specific individual variables, such as parcel area, form, slope, and land price (Montgomery, 1992; Iwata and Yamaga, 2007; Kim and Kim, 2017; Lee and Nam, 2020). Similar types of variables have been used in other studies employing statistical models at the parcel level (Cho and Lee, 2018; Kim et al., 2019; Park and Kwon, 2023), although the focus of these studies extends beyond housing. Data for physical variables, including parcel area, form, and slope, were obtained from the continuous cadastral maps available on the Korea National Spatial Data Infrastructure Portal, with the exception of land prices. Data for the land price variable was sourced from officially assessed land prices provided by the Korea Real Estate Administration Intelligence System of the Ministry of Land, Infrastructure and Transport. For parcels with no changes, year-on-year land price increases from 2021 were measured, while for parcels that had undergone any construction work, year-on-year land price increases from the year of the corresponding work were estimated. Meanwhile, average land price increases vary from year to year and from region to region. Thus, the obtained data did not accurately represent net price increases in each target area. To address these limitations, this study adopted relative land price increase rates[6], which were estimated by dividing each parcel's price increase by the land price change at the gu (district) level in Seoul. Seoul's land price changes at the gu level were sourced from the Korea Real Estate Board's data on year-specific, region-specific land price changes.

House characteristics were often represented by the age of houses in previous studies (Montgomery, 1992; Baum and Hassan, 1999; Baker and Kaul, 2002; Yim and Choi, 2016). While overseas studies primarily focus on detached houses, domestic studies have examined a broader range of housing types due to the distinct features of the housing market in the country (Yim and Choi, 2016; Kim and Kim, 2017). Therefore, the age of houses and house type were ultimately selected as variables to represent house characteristics.

Data for both variables were obtained from the building registers provided by the Ministry of Land, Infrastructure and Transport. More specifically, the house type was categorized into detached houses, multi-unit houses, and houses for commercial use. For parcels where multifamily houses, row houses, and apartment buildings already existed or were newly constructed before the commencement of housing renewal and improvement, it was impossible to extract homeowner data at the parcel level because land rights had already been established.

Meanwhile, previous studies have utilized a wide range of specific variables to analyze neighborhood characteristics.

For example, some researchers employed variables, such as crime rates, construction cost indexes, and tax rates (Boehm and Ihlanfeldt, 1986; Montgomery, 1992). However, this study only adopted a variable representing neighborhood deterioration (Shear, 1983; Boehm and Ihlanfeldt, 1986; Sari, 2014) due to variations in microscopic characteristics at each site and difficulties in obtaining the required data.

The variable of neighborhood deterioration was estimated based on the average age of all houses within the target area of the management-type residential environment improvement project. The required data were sourced from the building registers, similar to the estimation of the age of individual houses.

Finally, zoning was selected as a dummy variable to represent urban planning characteristics, which specified the type of zone for each parcel.

The required data were obtained from EUM (formerly known as the Land Use Regulations Information Service). Since building-to-land ratios and floor area ratios varied from zone to zone, the effect of these variations on the housing improvement type was examined.

Ⅳ. Analysis Results

1. Analysis of occupancy status

An independent sample t-test was conducted to determine the effect of homeowners' occupancy status on homeowner

characteristics, specifically their age and the period of ownership. The analysis results are summarized in 〈Table 3〉. There were variations in both the average age of homeowners ($t = -10.492$ and $p = 0.030$) and the average period of ownership ($t = -11.950$ and $p = 0.000$) between the two groups. The average age of homeowners in the owner-occupied group was 68.66 years, 9.01 years older than that of the non-owner-occupied group, whose average age was 59.65 years. The period of ownership was 19.21 years for the owner-occupied group and 10.01 years for the non-owner-occupied group. The difference between the two groups was 9.2 years.

