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A Planning Direction of the Prefab Public Housing in Deteriorated Residential Area

Hae-yeon Yoo

Assistant Professor, School of Architecture, Soongsil University,
369 Sangdo-ro, Dongjak-gu, Seoul, Republic of Korea.
E-mail: zenism@ssu.ac.kr

Jung-dae Park

Associate Professor, Department of Architectgure, Kyonggi University,
94-6 Yui-dong Yeongtaong-gu, Suwon, Kyonggi-do, Republic of Korea.
E-mail: jdpark@kyonggi.ac.kr

Abstract

Recently in Korea, the lack of environment management of deteriorated residential areas is one of the key social issues, and people are paying more attention to residential area regeneration as well as the improvement of small block-unit residential environments. This study therefore investigated the changes in policies and projects that have taken place for the regeneration of deteriorated residential areas. The study also clarified the actual status and limitations of the prefab & modular design. Particularly, based on the BIM program for the Residential Environment Management Project, this study provided a design process. This study attempted to reflect as many variables as possible by dividing the status into various design processes applicable to future domestic cases.

Keywords: Low-rise Residential, Residential Environment Improvement Program, Modular housing, Prefab Housing, BIM

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1 Introduction

As the Special Act for Urban Generation Activation and Support (hereinafter Urban Regeneration Special Act) was recently enforced, existing residential area maintenance projects are being carried out in order to ensure the constant maintenance and management of residential areas by using physical, social, and human resources in relevant areas, in accordance with residents' suggestions. In addition, the 'Urban Regeneration Activation Plan' according to the Urban Regeneration Special Act can be divided into two different types, 'Urban Economy-based Regeneration Type' and 'Neighborhood Regeneration Type', so it is possible to regenerate urban areas appropriate for the characteristics of each area. With the significant public interest in the government's policy paradigm for residential area maintenance, people have been paying more attention to the regeneration of residential areas and particularly to the improvement of previously problematic small-sized block unit residential environment projects. However, insufficient research has been performed on the design process for the sustainable management of concrete execution. Accordingly, this study proposed the Prefab design process of the public housing for sustainable management. [1], [2]

2 The Prefab Public Housing in Deteriorated Residential Areas

The main reasons for introducing prefabricated housing to South Korea can be summarized as follows. First, The improvement of the housing environment and the housing welfare of low income household. Second, The demand of ordinary residents for better housing environments.[3] Later, the government changed their public rental housing policies to accommodate /prefab design. Accordingly, SH Corporation(housing related company and research institute founded by the City of Seoul) and Korea Land & Housing(LH) started to pursue various prefab designs for low income households in connection with the Ministry of Land, Transport and Maritime Affairs. Since December 2013, a 4-year national research project on ‘the development of customized prefab housing technologies and the establishment of test sites’ began. Unit plans are diversified in line with main target households such as workers, newly married couples, and college students. Centered on Korea Institute of Civil Engineering and Building Technology(KICT), SH Corporation, universities, and industries such as POSCO A&C and STACO would carry out the project funded by the Ministry of Land, Transport and Maritime Affairs. If the modular housing tailored to characteristics of residents is developed and the pilot sites are established as part of the 4-year project, the Korean market might expand further in the future. [4]

3 Design Process of Prefab Housing by BIM

This chapter suggests a modular housing planning process and policy in consideration of the local conditions in Korea and a sustainable residential environment.

First, The land analysis stage should be linked to web-based established land information sites to find and understand the basic laws and regulations and other information on the land as well as the natural, physical, social, and economic

information. Moreover, these sites provide basic feasibility data on neighborhood infrastructures, floor area ratios, building-to-land ratios, and building height controls.

Second, to select a modular construction method for the plan, a preferred type is chosen in consideration of economic feasibility and the specific land. This study considered internal and external conditions, and focused on the 4 most widely used types: 1) Panel (Wall), 2) Rahmen (Component), 3) Infill (Unit) and 4) UDR/UBR, 5) Hybrid (complex). Especially, as the hybrid(complex) method involves using the Unit(such as Unit Bath Room, UBR) system providing finished units for bathrooms, dressing rooms or kitchens separate from the other spaces, it shortens the time spent on repetitive spaces and management and allows for the convergence of diverse construction methods.

