

A Study on Trends in Exterior Renovation Focused on University Buildings

¹Jiyoung Oh, ²Heangwoo Lee and ³Heykyung Park

¹Department of U-design, Inje University, 197 Inje-ro, 50834 Gimhae-si,
Gyeongsangnam-do, South Korea

²The Graduate School of Techno Design, Kookmin University, 02707 Seoul,
Seongbuk-gu, South Korea

³Department of Interior Architecture, College of Engineering, Inje University,
197 Inje-ro, 50834 Gimhae-si, Gyeongsangnam-do, South Korea

Abstract: University buildings should not only serve a strong public purpose but also fulfill social, cultural and symbolic needs and act as landmarks. Such requirements have triggered an increasing number of cases of renovations taking place at university buildings. Despite this, research regarding the renovation of university buildings is extremely lacking and further studies to fill this void are needed. The goal of this study was to accumulate basic research material regarding university building renovations after analyzing trends surrounding actual cases of renovations of university building exteriors. In doing so, the following conclusions were reached in this study. The reasons or causes behind university renovations were largely found to be associated with physical degradation, functional degradation or a combination of physical and functional degradation. University building renovations undertaken due to physical degradations demonstrated a tendency to focus on building facade design elements regarding building materials and colors. Such tendencies were regarded as passive renovations. University building renovations undertaken due to functional degradations demonstrated a tendency to focus on the expansion of building functions and the vertical and horizontal extension of buildings. Such tendencies were regarded as active renovations. On the other hand, the trend surrounding university building renovations due to functional degradations also demonstrated a tendency to omit passive renovations associated with building facade design elements undertaken to maintain the historical functions of buildings. University building renovations undertaken due to a combination of physical and functional degradations demonstrated both active and passive characteristics associated with renovations.

Key words: University buildings, renovation, performance enhancements, exterior design elements, demonstrated, tendency

INTRODUCTION

Purpose and background of research: Although, university buildings are generally regarded as educational facilities, other demands are often put on them to play social, cultural and symbolic roles and to function as landmarks. In response to the gradual expansion of the functions and roles of universities and the added complexities associated with this trend, university buildings are no longer solely the focus of quantitative expansions but are becoming the subjects of new paradigm shifts. This trend has contributed to the active implementation of university building renovations that have been undertaken during the past decade (Anonymous, 2015). The word ‘renovation’ which is the noun form of ‘renovate’ embodies not only the meaning associated with ‘to repair’ but also the meaning

associated with ‘to regenerate.’ In other words, renovation refers to the act of making something new again and the act of recreating something, so that, it can reach its maximum state of convenience. Past studies on renovation point to the value of renovations being found in the act of extending the lifespan of existing buildings through maintenance and management activities rather than the extension of building lifespans due to degradations. In addition to this, buildings are regarded as living organisms in which existing buildings can further grow and produce economic benefits (Yeo *et al.*, 2002). Furthermore, in addition to spatial and temporal continuity, buildings also serve as the means of bridging its interior and exterior (Im and Choi, 1999).

As of late, university building exteriors have become the object of renovations for a number of reasons. Due to renovations of university building exteriors not being

undertaken alongside campus development activities such renovations typically entail lower performance and more maintenance and repairs issues of existing buildings compared to newly built buildings. Also, in light of the users of university buildings mainly being students thus requiring maintenance and management, renovations are also considered essential (kim *et al.*, 2001). Despite the need for large volumes of basic research materials to account for the various functions required of existing university buildings subject to renovations, related research regarding the matter is largely lacking. In light of this in consideration of the effects that university building exterior renovations have on promoting the school image, various studies regarding renovations of university building exteriors need to be carried out.

With these considerations in mind this study analyzed the trends surrounding renovations of university building exteriors undertaken for various purposes after the year 2000 with the aim of establishing basic research material regarding the renovations of university building exteriors.