Next, the effect of homeowners' occupancy status on the type of housing improvement was examined. The results are summarized in 〈Table 4〉. In the non-owner-occupied group, 329 homeowners (44.3%) were categorized as No change, 65 (15.5%) as New construction, and 26 (6.2%) as Extension. In the owner-occupied group, 414 homeowners (91.2%) were categorized as No change, 27 (5.9%) as New construction, and 13 (2.9%) as Extension. A chi-square test was conducted to compare the distribution patterns of the two groups. There was a significant difference in their distribution trends, with a Pearson chi-square value of 28.474 and a significance probability (p-value) of 0.05, indicating that the observed differences are statistically significant at the 0.05 significance level. These results suggest that the occupancy status of homeowners is associated with the type of housing improvement. Specifically, among the non-owner-occupied groups, higher proportions of New construction or Extension cases were observed compared to the owner-occupied group.

To further determine the effect of homeowners' occupancy status, t-tests were conducted on two continuous variables: the age of homeowners and the period of ownership. Additionally, chi-square tests were performed on the housing improvement type, a discontinuous variable.

The results confirmed that homeowners in the owner-occupied group are older and have owned their homes for a longer period compared to those in the non-owner-occupied group. The non-owner-occupied group exhibited more than twice the proportion of both New construction and Extension compared to the owner-occupied group. This trend indicates that homeowners in the non-owner-occupied group may have a greater inclination toward housing improvement. This behavior can be attributed to the fact that these homeowners are in a more advantageous position to undertake new construction or housing improvements because they have the flexibility to reside elsewhere during the construction

Table 3. T-test of homeowner characteristics regarding occupancy status

Category	Occupancy status	obs.	mean	S.D.
Age	Owner occupied	454	68.66	12.336
	Non-owner occupied	420	59.65	13.061
t		-10.492**		
Years of ownership	Owner occupied	454	19.21	12.113
	Non-owner occupied	420	10.01	10.517
t		-11.950***		

*p<0.1, **p<0.05, ***p<0.01

Table 4. Chi-square test of house improvement type regarding occupancy status

Category			Non-owner occupancy	Owner occupancy	Pearson's chi-square
House improvement type	No change	Observed frequency	329 (78.3%)	414 (91.2%)	28.474***
		Expected frequency	357.0	386.0	
	New construction	Observed frequency	65 (15.5%)	27 (5.9%)	
		Expected frequency	44.2	47.8	
	Extension	Observed frequency	26 (6.2%)	13 (2.9%)	
		Expected frequency	18.7	20.3	

*p<0.1, **p<0.05, ***p<0.01

period. Alternatively, their motivation for housing improvement may be to facilitate the renting of their houses rather than improving housing quality for themselves while they reside in them.

2. Analysis of determinants influencing housing improvement

In this section, the effect of homeowner characteristics on housing improvement is examined, while controlling for other variables, to assess the moderating effect of homeowners' occupancy status. Stata 17 SE, a statistics software package, was utilized to conduct multinomial logistic regression analysis. This method is suitable for cases where the dependent variables are categorical, with three or more categories. In this analysis, parcels with no changes were defined as a reference category. Generally, a multinomial logit model is interpreted primarily based on the relative risk ratio (RRR). The RRR quantifies the relative change in the probability of a certain event occurring, given the presence of specific risk factors, when holding all other conditions constant. Specifically, an RRR greater than 1 indicates a positive (+) effect, while an RRR less than 1 indicates a negative (-) effect. A one-unit increase in a variable results in an increase in the probability of choosing the dependent variable by a factor equal to the RRR.

In regression analysis of moderating effects, the three-step hierarchical regression analysis is widely used. This method involves three hierarchical models, the independent variable model (X); the model with independent and moderating variables (X, M); and the model with independent, moderating, and interaction variables (X, M, X×M).

That said, Kim (2019) noted that the method proposed by Baron and Kenny (1986) had been mistakenly adopted by many researchers. This erroneous adoption, based on the notion that moderating effects are observed only when independent and moderating variables significantly influence dependent variables, has led to applications of the method lacking a solid theoretical basis. The researcher also argued that the literature specifying the relevant methodology (Frazier et al., 2004; Hair et al., 2005; Hayes, 2013; Whisman and McClelland, 2005) suggested the use of a two-step hierarchical regression analysis, demonstrating weak theoretical grounds for the aforementioned method.

