

The Factors Influencing Residential Satisfaction by Public Rental Housing Type

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Abstract

The purpose of this study is to determine the level of satisfaction among residents in public rental housing to solve the housing problems of low-income households. From among the various types of public rental housing, those with large differences in the physical housing environment were selected for an analysis of the environmental factors impacting tenants' residential satisfaction. To achieve the study's objective, the residential satisfaction of tenants in public residential housing in Seoul was researched and analyzed; results are as follows. First, the environmental factors impacting individuals living in public rental housing were described as the "Safety and Incivility Factor" (SIF), "Physical Factor" (PF), "Facilities Accessibility Factor" (FAF), and "Equipment Factor" (EF). Second, these factors were found to impact residential satisfaction of tenants in public rental apartments in the order of EF, SIF, PF, and FAF; they were found to impact the tenants of public rental general houses in the order of SIF, EF, PF, and FAF. These differences are based on the public rental housing type, which necessitates plans that consider priority improvement of residential environment factors according to housing types, to improve the residential satisfaction of tenants in both currently operating and future public rental housing.

Keywords: residential satisfaction; public rental housing; residential environment factors

1. Introduction

1.1 Background

Article 35, Clause 1 of the Constitution of the Republic of Korea states that "All citizens shall have the right to a healthy and pleasant environment. The State and all citizens shall endeavor to protect the environment." This publicly prescribes the right to pleasant living. Moreover, Article 3 of the Housing Act states that its purpose is "To make pleasant and suitable residential life available for the people" and "To ensure a preferential supply of housing on the scale of national housing to social strata in need of support on a residential welfare level, such as low-income or homeless persons, etc." In other words, a pleasant living environment is a basic right of all citizens, and the State has a responsibility to provide an environment in which citizens may sustain healthy lives, regardless of individual economic standing.

In the past, housing was defined as the physical space in which people resided and carried out their

everyday lives. Consequently, housing policies at the start of urbanization were focused on meeting demand through "increase in quantity" of housing. However, housing has risen in significance from a simple residential space to a driver of change in quality of life. In Korea specifically, where in 2002 the housing supply ratio surpassed 100%, "housing policy," which focused on housing quantity, has begun changing to "residential policy," focused instead on quality (Lee, 2003). Moreover, after 2010, "residential policy" has grown increasingly linked with "welfare policy." The perception of "achieving residential welfare" as a basic condition of the "happiness" due to all citizens is spreading, and improved policies to achieve this are put forth continuously.

Thus, improvement of residential quality has become a major goal of urban policy and planning in the modern age (Xiaoyu *et al.*, 2007). This approach is meaningful in that citizens' satisfaction with life is closely linked to residential satisfaction (Montgomery and Johansson, 1988).

However, the growing global frequency of neoliberal economic systems has led to the rapid progress of economic polarization. As a result of this phenomenon, the gap in individual residential quality grows despite regional similarities. To reduce this gap, improvement of residential quality should be given high priority. It has additionally been suggested that a solution to the housing problem for low-income households in

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difficult economic situations is a major social issue. Korea has carried out public rental housing policies on a consistent basis since the 1980s. However, public rental housing remains in short supply and is far worse in quality than regular housing. Therefore, the residential environment of this public rental housing must be improved, and to achieve this, improvements should be suggested based on research into satisfaction with housing and residential environments, targeting those tenants who currently reside in public rental housing.

1.2 Objectives

The purpose of this study is to investigate tenants' satisfaction with housing and residential environments with regard to housing type, targeting tenants who reside in public rental housing; and to suggest environmental factors that influence residential satisfaction in each type of housing. Through this research, the study aims to suggest useful methods for improvement of environments in both existing and newly formed public rental housing.

2. Literature Review

2.1 Residential Satisfaction

The justification for measurement of residential satisfaction is that it contains both current and future perspectives of residents on housing and residential environments. In other words, residential satisfaction measures the difference between the current state of the housing or environment, and what the residents wish for in terms of housing and neighborhood environments (Galster, 1987). Therefore, in a study of residential satisfaction, the definition of "residential environment" becomes critical. Normally, the residential environment is divided into the physical environment of the housing itself and the surrounding neighborhood, but the definition of "neighborhood" is ambiguous. Defining a neighborhood in a spatially accurate manner, for example, is not a simple matter. Dimensions of a neighborhood can vary based on the researcher. Therefore, a clear specification of dimensions is required prior to research (Amérigo and Aragonés, 1997).

