Sustainable Urban Development and Residential Space Demand in the Untact Era: The Case of South Korea

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Abstract

The study analyzes the demand for residential space in the Untact Era. Residential space comprises six categories: the most necessary dedicated space (DS), most preferred south-facing space (SFS), largest space (LS), most necessary shared space (SS), most necessary infra-space (IS), and others. Results indicated the following: 1) All respondents had the highest preference for relaxing spaces except DS. 2) Differences were found between DS, SFS, and LS by age and SS; IS by residential area; and DS, SS, and IS by household size. 3) People aged 60+ preferred a living room while people aged 40–59 preferred a larger kitchen. Seoul citizens preferred gardens or parks in the complex or neighboring forests whereas local citizens preferred shared offices and medical centers. Households of three or more persons preferred a park/forest and two-person households preferred a honbap restaurant. The implications for housing policy are as follows. 1) Nature-friendly spaces are needed to alleviate a sense of isolation. 2) Changing demand for residential space should be reflected in housing policies. 3) The government's housing supply policy with the same residential space and structure must be changed to provide various residential spaces according to age, residential area, and household size.

Keywords: Untact Era, Residential Space Demand, Dedicated Space, Shared Space, Residential Infra-space

JEL Classification Code: A19, R11, R12, R21, R28

1. Introduction

In 2016, the global era of the 4th industrial revolution began in earnest. In response, numerous sociologists emphasized the human reaction, signaling the advent of the Untact Era (UE). The UE, which emerged rapidly due to social restrictions imposed by the novel coronavirus (hereafter, COVID-19), reduced human contact with advances in digital technology. It continues to appear in various forms, such as non-face-to-face, non-contact, and unmanned services, which replace human interaction. In the UE, consumers regularly use non-face-to-face services such as kiosks, delivery app orders, and online shopping. The global COVID-19 pandemic brought about radical changes in perceptions and behavior throughout society with a new lifestyle, known as "untact". South Korea's education will center on online universities. The cultural performance industry is witnessing an increase in untact concerts, exhibitions, and performances, while large K-pop music agencies are building online platforms. Korea's CGV Yeouido was reborn as an untact cinema that minimizes face-to-face encounters. South Korea's untact medical treatment includes drive-through screening clinics that easily and quickly perform door-to-door examinations and sample collection while patients wait in the car. This method has been well received worldwide for minimizing face-to-face contact between patients and the medical staff, reducing diagnosis time. Hence, the economy, education, logistics, marketing, travel, culture, health care, and consumption of the UE is underway and warrants further research (Widagdo & Roz, 2021).

Residential space in the UE is fast evolving. Online education (Wolor et al. 2020), telecommuting, and online lifestyles are expected to accelerate as the existing physical buildings are reconstructed around residential spaces. With

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people spending considerable time at home, interest in nature is increasing. Subsequently, demand for residential spaces containing or located near natural environments will increase. In the UE, demand for apartments with terraces and residential infrastructure spaces with forests or parks is expected to rise. The demand for residential space in the UE will vary depending on age, residential area, and household size. Therefore, supplying housing that reflects the changing demand for residential spaces in the UE will positively affect the quality of life of many people. In the past, much time has been spent in offices and schools and the house was perceived as a place for rest. However, houses in the UE have various functions, serving as a school, office, and gym; thus, the residential space has become more important. This study analyzes the demand for residential spaces in the UE and presents implications for housing providers and government housing policies based on the results.

2. Literature Review

The global situation brought about by COVID-19 in 2020 stimulated numerous studies related to the UE, especially regarding untact customer service plans (Lee & Lee, 2020), untact technology, untact education, and untact medical care (Pramana et al., 2020). However, empirical analysis of the demand for residential space in the UE is insufficient.

The recent surge in untact lifestyles is expected to continue as an important socio-economic phenomenon after COVID-19. The sustainability of the UE lies in the effects of the government's lockdown policy, diffusion and adoption, and development of the 4th industrial revolution technology (Agustina, & Pramana, 2019). Currently, technologies, such as 5G, data accumulation and AI utilization, and block chain, are evolving globally. Service innovation is accelerating by transcending physical space through connectivity between robots and smart devices. Systems that allow customers to order through smartphone applications (Ryu, 2019) or kiosks are already common (Cha & Seo, 2019; Lee & Lee, 2020), even though companies retain clerks in their stores; examples are commonly found in coffee shops and fast-food restaurants. This reduces the burden of face-to-face contact with clerks and the wait time for food, which is receiving positive responses from users. The number of untact stores (Ao et al., 2020; Cho et al., 2020; Lakhwani et al., 2020), which are the heaviest users of technology, is increasing; examples include Tao Cafe and Amazon Go unmanned stores established by Alibaba and Amazon, respectively (Goh et al., 2021).