Therefore, in this study, Model 1, which involves only independent and moderating variables, was employed to examine the effect of homeowner age and ownership period on the type of housing improvement. Furthermore, Model 2 was also utilized to verify the moderating effect of moderating variables on the relationship between independent and dependent variables. This model incorporates not only independent and moderating variables but also interaction variables.

The natural logarithm of the land price and parcel area variables' values were used in the analysis to assess their normal distribution. The obtained analysis results are presented in 〈Table 5〉.

1) Analysis results from Model 1

In goodness-of-fit tests, the -2 log likelihood ratio (-2LL) of both models was found to be statistically significant: LR = 442.97 & $p<0.01$ for Model 1 and LR = 464.41 & $p<0.01$ for Model 2. With the addition of interaction variables, Model 2 exhibited improved -2LL compared to Model 1, indicating that the inclusion of interaction variables enhanced the model's fitness.

The analysis results of Model 1 are as follows. In Model 1-1, which represents the probability of choosing New construction over No change, both the age of homeowners (-) and the period of ownership (-), independent variables, were found to be statistically significant. Among the control variables, parcel area (+), parcel form (square and rectangular, +), land price increase rates (+), house type before construction works (detached houses, +), neighborhood deterioration (-), and zoning (Class I General Residential Area, -) were found to be statistically significant. The coefficients and RRR of the independent variables were also analyzed. The results suggest that for every one-year increase in homeowner age, the probability of undertaking new construction decreases by 2.6%, while for every one-year increase in ownership period, the probability decreased by 13.7%. When considering other variables, the probability of new construction increases by 2.96-fold for detached houses. The probability decreases by 37.2% for every one-year increase in the average age of houses in the area. It sharply decreases by 77% when the zone is classified as Class I General Residential Area. This is because when multi-unit houses and houses for commercial use, rather

Table 5. Multinomial logit model for housing improvement influence factors

Variable		Model 1				Model 2			
		Model 1-1 (new construction=1, no change=0)		Model 1-2 (small-scale improvement=1, no change=0		Model 2-1 (new construction=1, no change=0)		Model 2-2 (small-scale improvement=1, no change=0	
		β	RRR	β	RRR	β	RRR	β	RRR
Constant		5.852	347.986	17.563	4.24e+07***	5.885	243.923	18.223	8.24e+07
Parcel area (LN)		1.166**	3.211**	-1.684**	3.211**	1.176**	3.240**	-1.735**	0.176**
Parcel form (square = 0)	Rec_hor	0.106	1.112	1.029	1.	-0.010	0.990	1.0434	2.840
	Rec_ver	-1.350***	0.259***	-0.192	0.825	-1.255**	0.285**	-0.151	0.860
	Trapezoid	-1.392***	0.249***	-0.907	0.404	-1.420***	0.242***	-0.877	0.416
	Sack	-15.419	2.01e-07	1.512*	4.558*	-15.555	1.76e-07	1.441	4.224
	Triangle	-1.969	0.140	-14.593	4.59e-07	-1.837	0.159	-15.054	2.90e-07
	Irregular	-17.219	3.33e-08	0.282	2.215	-17.384	2.82e-08	0.262	1.299
Slope (Flat = 0)	Mild	0.211	1.236	0.795	3.590	0.208	1.231	0.836	2.308
	Steep	-0.035	0.966	1.278		-0.019	0.981	1.522	4.579
Land price increase rate (LN)		1.857***	6.406***	3.019***	20.475***	1.781***	5.933***	3.045***	21.003***
House type (multi-family/commercial) = 0)		1.085***	2.960***	-0.473	0.623	1.010**	2.737**	-0.505	0.604
House deterioration		0.015	1.015	-0.076***	0.927***	0.012	1.012	-0.078***	0.925***
Neighborhood deterioration		-0.466***	0.628***	-0.375***	0.688***	-0.446***	0.640***	-0.413***	0.661***
Zoning (class II general residential area = 0)		-1.471***	0.230***	-0.249	0.780	-1.277***	0.279***	-0.395	0.674
Owner's age		-0.026*	0.974*	-0.042**	0.958**	-0.014*	0.961*	-0.027	0.973
Years of ownership		-0.148***	0.863***	-0.053*	0.948*	-0.367**	0.932**	-0.079*	0.924*
Occupancy status (owner occupied = 0)		0.390	1.477	0.477	1.611	0.389	1.475	1.510	4.527
Occupancy status × Owner's age (owner occupied = 0)						**0.025**	**1.026**	**-0.023**	**0.978**
Occupancy status × Years of ownership (owner occupied = 0)						**-0.296*** **	**0.743*** **	**0.041**	**1.042**
		-2 Log Likelihood Ratio = 442.97*** Pseudo R2 = .509				-2 Log Likelihood Ratio = 464.41*** Pseudo R2 = .534			