Precedent studies reveal that existing research on residential satisfaction has focused on two main perspectives. First, standards for analysis of residential quality (Galster and Hesser, 1981; Cutter, 1982; Weidemann *et al.*, 1982), and second, use of residential satisfaction as a variable predicting action (Speare, 1974; Newman and Duncan, 1979; Weidemann and Anderson, 1985). The former delves into the extent to which the resident is satisfied with the residential environment, including the neighborhood, housing, and neighbors (Canter and Rees, 1982); the latter seeks to predict behaviors, such as residents with low residential satisfaction moving away or improving their residential quality through acting on new requirements (Priemus, 1986).

Previous studies on residential satisfaction have utilized diverse variables for the measurement of residential satisfaction, depending on the researcher. Amérigo and Aragonés (1990) utilized the following variables: "Relationships with neighbors," "Residential safety," "Basic residential infrastructure," "Neighborhood infrastructure," "Deterioration," "Urban activity and noise," "Open natural spaces," and "Miscellaneous." Of particular note is their use of psychological factors, such as relationships with neighbors, in addition to the physical factors concerning the residential environment. Fauth *et al.* (2004) examined factors including neighborhood and housing conditions, physical and mental health, and socioeconomic conditions such as economic outcomes and social contact. Alternately, rather than the physical environment, Leslie and Cerin (2008) sought to measure residential satisfaction through factors concerning the placement of the neighborhood environment surrounding housing, as well as surrounding conditions such as "Safety and walkability," "Access to destinations," "Social network," "Travel network," and "Traffic and noise." Mohit *et al.* (2010) measured residential satisfaction by exploring physical factors such as " Dwelling unit features," "Public facilities," and "Neighborhood facilities," as well as non-physical factors such as "Dwelling unit support services" and "Social environment." These various factors can be summarized as shown in Fig.1.

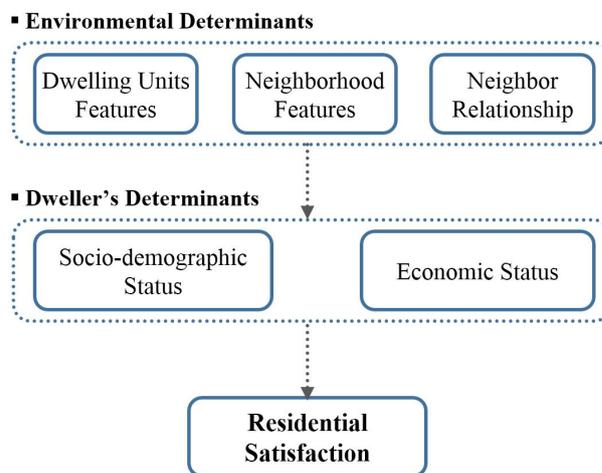


Fig.1. Determinants of Residential Satisfaction

In other words, the resident's assessment of physical factors (dwelling unit features/neighborhood features) and relationship factors (neighbor relationships) impacts human demographic factors (socio-demographic status/economic status), and this process determines residential satisfaction.

2.2 The Current State and Types of Public Rental Housing

The public rental housing policy of the Republic of Korea began with the planning of permanent rental

housing in 1989, intended to improve the residential environment of low-income households and to reduce their economic burden. Various types of public rental housing have been provided over the approximately 35 years following (Table 1.), and at the time of this study in 2014, a total of 1,176,840 units have been provided, accounting for approximately 6.06% of total (19,428,600) housing units (National Statistical Office). Permanent rental housing was organized in the form of apartment complexes, providing low-income households with housing at a one-time supply. However, these rental-housing methods changed along with the paradigm shift of housing policy to residential welfare in 2002, when the housing supply ratio exceeded 100%. In particular, this uniform rental housing construction method was shown to cause problems such as labelling, a result of separation of residents into social classes, as well as limiting the residents' selection of residential areas. Moreover, due to issues such as rising land prices, difficulties grew in acquiring the financial resources to construct rental housing in the form of large-scale apartment complexes. Therefore, a new public rental housing method was considered based on "job-housing proximity," and the Purchase-Rental Public Housing Business was introduced in 2004 to achieve residential stability among the urban poor; it remains in effect today.