The Korean approach to work style, education style, and industry is changing. In Korea, owing to the UE, work patterns are becoming more flexible and telecommuting rates are increasing, with 75 percent of large Korean companies newly introducing or expanding flexible work systems to cope with COVID-19. Additionally, 51.1 percent of Korean conglomerates plan to continue and expand flexible work systems after the pandemic ends. Korea is expected to rapidly introduce various methods of working and telecommuting. As Korea continues to transition, the UE is accelerating the introduction of online education in elementary, middle, and high schools, as well as in colleges and professional education settings. Interest in edu-tech is rising, and Korea is witnessing attempts to introduce various services, including Zoom. Through FinTech, the Korean financial sector can access various investments without having to go directly to financial institutions (Seo & Seo, 2020). Korean consumer preference for untact is growing rapidly. To counter the change, the nation's financial sector is expanding its online banking sector. The number of offline branches for all commercial banks in the first quarter of 2020 was 6,658, down 56 from the fourth quarter of 2019 and 85 from the third quarter of 2019. Korea's method of consumption has also been transformed by the UE. Untact technologies, such as kiosks (unmanned vending machines) and chatbots, eliminate the need for customers to receive help from shop assistants when purchasing products. With the emergence of generations for whom it is easier to click than to converse, untact technology utility increases (Han, 2020; Lee et al., 2020; Min & Lee, 2020). The home training (HOMT) market, which enables individuals to exercise at home, is growing rapidly in Korea. Yoga mats, home-based apps, YouTube broadcasts, and online coaching services are booming. HOMT has acquired an important position in the healthcare market, coupled with demand for replacement of fitness centers, increased dieting due to reduced outdoor activities, systematic and numerical exercise records, and application of new AI. The market for hardware and software, such as HOMT-related products and remote coaching content, is increasing. According to G-market, sales of fitness equipment, weight equipment, and fitness and yoga products increased by 20 percent in 2020.

Therefore, in the UE, residential spaces must perform various functions. In addition to be a residence, a house must now be an office, a classroom, a gym, and a space for meetings. Residential spaces in the UE require functions beyond those in the contact era, such as eating and sleeping. In line with these evolving times, and as the UE changes, satisfying the demand for residential spaces and understanding the new needs of their users will be essential. Government policies and housing supplies will need to reflect these changing demands for residential spaces. Studies related to residential spaces in the UE focus on residential space and health related to COVID-19. Public hygiene and well-being need to be considered comprehensively to cope with infectious diseases. Previous

research has examined housing environmental effects that heal people's mental health during the lockdown in the UE, which began with COVID-19. The environmental considerations of prevention of infectious diseases and the need to rebuild after COVID-19 (Choi et al., 2020) were studied. Choi and Jun (2020) examined urban spatial structure as an extended concept of residential space in the UE as well as socio-technological factors in changing urban spaces. Some studies emphasized that during COVID-19 and the subsequent UE, humans, including children, can be comforted by nature (Swank et al., 2020). Hence, there is a significant lack of research on residential spaces in the UE. As research in various fields related to the early stage of the UE is conducted, studying residential spaces as the center of individuals' lives is important. There is a need to research what kinds of residential spaces in the UE can accommodate various functions, but thus far, such attempts have been insufficient. Therefore, this study analyzes the demand for residential space in the UE. Data was constructed through a survey and empirical analysis was conducted. Based on the results of the analysis, this study provides important implications for government policy or housing providers.

3. Data and Research Methods

3.1. Data

In this study, the data were gathered using a survey. As of 2019, the number of apartment buildings in Korea was about 14 million, accounting for 77.2% of total housing (Korea Statistical Office, 2019). Since Korea has a small land area, less available land, and a high proportion of people living in cities, the proportion of people living in apartments with high land efficiency is high. Therefore, this study surveyed the residents of apartment houses, a representative type of housing in Korea. This study used stratified random sampling based on age, residential area, and the number of household members. Age classification was 20–39 years old, 40–59 years old, and over 60 years old. Residential areas were divided into Seoul (capital), Metropolitan area (Incheon and Gyeonggi-do), and Local city (cities excluding Seoul and the metropolitan area). Household size was divided into 1, 2, and 3 or more. The same allocation method was used to age, residential area, and household size. The survey period was from October 1, 2020 to October 20, 2020. The data were collected from 550 survey responses. Surveys that included missing responses were excluded and the final analysis was conducted on 523 responses.