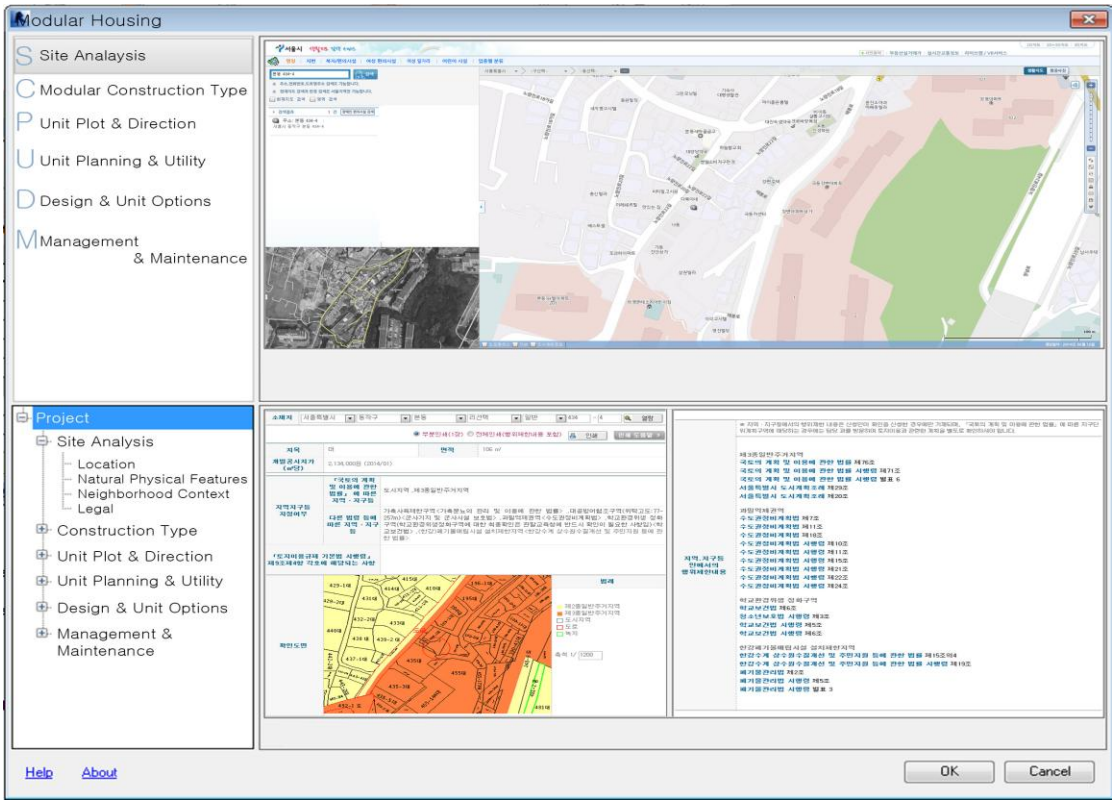

Fig. 1. Step1_Site Analysis

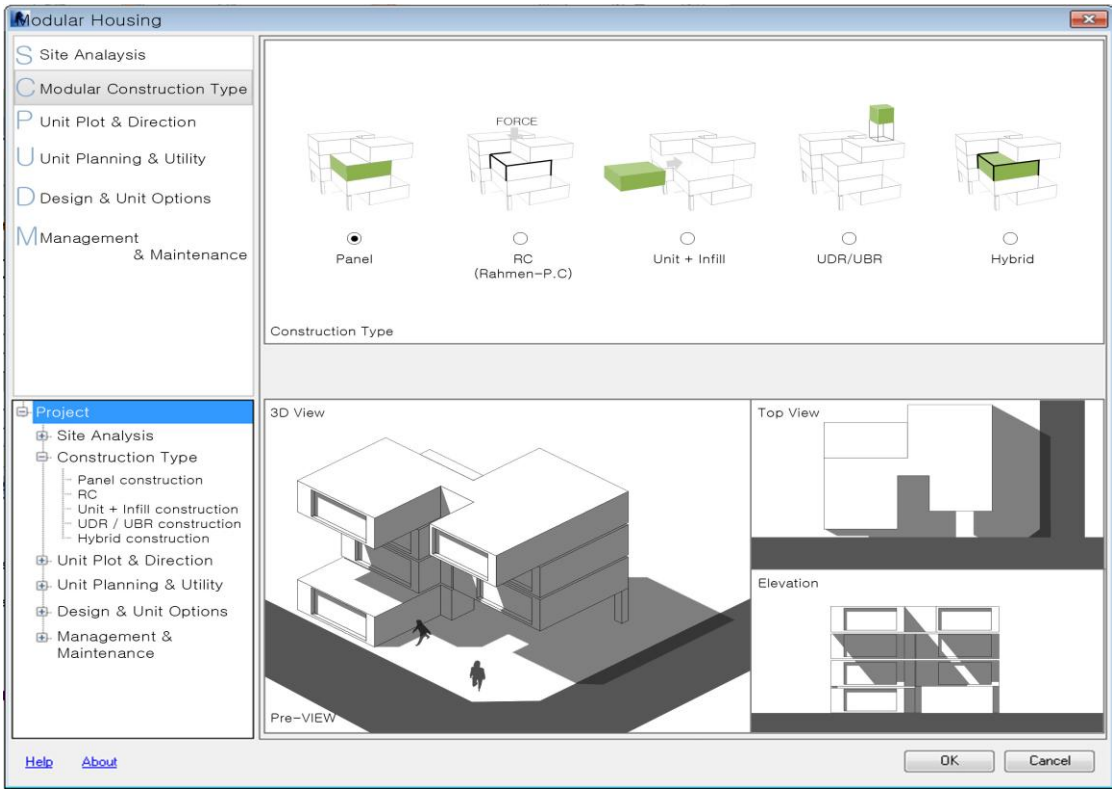

Fig. 2. Step2_ Modular Construction Types

Third, The types of buildings need be chosen in consideration of the characteristics of would-be residents and planned concepts. This study classified the types of buildings into stand-alone, court, straight-line, and parallel types. To select a unit for each type, upon available modular unit sizes and the number of stories chosen, the simulated draft plan within the floor area ratio determined in the first stage is shown. However, the common spaces including stairways, elevators, hallways, and equipment areas are excluded, which means approximately 15% of the floor areas are added to the estimation. Also, the piloti floor can be chosen with mouse clicks, enabling a rough simulation within the limited floor area ratio. In addition, neighborhood commercial buildings, community facilities or parking lots can also be selected.

Fourth, In choosing the components for a unit, it is beneficial to be able to select indispensable equipment and facilities instead of unnecessary built-in furniture. Especially, ordinary spaces such as kitchens, bathrooms, and dressing rooms can be separated and made similar to the UBR system so that they can be in-filled in each unit. Here, the design or space can be changed in line with the life-cycles.