Table 1. Types of Public Rental Housing

Type (Rental Period)	Primary Business Agent	Housing Type
Permanent rental (Permanent)	State, Local government, LH ^a , Local public corporation	Apartment
National rental (30 years)	State, Local government, LH, Local public corporation	Apartment
Long-term rental (20 years)	State, Local government, LH, Local public corporation	Apartment
Buy-to-rent (20 years)	Local government, LH	Detached house ^b , Multi-unit house ^c
5-10 year public rental (5-10 years)	LH, Local public corporation, Private firm	Apartment

a: Korea Land & Housing Corporation

b: including multi-family house

c: including multi-household house/row house

In terms of construction, all apartments are provided in the form of apartment complexes except for those in buy-to-rent public housing. In accordance with the Housing Act, residential units include shared welfare facilities such as public parking, shared facilities for residents, and facilities for daycare, exercise, and resting. However, because buy-to-rent public housing is provided as existing units in detached houses, multi-family houses, multi-household houses, and

row houses, external spaces apart from the residential areas are limited, and welfare facilities to be shared between residents fall excessively short when compared to apartments, resulting in a huge gap in the physical aspects of the residential environment. Furthermore, the buy-to-rent public housing is weak in terms of neighborhood environments and especially the transportation infrastructure. This is because the locations for buy-to-rent public housing are limited by the fact that public organizations buy this type of housing with the intention of selling it, whereas the public rental housing in the form of apartment complexes considers affordability and prioritizes easy access to public transportation when selecting the housing location. Thus, this study divides apartments into two types: "Apartment" and "General House" (which includes detached houses, multi-family houses, multi-household houses, and row houses).

3. Methodology

This study was performed based on the results of the state of rental housing research carried out in 2011 (the Ministry of Land, Infrastructure and Transport of the Korea government), and the survey period is from July to November. This research targeted rental units, including both public rental housing units and general rental units. The general rental units, which were not targets of the present study, were excluded; responses concerning public rental housing units were included. Moreover, to analyze the differences in residential satisfaction with regard to housing type, this study compared the residential satisfaction of residents living in buy-to-rent housing, and residents in apartment complex public rental housing (permanent rental, national rental, long-term rental, 5-10 year public rental, and employee rental). This study additionally targeted the oldest form of public rental housing, permanent rental apartments. Because residential support for low-income housing varies depending on the local government, residents of public rental housing located in Seoul were selected for analysis to restrict deviation.

The research used a structured questionnaire and a trained interviewer to carry out face-to-face personal interviews. The researchers also used the CAPI (Computer Aided Personal Interview) system to increase the study's effectiveness. Research content was divided into general items (gender, age, rental type, housing type, year of construction), dwelling unit satisfaction, and neighborhood environment satisfaction (see Table 2.). Level of satisfaction was measured on a 4-point scale.

4. Results

4.1 Status of Research Subjects

Table 2. shows the general characteristics of the demographic status and residences of the research subjects.

Table 2. Characteristics of Participants

Character-istics	Division	Total		permanent rental		buy-to-rent	
		f	%	f	%	f	%
Gender	Male	858	51.2	649	51.0	209	51.9
	Female	818	48.8	624	49.0	194	48.1
	Total	1,676	100	1,273	100	403	100
Age	Below 30	22	1.3	9	0.7	13	3.2
	30~39	74	4.4	40	3.1	34	8.4
	40~49	227	13.5	95	7.5	132	32.8
	50~59	394	23.5	284	22.3	110	27.3
	60~69	442	26.4	397	31.2	45	11.2
	70 or above	517	30.8	448	35.2	69	17.1
	Total	1,676	100	1,273	100	403	100
Housing type	General housing ^a	403	24.0	-	0	403	100
	Apartments	1,273	76.0	1,273	100	-	0
	Total	1,676	100	1,273	100	403	100
Year of construction	After 2005	67	4.0	-	0	67	16.6
	1995~2004	268	16.0	100	7.9	168	41.7
	Before 1994	1,341	76.5	1,173	92.1	110	27.3
	Unknown	58	3.5	-	0	58	14.4
	Total	1,676	100	1,273	100	403	100

a: including detached houses, multi-family houses, multi-household houses, row houses