After COVID-19, in the UE, the demands for residential spaces diversify, and the time to stay increases, so the residential spaces are changing dramatically. Therefore, in addition to the basic functions of a living space: eating, sleeping, and relaxing, residential spaces require spaces for leisure and rest, work and study, and exercise (Kunzmann, 2020; Camba et al., 2020).

The survey of residential space demand in the UE was composed of six categories: 1) The most necessary dedicated space for household members (DS), 2) The most preferred south-facing space (SFS), 3) the space requiring the largest area (LS), 4) the most necessary shared space in an apartment house (SS), 5) the most necessary residential infrastructure space (IS), and 6) other spaces.

Detailed items for evaluating these six sections were determined as follows by referring to the contents discussed in previous studies (Kunzmann, 2020). The detailed items are (1) Eating (E): the space to cook and eat , (2) Sleeping (S): sleeping space (3) Relaxing (R): the space for leisure and rest, (4) Working (W): the space for working and learning, (5) Exercising (X): exercising space, and (6) others (O). In DS, SFS, and LS, eating space is a kitchen with a dining room, sleeping space is a bedroom, relaxing space is a living room with a terrace, working space is a home office, and exercising space is HOMT. In SS, eating space is a shared kitchen, sleeping space is a guest house, relaxing spaces are a park or garden in the complex, working and learning space is a shared office, and exercising space is a fitness center. In IS, eating space is a *honbap* restaurant (a restaurant where you can eat alone), sleeping space is a hotel, relaxing spaces are parks and forests, working spaces are a shared office and/or study cafes, and exercising spaces are hiking and/or walking trails.

3.2. Research Hypothesis

This study began with the awareness that the UE triggered by COVID-19 changes the demand for residential space as the amount of time individuals spend at home has increased. The research question analyzed examines the demand for residential space in the UE as it depends on the age, area of residence, and household size. This study proposes three hypotheses.

H1: There is a difference in demand for residential space by age.
H2: There is a difference in demand for residential space by residential area.
H3: There is a difference in demand for residential space by household size.

3.3. Analysis Methods

Methods for analyzing the research questions are frequency analysis, ANOVA analysis and post-mortem

analysis, and cross-analysis. The ANOVA analysis and Levene test for choosing the post-analysis methods to verify the research hypothesis are as follows. Levene test statistic for equal variances

$$P_O = \frac{(N-k)\sum_{i=1}^{k} n_i (\overline{z}_1 \quad \overline{z})^2}{(k-1)\sum_{i=1}^{k}\sum_{j=1}^{n_j}(z_{ij} - \overline{z}_1)^2} \tag{1}$$

k : Number of groups, n_i : number of ith level samples, N : Total number of samples

The ANOVA analysis verified significant differences between groups within a 5 percent significance probability. The post-hoc analysis methods (Scheffe and Dunnett T3) were selected according to the Levene test results. When equal variance is assumed, the Scheffe test is used. It performs concurrent pairwise comparisons for all possible pairwise average combinations, using the F sampling distribution. It can be used to investigate all possible linear combinations of group means, as well as pairwise comparisons. The Dunnett T3 test is appropriate when the variances are unequal. This is a pairwise comparison test based on studentized maximum coefficients

4. Results and Discussion

4.1. Frequency Analysis

The age distribution of respondents was 34 percent for those aged 20–39, 32.5 percent for those aged 40–59, and 33.5 percent for those over 60. Thirty-four percent of respondents lived in Seoul, 34.5 percent in the metropolitan area, and 31.5 percent in local cities. The household size was 32 percent for 1 person, 33 percent for 2 persons, and 35 percent for 3 or more persons.

The results of the analysis of the frequency of demand for residential spaces are as Table 1.