*p<0.1, **p<0.05, ***p<0.01

than detached houses, existed before construction began, it was less likely that quality housing services were available. In such cases, decisions for new construction can be seen as efforts to enhance housing quality and services. Meanwhile, a decrease in the probability of new construction with a decline in the average degree of neighborhood deterioration can be interpreted differently for owner-occupied and non-owner-occupied groups. In the owner-occupied group, it may signify a desire for a better housing environment, while in the non-owner-occupied group, it is seen as efforts to increase property values. This tendency was commonly observed not only in Model 1-1 but also in all other analysis models employed. A decrease in the probability of new construction observed in houses designated as Class I General Residential Area, where stringent restrictions on the floor area ratio apply, can also be interpreted as

reflecting investment sentiment regarding the potential benefits of new constructions.

Model 1-2 describes the probability of choosing Small-scale improvement over No change. In this model, both independent variables, the age of homeowners (-) and the period of ownership (-), were found to be statistically significant. Among the control variables, parcel area (-), land price increase rates (+), house deterioration (-), and neighborhood deterioration (-) were confirmed to be statistically significant.

Similar to the previous model, the RRR values of the independent variables indicate that for every one-year increase in homeowner age, the probability of undertaking small-scale improvement decreased by 4.2%. Similarly, for every one-year increase in the period of ownership, the probability decreases by 5.2%. Overall, there was no significant difference in the effect of homeowner age on decisions for New construction and Small-scale improvement. However, the probability of choosing New construction was significantly more affected by the period of ownership.

The occupancy status of homeowners, as a moderating variable, was found not to have any statistically significant influence on the probability of choosing New construction or Small-scale improvement.

However, according to Baron and Kenny (1986), confirming whether independent and moderating variables have a significant effect on the dependent variables is conceptually distinct from verifying the moderating effect of moderating variables. Hayes (2013) also argued that the moderating effect of moderating variables should be verified regardless of the presence of a significant relationship between independent and dependent variables.

In other words, even if there is no significant relationship between the independent and moderating variables in Model 1, the moderating effect of the moderating variable can still be confirmed as long as interaction variables hold statistical significance in Model 2 because these variables signify the presence of moderating effects. Below are the analysis results using Model 2, which incorporates interaction variables.

2) Analysis results from Model 2

Model 2 employs interaction variables to confirm the moderating effect of the occupancy status of homeowners, specifically with regard to whether this variable moderates the effect of the ownership period on the probability of choosing new constructions. There is no significant difference in the overall results between Model 1 and Model 2, except that in Model 2-1, which represents the probability of choosing New construction over No change, both the period of ownership (-) and the age of homeowners (-) were found to be statistically significant. In Model 2-2, the effect of ownership period (-) was noticeable but not highly significant, with a p-value of 0.1.

The interaction variable between occupancy status and ownership period in Model 2-1 was the only variable found to be statistically significant. This interaction variable in Model 2-1 has a negative regression coefficient ($\beta = -0.296$), and the ownership period, as an independent variable, also has a negative coefficient ($\beta = -0.367$). This suggests that in the non-owner-occupied group, an increase in the period of ownership strengthens the negative (-) effect on the probability of choosing New construction over opting not to choose Small-scale improvement.