Overall, 80.7% of respondents were over the age of 50. For permanent rental housing, 88.7% of the respondents were over the age of 50, which is a relatively high percentage compared to the buy-to-rent housing group, where only 55.6% of respondents

were over the age of 50. Rental types consisted of 1,273 cases (76%) of permanent rental housing, and 403 cases (24%) of buy-to-rent housing. Housing types consisted of 1,273 (76%) apartments, and general housing (including detached homes, multi-family houses, multi-household homes, and row houses) (24%). In other words, public permanent rental housing consists of apartment complexes, while public buy-to-rent housing is comprised of general housing. Lastly, the records of rental housing construction periods showed that over 90% of the permanent rental housing units were built before the mid-1990s, which explains the severe structural deterioration in the buildings. However, more than 55% of the buy-to-rent housing structures are only about 10 years old.

4.2 Differences in Satisfaction According to Housing Type

The authors examined satisfaction in dwelling units and neighborhood environmental factors to determine the residential satisfaction of public rental housing residents (Table 3.). As a result of studying all respondents' residential satisfaction, NES 16_Overall neighborhood environment satisfaction, at 2.9, was higher than DUS 9_Overall dwelling unit satisfaction at 2.79. For detailed evaluation elements, the highest

Table 3. Analysis of Satisfaction According to Housing Type^a

Division	Total average (n=1,676)	General housing average (a) (n=403)	Apartment average (b) (n=1,273)	Mean difference (b-a)	t
DUS 1_Usable areas	2.61	2.75	2.56	-0.19	-5.401***
DUS 2_Number of rooms	2.67	2.79	2.63	-0.16	-4.485***
DUS 3_Room size	2.55	2.71	2.50	-0.21	-5.878***
DUS 4_Layout of each room (plane structure)	2.77	2.76	2.78	0.02	0.545 ^{n.s}
DUS 5_Ventilation and lighting	2.81	2.57	2.89	0.32	7.997**
DUS 6_Heating conditions (winter temperatures)	2.75	2.66	2.78	0.12	3.209**
DUS 7_Soundproofing (blocking noise between floors and extraneous noise)	2.54	2.44	2.58	0.14	3.211**
DUS 8_Satisfaction in remodeling when moving in	2.85	2.69	2.90	0.21	6.394***
DUS 9_Overall dwelling unit satisfaction	2.79	2.70	2.82	0.12	3.94***
NES 1_Accessibility to markets, hypermarkets, and department stores	2.94	2.73	3.01	0.28	7.566***
NES 2_Accessibility to hospitals and medical welfare facilities	2.94	2.76	3.00	0.24	7.046***
NES 3_Accessibility to cultural facilities, parks, and playgrounds	2.98	2.77	3.05	0.28	7.849***
NES 4_Accessibility to public transportation such as buses and subways	3.03	2.81	3.10	0.29	8.565***
NES 5_Convenience in using parking facilities	2.94	2.80	2.99	0.19	5.473***
NES 6_Burden in commuting to work or school	3.03	2.90	3.07	0.17	5.03***
NES 7_Educational environments such as schools and private educational institutes	2.98	2.91	3.00	0.09	3.383**
NES 8_Public security issues such as burglaries and robberies	2.90	2.76	2.95	0.19	5.861***
NES 9_Car horns and noise levels around the house	2.69	2.65	2.70	0.05	1.369 ^{n.s}
NES 10_Cleanup and state of refuse disposal around the house	2.78	2.73	2.80	0.07	1.694 ^{n.s}
NES 11_Satisfaction with relationships with neighbors	3.00	2.86	3.05	0.19	6.264***
NES 12_Privacy protection from neighbors	2.93	2.89	2.94	0.05	1.581 ^{n.s}
NES 13_Safety from disasters	3.04	2.98	3.06	0.08	2.846**
NES 14_Facility management within the complex, such as elevators	3.00	-	3.00	0.12	0.931 ^{n.s}
NES 15_Exterior of the complex, such as outer wall painting and landscape	2.96	-	2.96	0.13	-2.891**
NES 16_Overall neighborhood environment satisfaction	2.96	2.82	3.01	0.14	6.506***