Results for DS are as follows. The highest proportion was the bedroom, followed by the home office. The reason is that the demand for home offices has increased due to the flexible working system and telecommuting. There was also a significant demand for a living room with a terrace to alleviate the stuffiness of the indoor space, as well as demand for a space to exercise at home. Finally, there was demand for pet space in other spaces. In Korea, there is a strong preference for south facing residential spaces. In SFS, a living room with a terrace occupied the largest proportion. The living room is the most preferred space where Koreans spend most of their time at home and the terrace of an apartment house is in front of the living room. In south-facing houses, the sun is high in the summer, therefore, sunlight deeply penetrates the room. In winter, as the sun is low, sunlight spreads across the house.

Results for LS are as follows: The living room occupied the largest proportion because it functions as a home office and kitchen when there are few rooms. In the UE, there are more opportunities to cook at home. Therefore, preference for spacious kitchens and dining rooms is increasing.

For SS, outdoor parks or gardens within the complex comprised the largest proportion, reflecting the psychology of people who want to eliminate isolation or depression by experiencing nature. Next is the guest house: This represents the demand for booking a guest house for customers when they visit, instead of putting them up at their own home. In the case of small communal houses, there is a demand for shared offices and shared kitchens. Other spaces mentioned were spaces to meet visitors and a pleasant waste treatment plant. In IS, parks and forests are the largest proportion, followed by trails. This reflects people's desire to resolve lack of exercise and depression through light walks in the midst of nature. It is the result of wanting to exercise in nature rather than an indoor space. There was also demand for a *honbap* restaurant. Other spaces were cultural spaces and medical centers.

4.2. ANOVA Analysis and Post Analysis

The post-test results for age and residential space demand are shown in Table 2 below.

Differences in DS were found between those over 60 and 20–39 years old as well as between those over 60 and 40–59 years old. In SFS, there were differences between those in the 20–39 years old and 40–59 years old categories, as well as between 40–59 years old and those over 60 years old. Differences in LS were found between those in the 40–59 years old and 20–39 years old categories and also between 40–59 years old and those over 60.

Table 1: Frequency Analysis of Residential Space Demand

	Eating	Sleeping	Relaxing	Working	Exercising	Others	SUM
Dedicated Space(%)	16.3	28	17.3	22.7	14.5	1.2	100.0
South-facing Space(%)	2.7	13.1	65.6	13.4	5.2	0	100.0
The Largest Space(%)	21.4	6.1	47.2	15.9	9.4	0.0	100.0
Shared Space(%)	2.1	20.0	50.5	9.8	7.7	9.9	100.0
Infra-Space(%)	18.2	0.0	37.5	13.2	20.8	10.3	100.0

Table 2: Post-hoc Test of Age and Residential Space Demand (Multiple Comparison)

Age		DS(Dunnett T3)		SFS(Dunnett T3)		LS(Dunnett T3)	
		Mean	Standard error	Mean	Standard error	Mean	Standard error
2030	4050	−0.0525	0.0863	−0.4361*	0.1455	−0.3586*	0.0857
	60+	−0.3323*	0.1071	0.1168	0.1244	0.2375	0.1466
4050	2030	0.0525	0.0863	0.4361*	0.1455	0.3586*	0.0871
	60+	−0.2798*	0.1037	0.5529*	0.1491	0.4272*	0.1663
60+	2030	0.3323*	0.1071	−0.1168	0.1244	−0.2375	0.1466
	4050	0.2798*	0.1037	−0.5529*	0.1491	−0.4272*	0.1663

Note: 2030 = aged 20 – 39 years, 4050 = aged 40 – 59 years, and 60+ = aged 60+ years. *: Mean difference is significant at the 0.05 level.
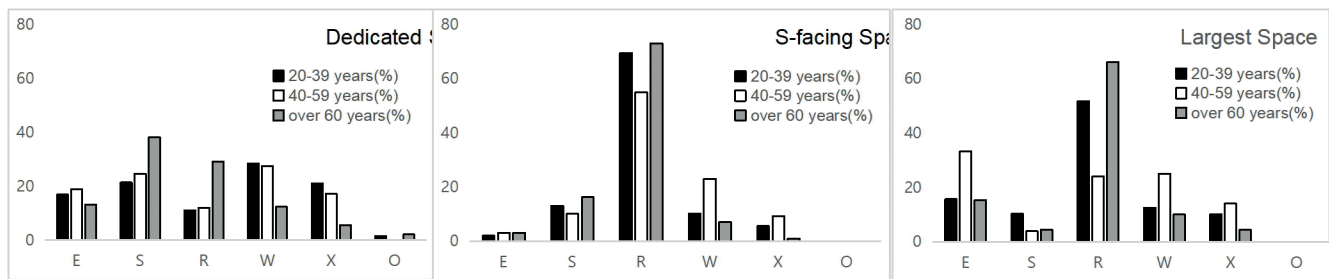