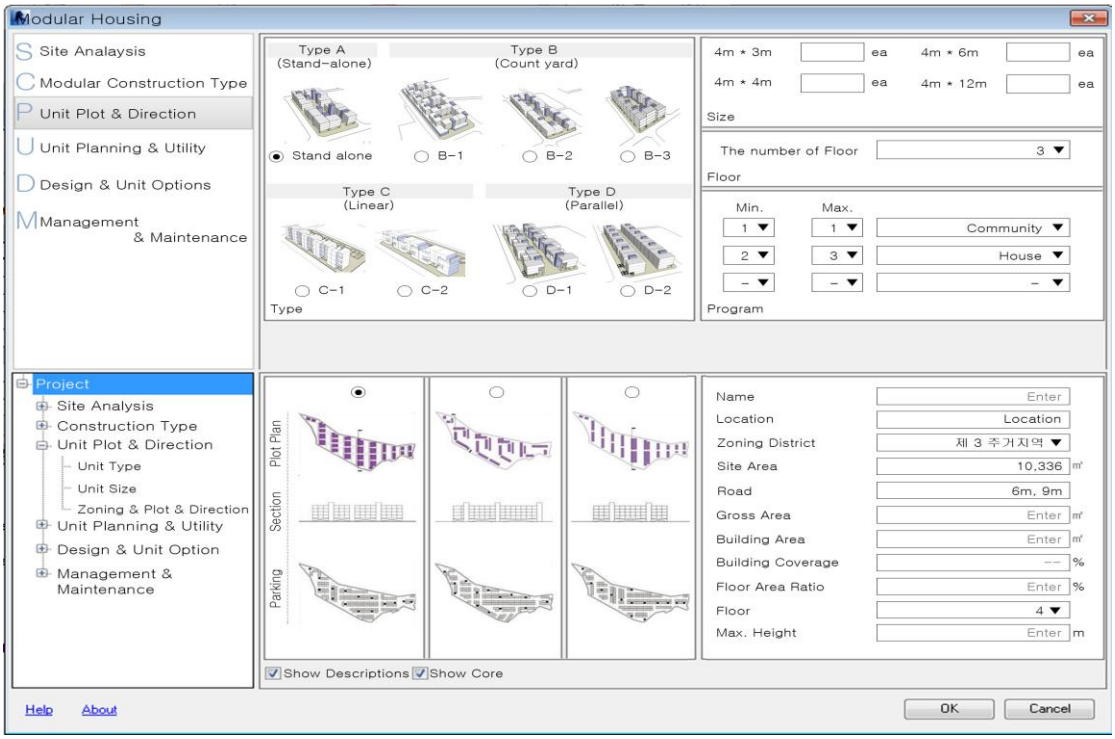

Fig. 3. Step3_Unit Plot & Direction

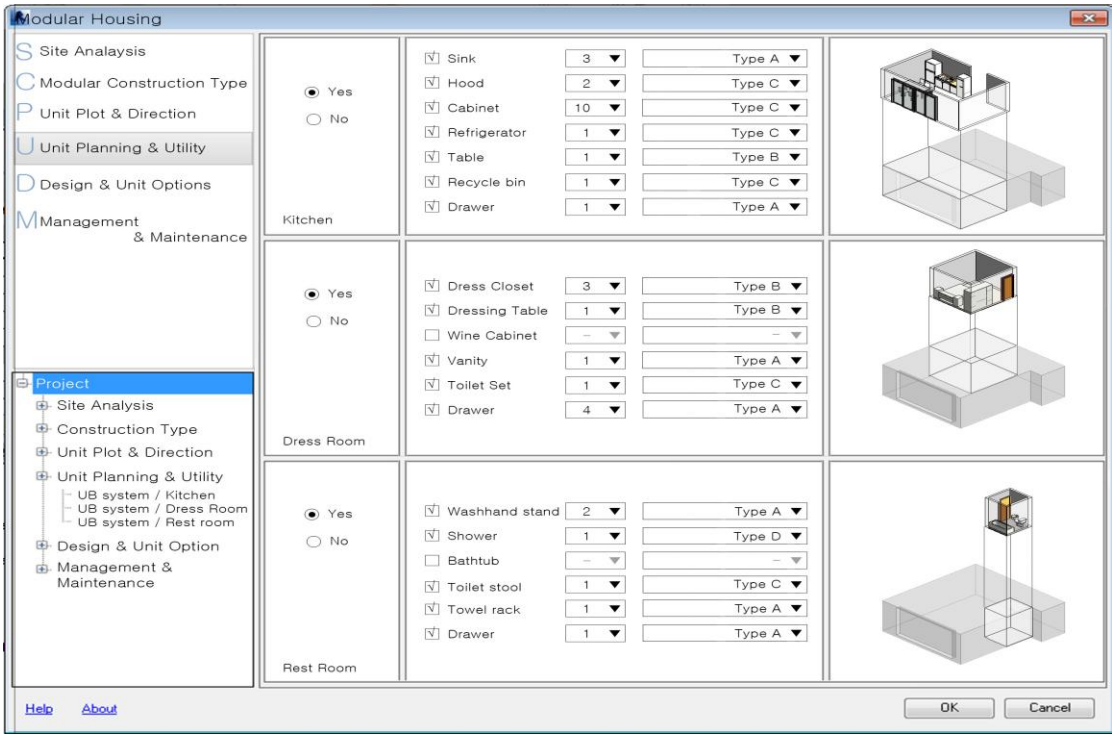

Fig. 4. Step4_ Unit Planning & Utilities

Fifth, The remaining additional spaces can be chosen based on personal taste. For example, a general selection can be made on the program regarding balcony design, common spaces including elevators, gardens and community facilities, and then specific designs may be discussed and developed with the architect. Determining the final building design in line with user requirements is an important part. Finally, In terms of maintenance and repair, the equipment and facilities of each unit need to be computerized for the benefit of easy replacement or repair of facilities or electricity over time.