3. Sub-conclusions

Overall, the results above confirm that both the age of homeowners and the period of ownership have a negative (-) effect on the probability of choosing New construction and Small-scale improvement. Additionally, the period of ownership has a greater negative (-) effect on the probability of choosing New construction compared to Small-scale improvement. These results align with previous studies indicating that homeowners tend to become more passive in undertaking housing renewal and improvement as they age (Shear, 1983; Montgomery, 1992; Yim and Choi, 2016; Kim and Kim, 2017). They are also consistent with previous reports demonstrating that an increase in the period of ownership leads to a decrease in the probability of choosing housing renewal and improvement (Montgomery, 1992; Baum and Hassan, 1999; Kim and Kim, 2017).

This study further classified housing renewal and improvement into New construction and Small-scale improvement. It also confirmed the moderating effect of homeowners' occupancy status on both homeowner age and ownership period, offering more specific and practical insights than previous studies.

In Model 1, both homeowner age and ownership period were statistically significant factors in determining choices for New construction and Small-scale improvement. However, in Model 2, which incorporates interaction variables, homeowner age and ownership period were statistically significant for New construction, whereas only the ownership period was significant for Small-scale improvement.

In the non-owner-occupied group, the moderating effect of homeowners' occupancy status was confirmed: this variable negatively moderates the negative (-) effect of ownership period on the probability of choosing New construction over No change. Simply put, an increase in ownership period reduces the probability of choosing New construction to a greater extent in the non-owner-occupied group than in the owner-occupied group. This suggests that in the non-owner-occupied group, the period of ownership has a more significant effect, particularly when homeowners opt for New construction. As homeowners own their houses for a longer period, they are less likely to choose New construction, and the interpretation above suggests that this decrease in possibility will be greater in the non-owner-occupied group than in the owner-occupied group.

Ⅴ. Conclusions

This study aimed to gain insights into housing renewal and improvement, which are not frequently discussed topics yet in Korea, from the perspectives of homeowners. Preferences for housing renewal and improvement may vary depending on the occupancy status of homeowners, but these potential variations have not been actively explored. Therefore, this study focused on assessing the effect of the characteristics of homeowners on their decisions regarding housing renewal and improvement, while also identifying and confirming the moderating effect of homeowners' occupancy status on these relationships. To this end, 874 parcels from eight sites where the public-sector portions of management-type residential environment improvement projects had already been completed were selected for analysis. Housing renewal and improvement works undertaken as a result of each project were classified into three categories: No change, New construction, and Small-scale improvement. Subsequently, the effect of homeowner characteristics, including age and ownership period, on their decisions regarding housing renewal and improvement.

First, t-tests were conducted with respect to the occupancy status of homeowners within the selected sites. The owner-occupied group had a higher average age and longer average ownership period compared to the non-owner-occupied.

Chi-square test results confirmed a difference in the type of housing renewal and improvement between the two groups: housing renewal and improvement works were undertaken more actively in the non-owner-occupied group.

To more specifically verify this tendency, a two-step multinomial logistic regression analysis was conducted, with housing improvement type as the dependent variable, homeowner characteristics (including age and ownership period) as independent variables, and homeowners' occupancy status as a moderating variable. In Model 1, which includes only independent and moderating variables, homeowners were less likely to opt for New construction or Small-scale improvement as they were older and had a longer ownership period, with other conditions controlled. Model 2 was designed to include interaction variables representing the relationship between moderating and independent variables, with the aim of confirming the presence of moderating effects. The results confirmed that the probability of choosing New construction was negatively affected to a greater extent by an increase in the ownership period in the non-owner-occupied group compared to the owner-occupied group.