* p < .05, ** p < .01, *** p < .001

a: 1 point – very unsatisfied, 2 points – unsatisfied, 3 points – satisfied, 4 points – very satisfied

DUS: Dwelling Unit Satisfaction, NES: Neighborhood Environment Satisfaction

average in "dwelling unit satisfaction" was DUS 8_Satisfaction in remodeling when moving in (2.85), followed by DUS 5_Ventilation and lighting (2.81), and DUS 4_Layout of each room (plane structure) (2.77). The highest average of "residential satisfaction" was NES 13_Safety from disasters (3.04), followed by NES 4_Accessibility to public transportation such as buses and subways (3.03), NES 6_Burden in commuting to work or school (3.03), NES 11_Satisfaction with relationships with neighbors (3.00), and NES 14_Facility management within the complex, such as elevators (3.00).

Next, the authors classified respondents' housing type into "general housing" and "apartments" to determine residential satisfaction according to housing type. In DUS 9_Overall dwelling unit satisfaction, "apartment" residents (2.82) turned out to be more satisfied than "general housing" residents (2.70). In NES 16_Overall neighborhood environment satisfaction, "apartment" residents (3.01) also showed more satisfaction than "general housing" residents (2.82). After investigating the difference between the two groups' satisfaction to compare the level of residential satisfaction, the authors found that "apartment" residents were overall more satisfied than "general housing" residents. In particular, there is a great difference among DUS 5_Ventilation and lighting, NES 4_Accessibility to public transportation such as buses and subways, NES 1_Accessibility to markets, hypermarkets, and department stores, NES 3_Accessibility to cultural facilities, parks, and playgrounds, NES 2_Accessibility to hospitals and medical welfare facilities, and DUS 8_Satisfaction in remodeling when moving in. However, the authors found that "general housing" residents were more satisfied with DUS 3_Room size, DUS 1_Usable areas, and DUS 2_Number of rooms.

4.3 Factor Analysis of Determinants of Residential Satisfaction

Residential satisfaction showed a great difference depending on housing type. To determine the environmental factors affecting the residential satisfaction of residents living in each housing type, the authors conducted a factor analysis of 21 elements (the authors excluded DUS 9 and NES 16 in order to use them as dependent variables in future regression analysis, as well as NES 14 and NES 15, since these traits are irrelevant to general housing). The authors classified a total of 21 environmental qualities into four factors. The KMO measure was 0.893, and the significance probability of Bartlett's sphericity test turned out to be .000, indicating that it is suitable for use as data to conduct a factor analysis. The total variance explained through the factor analysis was 56.763%. In addition, to test the reliability, the authors studied Cronbach's alpha values, which can measure internal consistency, via each extracted factor. Consequently, all values turned out to be 0.6 or above.

Based on the factor analysis (Table 4.), the authors grouped the elements into four types. The first is the "Safety and Incivility Factor," consisting of "NES 12_Privacy protection from neighbors," "NES 10_Cleanup and state of refuse disposal around the house," "NES 9_Car horns and noise levels around the house," "NES 8_Public security issues such as burglaries and robberies," "NES 11_Satisfaction with relationships with neighbors," "NES 13_Safety from disasters," "NES 5_Convenience in using parking facilities," and "NES 7_Educational environments such as schools and private educational institutes." The second quality is the "Physical Factor," consisting of "DUS 1_Usable area," "DUS 2_Number of rooms," "DUS 3_Room size," and "DUS 4_Layout of each room (plane structure)." The third feature is the "Facilities Accessibility Factor," consisting of "NES 2_Accessibility to hospitals and medical welfare facilities," "NES 1_Accessibility to markets, hypermarkets, and department stores," "NES 4_Accessibility to public transportation such as buses and subways," "NES 3_Accessibility to cultural facilities, parks, and playgrounds," and "NES 6_Burden in commuting to work or school." The fourth attribute is the "Equipment Factor," consisting of "DUS 5_Ventilation and lighting," "DUS 6_Heating conditions (winter temperatures)," "DUS 8_Satisfaction in remodeling when moving in," and "DUS 7_Soundproofing (blocking noise between floors and extraneous noise)."