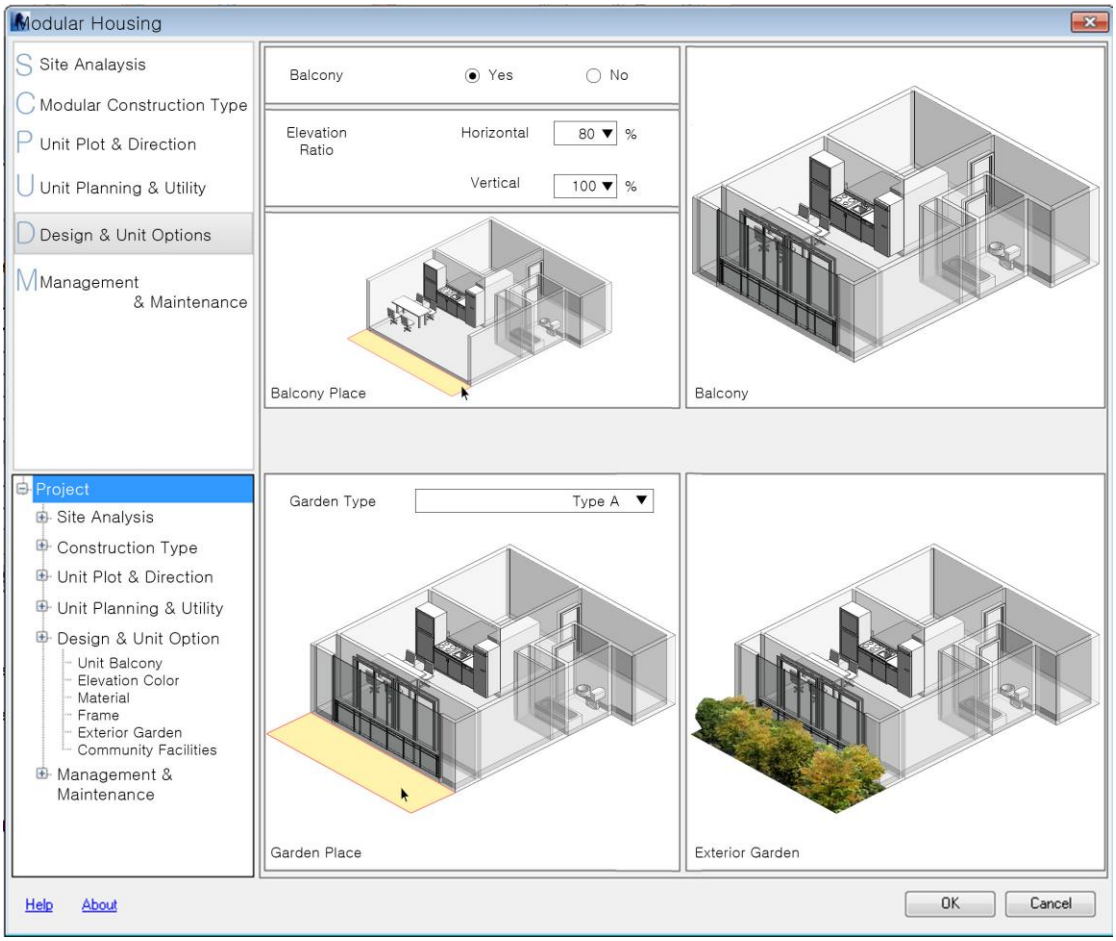

Fig. 5. Step5_ Design Option

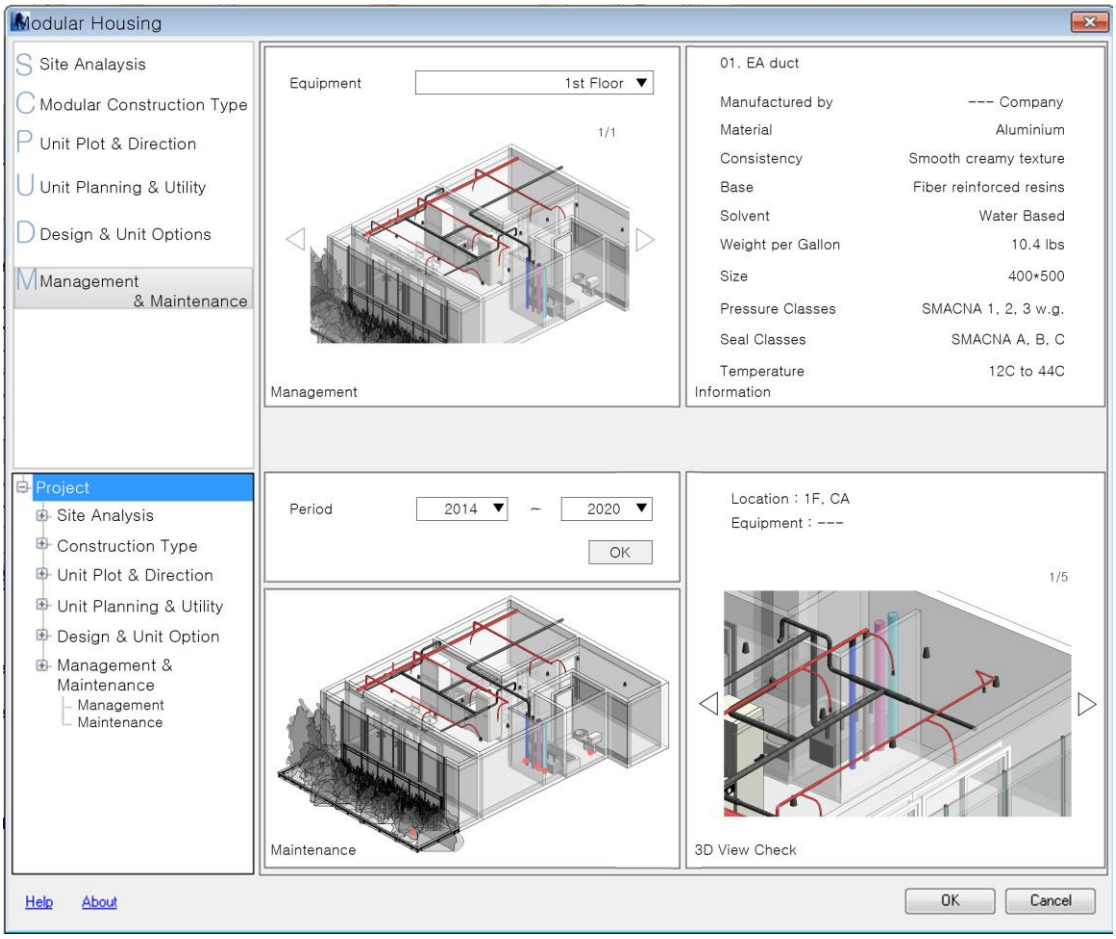

Fig. 6. Step6_ Management and Maintenance

4 The Improvement direction for the Prefab Design in Korea

The following 4 suggestions may be regarded for planning improvement.