The non-owner-occupied group comprises homeowners who own houses within the selected sites but reside elsewhere, not in these houses; they often own multiple houses, using the properties primarily for investment rather than residency. New construction can effectively maximize property values and corresponding benefits by significantly improving the quality and services of aged houses. Indeed, in the non-owner-occupied group, it took less time before homeowners undertook new construction. This tendency can be interpreted as homeowners having already decided to opt for new constructions even before purchasing the properties. In contrast, construction work for housing improvement are typically on a smaller scale and involve

lower costs. Thus, expectations for housing service improvement are also low. Therefore, housing improvement is primarily undertaken to improve housing services for those who reside in them rather than for investment purposes. In summary, homeowners in the owner-occupied group typically undertake housing renewal or improvement to enhance housing services for themselves, whereas those in the non-owner-occupied group do so in response to tenant requests or to maximize their rental incomes.

The major findings of the present study hold significance in that they examine the effect of homeowner characteristics and occupancy status on decisions regarding housing renewal and improvement, providing more specific insights into these relationships than previous studies.

Homeowners, undertaking housing renewal and improvement, can be classified into groups based on their occupancy status, age, and ownership period. Moreover, the scale or purpose of housing renewal and improvement may vary depending on their classification. However, not only in management-type residential environment improvement projects, which fall within the scope of this study, but also in numerous other urban restoration projects currently underway, residents are often simply categorized as a single group of people residing in the region, despite the potential for various divisions. As a result, these initiatives often limit themselves to specific support methods for housing improvement, such as those relying on loan systems (Kim and Kim, 2017). Maeng et al. (2015) identified one-size-fits-all project strategies and action plans as contributing factors to poor performance in promoting housing renewal and improvement during those projects. Enhancing their performance necessitates a deeper understanding of the specific aspects of homeowner characteristics.

The present study has limitations that need to be addressed as follows. First, the scope of the present study was limited to the target areas of Seoul City's management-type residential environment improvement projects.

Future studies should broaden the scope to encompass numerous relevant project sites nationwide to ensure the universality of the analysis. Additionally including variables that represent the unique characteristics of each site will enhance precision. Second, only homeowner age and ownership period were selected as independent variables among homeowner characteristics due to difficulties in obtaining the required data. Although previous studies have employed a wide range of variables to represent homeowner characteristics, such as household incomes, household size, and homeowners' educational background and marital status, accessing such information at the parcel level was impossible because it was categorized as personal information in Korea. Notably, data on apartment houses, including multifamily houses and row houses, could not be utilized for analysis due to the inability to identify their homeowners at the parcel level. Including a wider range of variables representing demographic and societal characteristics, beyond the scope of this study, will contribute to obtaining more specific results from diverse perspectives.

Note 1. Residential environment improvement projects were launched in 2012 as a next-generation initiative for environmental maintenance under the Act on the Maintenance and Improvement of Urban Areas and Dwelling Conditions for Residents. After a complete revision of the act in 2018, these projects were incorporated into existing residential environment improvement projects. They are now being carried out as management-type residential environment improvement projects.

Note 2. The budgets for residential environment improvement projects were reliably secured through legal and institutional mechanisms because the Bukgajwa-dong site, which was within the target area of the project, was the first to be selected as the pilot project area for Human Town in 2011 and 2012.

Note 3. Change of intended usage does not require building permits, which are necessary for actions that directly affect housing service improvement or involve direct physical alterations to houses, such as new constructions, extensions, renovations, and major repairs. However, given that it can encompass remodeling work ranging from small-scale alterations to major repairs, all intended to create new functions and spatial designs (Kim, 2016), it was included as a subcomponent of housing improvement in the present study.

Note 4. Previous studies, including those conducted by Maeng et al. (2015) and Kim and Kim (2017), also classified cases based on whether there were changes in the type of housing improvement before and after the year of project designation.

Note 5. Small-scale improvement, classified as a dependent variable, is defined as encompassing all types of housing improvement apart from New construction. This category includes activities, such as extensions, renovations, changes of intended usage, and major repairs.

Note 6. A relative land price increase rate of more than 1 indicates that the year-on-year land price increase in the corresponding parcel has exceeded the average year-on-year land price increase for the site. If the figure is less than 1, the year-on-year land price increase in the parcel is lower than the site's average year-on-year land price increase.

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