Methods and scope of research: In light of the goal of this study being the analysis of trends surrounding university buildings in which its building exteriors have been renovated, cases of university building renovations were categorized according to the reasons for renovations and further studies were undertaken to examine the changes in exterior compositional elements. In doing so, the following methods of research were applied. First, as a means of studying relevant theoretical implications, the concepts, causes and scope of renovations were studied. Second, as a means of undertaking basic studies, the status of university building renovations were studied through the study of reference materials and preliminary studies in the form of on-site visits. Third, based on the collected materials, cases of renovations were categorized according to the cause or reason for renovations and changes in exterior compositional elements were analyzed. The subjects selected for further analysis in this study were limited to universities located in Seoul and Gyeonggi-do in South Korea. In the case of South Korea, the importance placed on a college education is greater than that of most other advanced countries and according to some reports, the rate of high school graduates pursuing a college degree was found to be 68.9%. This is one of the highest rates among advanced countries and is indicative of the emphasis placed on receiving a college education (Anonymous, 2017). Cases of renovation involving universities founded more than 30 or 40 years ago in which renovations were undertaken after the year 2000 were selected as the subjects of

analysis in this study. This was done in order to include cases involving renovations that were carried out due to the effects of aging facilities. In order to analyze the latest trends regarding university building renovations, a university currently undertaking exterior renovations that was not within Seoul and Gyeonggi-do was included for analysis in this study. In addition, in consideration of the goal of analyzing the trends surrounding renovations, the scope of analysis of this study was set to include architectural elements associated with changes in the materials, decoration, color, main entry and exit points, walls and windows of a building exterior.

Concept and causes of renovation

Renovation concepts: Renovation a word derived from ‘renovate,’ refers to an act of recovering or improving upon an aging building for the purpose of regaining original functions. In general, renovations refer to large scale repair and maintenance activities undertaken to maximize convenience, extend lifespan or improve the functions of a building according to changing needs. During recent times, the word renovation has been used interchangeably with remodeling in South Korea (Kim and Park, 2002; Oh and Lee, 2017). The reasons behind undertaking renovations are generally due to the aging of buildings. Other reasons for undertaking renovations include cases associated with legal restrictions or concerns regarding historical preservation in which new constructions are not possible. Issues surrounding geographic restrictions may also be included as reasons for undertaking renovations as well. Before undertaking renovations a thorough study of the existing building must be undertaken and the functional demands of interior spaces must be taken into account. In addition to this, issues regarding structural limitations and economic feasibility must also be taken into account (Yoon and Park, 2011). By its nature, renovations entail changes in the original purpose and properties surrounding the initial sources of value found in buildings.

Definition of renovation: Currently, as shown in Table 1 what is generally referred to as an act of renovation includes a wide range of activities and varying classifications. Renovations can be defined as including acts of new construction or the extension, alteration, relocation and reconstruction of a building (Im and Choi, 1999). Under this definition and depending on the situation, renovations may also include acts of preserving, restoring and repairing. The definition of the term renovation extends beyond the act of simply reusing a building and entails a larger meaning embodied in an act of actively reviving an environment. In other words an act

Table 1: Classification and concept of renovation

Term	Definition
Reconstruction	The act of (re)building a damaged building by and large to its original size and structure
Repair	The act of remedying improper aspects to revert a structure to achieve its original safety functions in which the reverted result may not completely satisfy initial conditions
Preservation	The act of maintaining building site, structure and facilities according to relevant laws
Restoration	The act of erecting or installing buildings or building facilities that have been destroyed, damaged or lost due to natural disaster to their original state
Extension	The expansion of floor area within the same roof ridge

of renovation is not limited to past or future forms but rather encompasses the materialization of the future in the present based on the past.

Causes of renovation: The causes of renovation are largely divided into causes related to physical degradations such as the aging of building materials and causes related to functional degradations such as the need for more necessary facilities and the need for spatial restructuring and altering due to changes in the educational environment (Young *et al.*, 2001). Further details regarding these aspects are provided in the following section.