Firstly, the limitations of modular construction methods and materials should be overcome with the convergence of diverse methods and materials. In Korea, modular housing has been based on steel, whereas in overseas countries, the hybrid construction method has been used, as previously discussed, with different materials such as steel, wood, and composite panels. Secondly, sustainability should be pursued, while at the same time the perception that modular housing units are cheap should be changed. In Korea, modular housing is called “prefabricated housing”, “temporary housing", “industrialized housing”, and “container housing” and is perceived as a cheap housing type. Accordingly, alternatives should be developed to change such image. Melbourne Univ. in Australia helped to improve the image using competitions and workshops in planning a primary school with a prefab design. Thirdly, as the roles of architects in modular housing are considered mostly insignificant, it should be emphasized that the role of the designer is still important. In general, modular housing is regarded as factory-finished units ready to be layered or in-filled. However, as

aforementioned, modular housing encompasses multiple methods, such as panels, layers, components, and hybrids. Above all, the hybrid method requires an architect's new attempts and ideas with the same design process applied as that in the ordinary housing construction. Lastly, spatial variability need be proposed. As in the existing Unit System(such as UBR) method, where only bathrooms or kitchens are in-filled, other spaces in a unit including living rooms, bedrooms, and community spaces can be varied. In addition, public and community spaces may possibly be connected with each other inside an apartment building [5]

In terms of policy, the following improvements need to be made.

Firstly, the public sector should extend its roles. Korea has embarked upon 4-year consecutive research initiatives since December 2013, including that commenced in September 2014, which is to contribute to developing a concrete system involving modular housing supplies, financial support for earlier settlements, post-research technology transfers, and applicability to industrial practices. Secondly, for technical alternatives, an MC system targeted at modular housing only has already been proposed domestically. However, more often than not, standardized MC limits the diversity of design. Overseas countries apply general building codes even to prefab design or modular housing with no extra standards or regulations. Thus, rather than the MC system imposing standardized spatial restrictions, it is necessary to focus on reinforcing technical alternatives for controlling and producing a range of modules. Thirdly, a unit-based order placement and supply needs to be considered; for example, the Japanese shell plan for German show housing or hope housing, and in the case of fit-out, a zoning plan for the interior of the Australian shell plan. In Australia, in particular, the shell plan is ordered by the public sector, while the interior space is dealt with by the private sector. Finally, BIM technology needs be developed further to ensure housing performance and to sustain maintenance and control. Importantly, instead of modularizing entire units or a whole apartment building, as seen in the simulation in Chapter 3, the repetitive equipment space needs to be ordered according to units, followed by constant maintenance and control. For apartment housing units, repetitive small spaces such as bathrooms or kitchens may be modularized, while the other spaces may be constructed using panels. In this case, the initial BIM-based design followed by constant maintenance and control ensures a higher quality of housing environment and constant performance.

5 Conclusion

This study was conducted to clarify the importance of the management and design process for the selection, planning, and constant future management of deteriorated residential areas. Thus, by examining the changes in the deteriorated residential areas and the changes made to the residential policies in South Korea. At the same time, it was necessary in this study to change our residential area maintenance policies and to urgently provide a design process for public housing.

Particularly, we provided the prefab design process through consultations with experts. Here, a BIM-based prefab housing planning for sustainable maintenance was

proposed, followed by a few suggestions for improving the planning and policy measures.

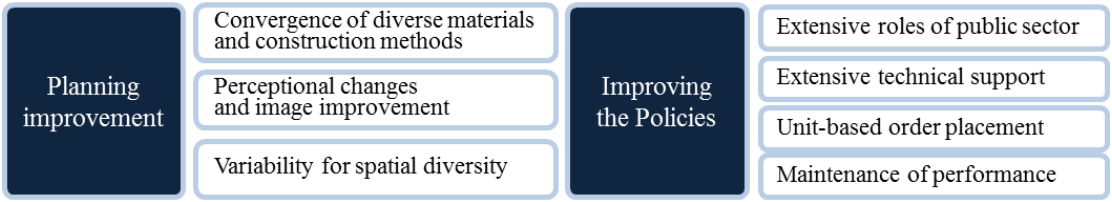

Fig. 7. Step6_ Management and Maintenance

A prefab housing is applicable to a wide range of market segments, including schools, hospitals, dorm rooms, and rental housing units. Moreover, it can be used in multiple regions to meet diverse demands, such as rural villages, retirement resorts, North Korean regions after unification, and some areas struck by natural disasters. Notably, the web BIM program features maintenance in consideration of life cycles from the earliest stage of planning. In this study, we were not able to verify the actual candidate areas or propose a concrete support plan and pattern for the program, but we expect there will be further studies in this area.

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