Table 4. Analysis of Residential Environmental Factors

Factors	Factor Eigen loading values	Variance	Cronbach' α
Safety & Incivility Factor (SIF)	3.92	18.665%	0.820
NES 12	0.757		
NES 10	0.687		
NES 9	0.661		
NES 8	0.659		
NES 11	0.626		
NES 13	0.609		
NES 5	0.567		
NES 7	0.562		
Physical Factor (PF)	2.999	14.283%	0.880
DUS 1	0.914		
DUS 2	0.91		
DUS 3	0.89		
DUS 4	0.599		
Facilities Accessibility Factor (FAF)	2.876	13.695%	0.807
NES 2	0.776		
NES 1	0.757		
NES 4	0.713		
NES 3	0.705		
Equipment Factor (EF)	2.125	10.121%	0.660
DUS 5	0.776		
DUS 6	0.737		
DUS 8	0.602		
DUS 7	0.507		

4.4 Regression Analysis of Factors Affecting Residential Satisfaction

To examine the environmental factors affecting residential satisfaction according to housing type, the authors set four factors extracted in <4.3> as independent variables, and set the residential satisfaction of residents as a dependent variable for regression analysis. The authors determined the residents' residential satisfaction using the average of DUS 9 and NES 16. The authors used the stepwise method for the input of the independent variables.

By analyzing the residential environmental factors that affect the residential satisfaction of "apartment" residents, the authors extracted four models, and selected the model with the highest explanation power. In the selected regression model, the authors showed that 4 residential environmental elements (SIF, PF, FAF, EF) influenced residential satisfaction. Hence, the residential environmental factors included in the model explain 58% (adjusted R²: 57.5%) of residential satisfaction in terms of apartments (see Table 5.).

Table 5. Regression Model Summary of Factors for Residential Satisfaction in Apartments^e

Model	R	R Square	Adjusted R Square	Std. Error of the estimate
1	.592 ^a	0.351	0.349	0.3996
2	.679 ^b	0.462	0.458	0.36444
3	.726 ^c	0.526	0.522	0.34235
4	.762 ^d	0.58	0.575	0.32292

- a. Predictors: (Constant), SIF
- b. Predictors: (Constant), SIF, PF
- c. Predictors: (Constant), SIF, PF, FAF
- d. Predictors: (Constant), SIF, PF, FAF, EF
- e. Dependent Variable: Residential Satisfaction

Due to variance analysis for the 4 residential environment factors, the F value was 110.102, and Sig. was 0.000 (p < .01). One can see that the analyzed regression analysis is statistically significant (Table 6.).

Table 6. Regression Model Variance Analysis of Factors for Residential Satisfaction in Apartments^b

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	45.924	4	11.481	110.102	.000 ^a
Residual	33.264	319	0.104		
Total	79.188	323			

- a. Predictors: (Constant), EF, SIF, PF, FAF
- b. Dependent Variable: Residential Satisfaction

Next, the authors tested the influence of residential environment factors on residential satisfaction and statistical significance. In the derived regression equation, the tolerance for diagnosing multicollinearity between the independent variables was 0.985 at maximum, and the VIF was 1.03, showing that there is no problem in the correlation between the independent variables.

The residential environment factors affecting residential satisfaction in apartments that vary considerably at the significance level of 0.05 were EF

(t=15.42, p=.000), SIF (t=10.492, p=.000), PF (t=6.967, p=.000), FAF (t=6.378, p=.000) (see Table 7.).

Table 7. Regression Analysis Results of Factors for Residential Satisfaction in Apartments

Model	UC	SC	t	Sig.	CS	
	B	Std. Error	Beta		Tolerance	VIF
(Constant)	2.856	0.021		135.601	0.000	
EF	0.243	0.016	0.565	15.42	0.000	0.982
SIF	0.194	0.018	0.386	10.492	0.000	0.971
PF	0.148	0.021	0.255	6.967	0.000	0.985
FAF	0.091	0.014	0.235	6.378	0.000	0.973

UC: Unstandardized Coefficients

SC: Standardized Coefficients

CS: Collinearity Statistics

Next, after analyzing the residential environmental factors that affect the residential satisfaction of "general housing" residents, the authors extracted four models, and selected the model with the highest explanation power. In the chosen regression model, the authors showed that 4 residential environmental elements (SIF, PF, FAF, EF) influenced residential satisfaction. Hence, the residential environmental factors included in the model explain 61.2% (adjusted R²: 61.1%) of residential satisfaction in general housing (see Table 8.).