First, physical degradations are considered to be the most common cause of renovations. Physical degradations are largely the same as the effects of aging and are considered as passive causes of renovation (Yeo *et al.*, 2004). With the passing of time, buildings and facilities ultimately reach an unusable state due to wear and fatigue. In other words, the progression of physical degradation due to changes in social and technological circumstances results in the decline of living conditions due to greater maintenance costs, greater utility costs and declining levels of performance. Examples of physical degradation include the degeneration of interior and exterior wall coats of paint, the development of leaks in various valves, the formation of cracks in support structures, the aging of water supply pipes and electric wires, the degeneration of window coating materials, the formation of cracks in building structures and the onset of reliability issues regarding internal facilities (Kim and Choi, 2000). Due to its main users being students, maintenance and management activities of aging facilities on college campuses are typically lacking. Also, due to the fact that campus facilities are usually not constructed at once, acts of altering and repairing buildings that have initially been on campus are recommended from a facility management standpoint. Second, functional degradations refer to a decline in utility regarding the functional aspects of a building with the passing of time. Functional

degradations are considered as active causes of renovation (Kim and Choi, 2000). They involve a need to make improvements to a building due to a rise in inconveniences associated with the use of building facilities or the development of outdated educational environments due to social and cultural changes. Examples include increases of the number of needed facilities, spatial restructuring to accommodate change and cases of apparent economic benefits when undertaking full replacement using new systems rather than undertaking repairs or alteration to have buildings fit current environments. In other words, causes of renovations are related to all manners of problems that continually arise due to the presence of functional inconveniences in building facilities compared to facilities in new buildings or due to the lack of structural integrity. In light of the fact that university facilities largely represent the image of schools, improvements of facilities that entail a highly advanced image or environmental suitability are essential (Young *et al.*, 2001).

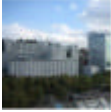





MATERIALS AND METHODS

Selection of subjects of analysis: The subjects of analysis of this study were selected based on relevant studies (Lee, 2002). Based on the fact that the finishing materials of buildings have an average lifespan of 30-40 years, buildings of universities were selected that have reached the point of needing renovations as they have passed this time marker. In addition, although this study initially selected only those universities located in Seoul and Gyeonggi-do, as mentioned earlier to reflect the latest trends a school located in Gimhae city in which renovations as of August 2017 were taking place was additionally selected. On a different note, the subjects of analysis of this study were limited to the buildings present in a university rather than the university as a whole.

As shown in Table 2, the causes of renovations of the subjects of analysis of this study were further classified into functional degradations, physical degradations and functional and physical degradations.

Method of analysis: Upon undertaking a review of the theories regarding methods of building composition a study by Bacon was reviewed in which he proposed design elements of the main elevation of a building to include land composition, material, direction, co-existence with nature and characteristics of forms, height of buildings, location of windows and surface texture (Bacon, 1974). According to studies by Brodin, physical

Table 2: Setting analysis target

Cause of renovation	Name of school/ Name of building	Function	Exterior image
Physical degradation	Hongik university/ Main building	Univ. Headquarters, Museum	
	Hanyang university/ College of Humanities	Classrooms, meeting rooms	
	Inje University/ College of Humanities	Classrooms, research laboratories	
Functional degradation	Hanyang University/ Hanyang Institute of Technology	Office of Industry-Academy, Research Laboratories, Main Conference Hall	
	Dongguk University/ Main building	Univ. headquarters, auditorium, main auditorium	
Functional/physical degradation	Hongik University/ Student Union Center	Student center, Club rooms, Student cafeteria,	

elevation elements of exterior design were classified into building ratios and direction form and outline, materials, location of windows and doors, color and building heights (Brolin, 1976).

Based on existing theories that have been established in the past, five buildings classified on the basis of the cause of renovations were linked with a total of six of the above-mentioned building elevation design elements for further analysis.

RESULTS AND DISCUSSION


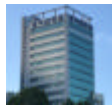
This study undertook trend analyses based on the causes of university building exterior renovations and building elevation design elements (Table 3). The findings were as the following.