Figure 1: Cross-analysis of Detailed Differences by Age

Table 3: Post-Hoc Test of Residential Area and Residential Space Demand (Multiple Comparison)

Residential Area		SS(Dunnett T3)		IS(Dunnett T3)	
		Mean	Standard error	Mean	Standard error
Seoul	Metropolitan	0.0535	0.1483	0.2759	0.1407
	Local City	0.3722*	0.1335	0.4883*	0.1271
Metropolitan	Seoul	−0.0535	0.1483	−0.2759	0.1407
	Local City	0.3987*	0.1342	0.5124*	0.1258
Local city	Seoul	−0.3722*	0.1335	−0.4883*	0.1271
	Metropolitan	−0.3987*	0.1342	−0.5124*	0.1258

Note: Seoul = Seoul area, Metropolitan = Metropolitan area, and Local city = Local city area. *: Mean difference is significant at the 0.05 level.

The results of the cross-analysis by age, are shown in Figure 1. In DS, those aged 60+ years had a higher preference for a bedroom (38%) and a living room with a terrace (29%) than other age groups. The reason for this is that individuals who are 60 and above prefer a spacious living room because they spend more time there compared with the younger generation. In SFS, people aged 40–59 preferred a home office (23%) more than other age groups. In LS, compared with 20–39-year-olds and those aged 60+, people aged 40–59 had a higher preference for a kitchen (33.2%) and a home office (25%). The children of most people aged 40–59 are grown-ups; therefore, it is possible that they prefer a large home office for online education and a large kitchen with a dining room to share meals with their families.

As a result of ANOVA analysis, the significant variables were SS and IS (5 percent significance probability). For the post-hoc test of residential area and residential space demand, the Dunnett T3 was used. The results are shown in Table 19. In SS and IS, there was a difference between Seoul and local cities, as well as metropolitan and local cities.

As a result of the crossover analysis, detailed differences by residential area are as follows. In SS, people in Seoul had a higher preference for gardens and parks in the complex (63.5%) than people in local cities. Residents in local cities preferred shared offices (15.5%) and guest houses (34.5%) more than Seoul residents. In IS, Seoul and metropolitan residents preferred *honbap* restaurants (22.4%), parks or forests (45.6%), and trails (24.2%) over local city residents.

Those in local cities had a higher preference for shared offices or study cafes (25.7%) and cultural spaces or medical centers (24.6%) than Seoul and Metropolitan citizens. The above result is due to the fact that Seoul lacks a natural environment, therefore, the preference for nature-friendly space is high. Local cities are rich in natural environments. However, due to the lack of infrastructure space for culture, healthcare, work, or education, we can see that local city residents' preference for these spaces is high.

As a result of ANOVA analysis, the significant variables with differences in demand for residential spaces by household size were DS, SS, and IS (5 percent significance probability). In the post-hoc analysis, the variable analyzed by the Scheffe test is IS, and the variables using the Dunnett T3 test are DS and SS. The post-hoc analysis results are shown in Table 4. The DS showed differences in one person and two person households as well as between one person and three or more person households. The SS and IS showed differences in two person and three or more person households.

See Table 4 below:

The results of the cross-analysis are shown in Figure 2. In DS, three or more person households had a higher preference for a living room with a terrace (24.2%) and a kitchen and dining room (32.5%) than other groups. In SS, three or more person households preferred gardens and parks (61.9%), fitness centers (14.0%), and spaces to meet visitors and pleasant waste treatment plants (12.6%) in the complex over two person households. In IS, the preference for a *honbap* restaurant was higher for one person households (30%) and two person households (22.7%) than for three or more person households (2%). However, three or more person households (57.5%) had a higher preference for parks or forests than one person households (20%) and two person households (34.9%).

From the above results, it can be seen that three or more person households prefer the family lifestyle. They prefer living rooms, spacious kitchens and dining rooms, gardens and parks within the complex, and forests and outdoor parks. In contrast, it is necessary to supply *honbap* restaurants around apartment houses with many 1 to 2-person households.