Table 8. Regression Model Summary of Factors for Residential Satisfaction in General Housing^e

Model	R	R Square	Adjusted R Square	Std. Error of the estimate
1	.512 ^a	0.262	0.261	0.3386
2	.647 ^b	0.418	0.417	0.30076
3	.754 ^c	0.568	0.567	0.25922
4	.782 ^d	0.612	0.611	0.2458

- a. Predictors: (Constant), SIF
- b. Predictors: (Constant), SIF, PF
- c. Predictors: (Constant), SIF, PF, FAF
- d. Predictors: (Constant), SIF, PF, FAF, EF
- e. Dependent Variable: Residential Satisfaction

Due to variance analysis for the 4 residential environment factors, the F value was 373.042, and Sig. was 0.000 (p < .01). One can see that the analyzed regression analysis is statistically significant (Table 9.).

Table 9. Regression Model Variance Analysis of Factors for Residential Satisfaction in General Housing^b

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	90.154	4	22.538	373.042	.000 ^a
Residual	57.095	945	0.06		
Total	147.248	949			

- a. Predictors: (Constant), SIF, PF, EF, FAF
- b. Dependent Variable: Residential Satisfaction

Next, the authors tested the influence of residential environment factors on residential satisfaction and statistical significance. In the derived regression equation, the tolerance for diagnosing multicollinearity between the independent variables was 0.997 at maximum, and the VIF was 1.008, showing that there is no problem in the correlation between the independent variables.

Table 10. Regression Analysis Results of Factors for Residential Satisfaction in General Housing

Model	UC		SC	t	Sig.	CS	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	2.888	0.008		351.8	0.000		
SIF	0.198	0.008	0.504	24.793	0.000	0.995	1.005
EF	0.169	0.009	0.394	19.423	0.000	0.997	1.003
PF	0.145	0.008	0.376	18.497	0.000	0.995	1.005
FAF	0.099	0.01	0.21	10.351	0.000	0.992	1.008

UC: Unstandardized Coefficients

SC: Standardized Coefficients

CS: Collinearity Statistics

The residential environment factors affecting residential satisfaction in general houses that vary considerably at the significance level of 0.05 were SIF ($t=24.793$, $p=.000$), EF ($t=19.423$, $p=.000$), PF ($t=18.492$, $p=.000$), FAF ($t=10.351$, $p=.000$) (see Table 10.).

5. Discussion

This study aims to determine how satisfied residents are with public rental housing, which was developed and implemented to solve the residential problems of low-income groups. This study focused on public rental housing, which shows a great difference in physical residential environments among various types, and analyzed the environmental factors affecting residents' residential satisfaction. The results will be used to determine the suitability of residential environments in future public rental housing, or improve current public rental housing. The details of the analysis are as follows.

First, regarding the satisfaction of residents and detailed residential environmental factors (Table 2.), the satisfaction of apartment residents turned out to be higher in terms of all residential environmental factors, excluding those of the physical form of housing (usable areas, number of rooms, room size). This is due to the difference in residential environments, which inevitably occurs according to the construction type of public rental housing. In particular, a settled population is concentrated in apartments in the form of a complex; thus, apartments provide a setting suitable for education, business, and culture facilities. Moreover, since residents share the exterior space within the complex, there are more opportunities to be in touch with one another, thereby relatively increasing the opportunity for mutual trust than for general housing residents. Furthermore, manpower for complex management is stationed in the complex, and regular meetings among residents (per complex) enable them to maintain and repair the complex. This indicates that there is a system for constantly managing safety or cleanliness. Therefore, residents' residential satisfaction in public housing apartments is higher than that of residents in public rental general housing. Previous studies show similar results (Kim and Noh, 2011). Furthermore, the older age group, which comprised the majority of the respondents, showed dissatisfaction

with the effectiveness of soundproofing (DUS 7) and levels of noise pollution (NES 9) in the housing units. This dissatisfaction rate from the majority of respondents indicates that this is an important problem to solve. According to Akeroyd *et al.* (2007) and Aydelott *et al.* (2010), senior residents who are prone to hearing loss may have difficulty hearing essential sounds, such as safety alarms, a phone ringing, and daily conversation due to noise pollution and inefficient soundproofing. Therefore, we believe that housing for senior residents requires a building code for acoustic design to resolve and prevent problems related to hearing loss.