First, as shown in Table 4, the main building of Hongik University was renovated due to physical degradation. Such renovations were carried out as a matter of necessity due to the manifestations of the effects of aging in the building exterior. Prior to the renovations, the building was finished with a white colored paint and outdoor AC units were attached across its exterior walls. The building had a simple hexagonal structure in which its windows were placed more inside

Table 3: Design element and concept of buildings

Design element	Conceptual explanation
Material	Materials refer to an important element that determines the image of a building exterior and includes items such as concrete, glass, stones, metals, tiles, and bricks
Decorations	Decorations are fundamental compositional elements that breathe personality into a building exterior and makes an exterior appealing
Color	Color entails visual responses to light energies and raises the function of visual transfer
Main entry and exit point	Main entry and exit points are locations that provide first impressions where the interior and exterior of a building are made public at the same time
Walls	Wall faces are fundamental elements that interact with the function and significance of buildings that also serve the function of an exterior skin that covers interior functions
Windows	Windows establish the exterior image of a building and exist in various forms according to its use and function

Table 4: Analysis results of Hongik University

Exterior image	Elevation design element renovations	
Before renovations	Material	Paint Finishing-Aluminum Panel, Glass
	Decorations	Installation of horizontal decorations on top of the building
	Color	White-Gray
After renovations	Main entry walls	Installation of a canopy
		Paint Finishing-Aluminum Panel, Glass
	Windows and exit point	Replacement of windows

than directly along exterior walls. The greatest change made to the building was that the exterior wall was flattened out with aluminum panels and glass and the outdoor AC units were relocated indoors. Although, the hexagonal structure of the building was left as it was a decorative element was added to the top of the building and a canopy was installed at the main entry and exit point. Circular columns were also juxtaposed in an accommodative manner with the outer walls. This building was subject to renovations due to physical degradation in which the building was subject to passive renovations regarding changes in aspects such as exterior materials rather than changes in aspects regarding the form of the building.

Second, as shown in Table 5, the building for the College of Humanities in Hanyang University was renovated due to physical degradation an act of renovation due to the effects of aging. As shown in the picture, prior to the renovations, the exterior walls of the building were finished with white paint, the windows of the building were large and AC ventilators were exposed. After renovating, the area of the building exterior composed of red bricks was painted over using white and gray paint and was covered with perforated panels thereafter. The sizes of the windows were largely reduced and a curtain wall was installed at the main entry and exit

Table 5: Analysis results of Hanyang University





Exterior image	Elevation design element renovations	
Before renovations 	Material brick, Decorations Color	Paint Finishing-Paint Finishing, Perforated panels No change No change
After renovations 	Main entry and exit point walls Windows	Installation of curtain wall Brick, Paint finishing-Paint finishing Replacement of windows

Table 6: Analysis results of Inje University

Exterior image	Elevation design element renovations	
Before renovations 	Material Decorations Color	Paint finishing-Paint finishing, Zinc/Enamel Panels No change Highlighting colors: Green, Purple
After renovations (Planned) 	Main entry and exit Point walls Windows	Installation of zinc panels Installation of zinc/enamel panels Replacement of windows

point. This building was renovated due to physical degradation and was considered to have been subjected to passive renovations regarding changes in building exterior materials.

Third, as shown in Table 6, Hayeon Hall that is currently under active construction in Inje University was renovated due to the effects of aging. Prior to the renovations, the building exterior walls were finished with bright brown and orange paint which resulted in a relatively monotonous looking building. After renovations, the dominant colors of the front-facing side of the building are planned to be left in their original state and additional highlighting colors including green and purple as well as enamel panels are planned to be applied. The main entry and exit point of the building is also planned to be finished with zinc panels to provide a sense of uniformity with other parts of the building. These renovations are considered to be passive renovations involving changes in building material and color.

Fourth, as shown in Table 7, the Hanyang Institute of Technology in Hanyang University was renovated due to functional degradation. Upon completion of its construction a cyber-university was opened in the building which resulted in a lack of space and the subsequent undertaking of horizontal and vertical building extension. Prior to the renovations, the exterior wall of the building was finished with paint and glass and round decorative elements were distributed across the top

Table 7: Analysis results of Hanyang University





Exterior image	Elevation design element renovations	
Before renovations 	Material Decorations Color	Installation of aluminum No change No change
After renovations 	Main entry and exit point walls Windows	No change No change No change



Table 8: Analysis results of Dongguk University

Exterior image	Elevation design element renovations	
Before renovations 	Material Decorations Color	Installation of aluminum panels No change No change
After renovations 	Main entry and exit point Walls Windows	No change No change No change

of the building. After renovations there were no large changes in the building exterior walls. However, the walls were covered with aluminum panels and a horizontal louver was installed to avoid an appearance or feeling of monotony. The sizes of building windows were increased twofold and the color of the building exterior was left as its original gray color. This building was renovated due to functional degradation in which further functional demands of the building resulted in horizontal and vertical building extensions. This type of renovation is regarded as an example of active renovations. The exterior of the building was not renovated in terms of design elements such as materials and color which was thought to have been the case due to a desire to maintain the historical value of the building.