Table 4: Post-hoc Test of Household Size and Residential Space Demand (Multiple Comparison)

Household Size		DS(Dunnett T3)		SS(Dunnett T3)		IS(Scheffe)	
		Mean	Standard error	Mean	Standard error	Mean	Standard error
1	2	−0.0525	0.0863	−0.4361*	0.1455	−0.1897	0.157
	3 or more	−0.3323*	0.1071	0.1168	0.1244	0.3975*	0.1466
2	1	0.0525	0.0863	0.4361*	0.1455	0.1897	0.1571
	3 or more	−0.2798*	0.1037	0.5529*	0.1491	0.4272*	0.1663
3 or more	1	0.3323*	0.1071	−0.1168	0.1244	−0.3975*	0.1466
	2	0.2798*	0.1037	−0.5529*	0.1491	−0.4272*	0.1663

Note: 1 = 1 person, 2 = 2 persons, and 3 or more persons. *: Mean difference is significant at the 0.05 level.
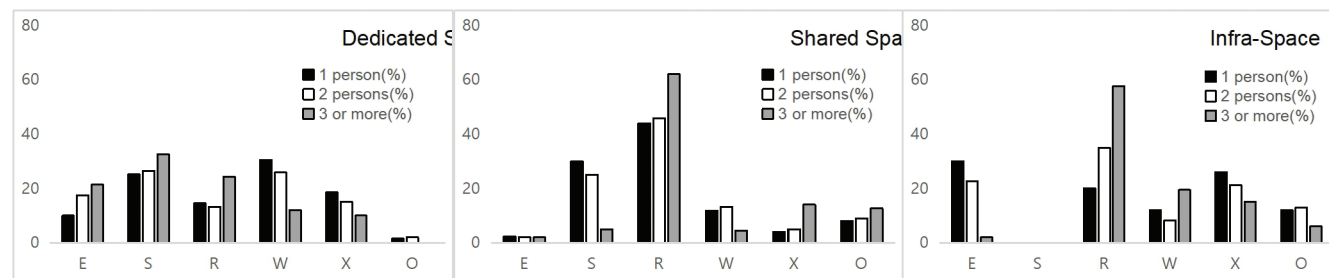

Figure 2: Cross-Analysis of Detailed Differences by Household Size

5. Conclusions

We are currently experiencing a new paradigm called "untact." The untact lifestyle has begun to permeate life under the influence of the 4th Industrial Revolution and the new realities of COVID-19. The residential space is at the center of a new lifestyle in the UE. In addition to the basic functions of a residential space, it takes on a multiple other role such as providing a place to work, study, and exercise. Therefore, residential spaces have a growing influence on our quality of life. The demand for residential space in Korea has changed over time. Large apartments were preferred when the majority of households consisted of four persons. Then, as the number of one person households increased rapidly, demand for small apartments skyrocketed in Korea and prices soared. Recently, COVID-19 has driven large apartment prices in Korea. This is the beginning of a change in demand for residential spaces in the UE.

Therefore, in this study, we analyzed the residential space demand in the UE by age, residential area, and household size. As a result of the analysis, the following implications are suggested. First, people attempt to solve the problem of having a small living space and sense of isolation by spending time in a nature-friendly spaces. Housing policymakers and housing providers must provide comfortable and efficient residential spaces that are directly connected to and considerate of the quality of life of the residents. Providing a nature-friendly shared space and residential infrastructure to combat the lack of exercise and alleviate depression is essential in the UE. There is a need for residential policies that support wellbeing and harmony through communion with nature in light of a smaller residential space. Second, new spaces required for residential spaces in the UE include home offices, spacious kitchens, HOMT spaces, and terraces. In addition, a garden and/or park in the complex, a shared space (kitchen and office), and a pleasant waste disposal facility are practically required. For residential infrastructure spaces, forests, hiking trails/walkways, and *honbap* restaurants are essential. Third, in the UE, the demand for residential space varies according to age, residential area, and household size. Government policy and housing providers should avoid uniform housing types and identical residential space structures. It is essential to provide housing that reflects the demand for various residential spaces according to age, residential area, and household size. Currently, the government announced the 3rd new city as a housing supply plan. It is necessary to establish a housing supply policy that reflects the demands of consumers according to the changing times. In other words, it is necessary to provide a suitable residential space for the UE.

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