Next, it is necessary to discuss the differences found in the analysis of how the extracted residential environmental elements (SIF, PF, FAF, EF) from the factor analysis affect residential satisfaction according to the type of public rental housing (Fig.2.).

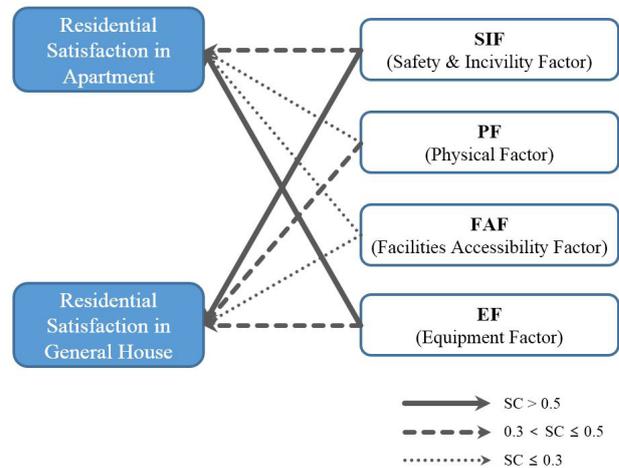


Fig.2. Residential Environment Factors Affecting Residential Satisfaction

On the other hand, the Safety & Incivility Factor (SIF) and the Equipment Factor (EF) have a relatively significant effect on the residential satisfaction of public rental housing residents. Social interests and the demand for safety from crimes have been recently increasing. According to the broken windows theory by Wilson & Kelling, cleanliness or noise in the neighborhood may also affect the occurrence of crime. From this perspective, SIF is a key factor of residential satisfaction. EF is the factor that can be approached most easily to improve homes' physical environments. This is because functions such as heating, soundproofing, and lighting can be easily enhanced by repairing windows and doors. Furthermore, indoor environments can be improved only by replacing old boilers or finishing materials with those that have excellent insulation effects.

However, the effects of SIF and EF varied according to housing type. First, the residential satisfaction of apartment residents is more affected by EF than SIF. This is because apartment-type public rental housing

is in the form of a complex, thereby limiting outsiders' access to the complex through the security office at the main entrance or around fences. Safety is improved by installing CCTVs or alarms in dangerous spaces. Therefore, apartment residents have a high interest in improving performance within housing. Permanent rental housing consists of worn-out apartments over 30 years old, which increases the demand for EF. Accordingly, to improve the residential satisfaction of permanent rental housing, the management authority (see Table 1.) must actively resolve issues related to facilities. This is because current permanent rental housing residents face difficulty in voluntarily improving the environment due to a lack of financial ability.

On the contrary, the entrances of general housing face directly onto the street, with no separate management staff, which makes it difficult to control outsiders' access. Moreover, buy-to-rent houses are not concentrated in a single area, but are scattered sporadically; thus, it is difficult to manage them. In addition, realistically speaking it is difficult to build a cooperative relationship with neighborhood residents. Accordingly, it is relatively more urgent and important than EF to manage and improve protection against outside intrusion or neighborhood environments. To resolve this issue, it is important to induce active participation, not only on the part of the management authority or rental housing residents, but also administrative agencies with control over the region (e.g., local governments, police agencies, and fire stations). Satisfaction with SIF can be improved by reinforcing patrols in dangerous areas, installing more CCTVs, and improving the workforce to sustain cleanliness.

This study only used dwelling units and neighborhood environments for analysis to evaluate the residential satisfaction of those who live in public rental housing. However, there is a need to examine individual characteristics, as it is important to investigate subjective judgments according to each person's residential satisfaction. Therefore, it is necessary to study more subdivided classes in the future, through which it will be possible to seek solutions to improve the residential environments of public rental housing.

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