Fifth, as shown in Table 8, the main building of Dongguk University was renovated due to functional degradation. This building was used as the headquarters of the university and was vertically extended due to a lack of conference rooms and auditoriums. Prior to the renovations, the exterior wall of the building was finished with paint and the top of the building included a modular structure approximately one floor in height that was different from the building itself. Upon completing the renovations that are currently being undertaken, the building, as shown in Table 7 will have its top side extended and its exterior walls will be covered with aluminum panels. Also, a horizontal louver was installed above the windows to avoid an appearance or feeling of monotony. As indicated in the table, the building presents differences only regarding materials and decorations and

Table 9: Analysis results of Hongik University

Exterior image	Elevation design element renovations	
Before renovations 	Material Decorations Color	Paint Finishing-Stone Installation of canopies No change
After renovations 	Main entry and exit point Walls Windows	Installation of a canopy Paint-Stone Replacement of windows

no changes were made to the color, main entry and exit point, walls and windows of the building. Although such functional expansions, regarded as an example of active renovations, were undertaken, changes in design elements regarding the building exterior were thought to have not been undertaken to maintain the landmark function of the building.

Lastly, as shown in Table 9, the Student Union Center of Hongik University was renovated due to both physical and functional degradation. Building extensions were carried out due to the aging of the building and redress the lack of space in order to provide the students with greater convenience. Prior to the renovations, the exterior wall of the building was finished with white. However, after renovations, the material of the exterior wall was replaced with stones. The windows of the building were also replaced, canopies were installed on the top area of the building and at the main entry and exit point as a decorative element and columns were exposed. This building was renovated due to physical and functional degradations which resulted in an example entailing both active and passive renovations.

CONCLUSION

University buildings should serve not only a strong public purpose but also to fulfill social, cultural and symbolic needs and to act as landmarks. Most university buildings were built based on growth and development considerations. Today with 20-30 years having elapsed since the construction such buildings, cases of renovations of university buildings have been on the rise. Upon analyzing cases of recent university building renovations using six building exterior compositional elements, the following conclusions were reached. This study analyzed the trends surrounding renovations of university building exteriors undertaken for various purposes after the year 2000 for the purpose of establishing basic research material regarding the renovations of university building exteriors.

First, despite the various causes and demands associated with the undertaking of university building renovations, renovations are largely being undertaken

due to physical degradation associated with the effects of aging, functional degradation associated with changing and increasing functional needs and a combination of both physical and functional degradation.

Second, physical degradations which are regarded as general causes of university building renovations were found to mostly result in passive renovations regarding changes in elevation design elements associated with color and material rather than changes in the form of buildings.

Third, the renovations of university buildings due to functional degradations were found to result in horizontal and vertical building extensions undertaken to accommodate the changing and increasing functional needs of the university building in which active renovations involving changes in building exteriors were undertaken. However, such renovations of university buildings due to functional issues were found to have been undertaken in consideration of the historical value of the renovated building in which a tendency to avoid renovations associated with building exterior design elements such as material and color was present.

Fourth, university building renovations undertaken due to a combination of physical and functional degradations presented both active and passive characteristics associated with renovations as mentioned above. In such cases, appropriate renovation plans that account for concerns regarding the possible weakening of the original historical function of the building must be developed.

Despite this study having significance in that it establishes basic research material regarding university building exterior renovations after having undertaken an analysis of the trends surrounding university building exteriors, this study is limited in that it only focused on building design elements and building exteriors. To improve upon this aspect, further studies that consider the various functions and roles of acts of renovation must be undertaken and studies that include more cases of university building renovations must also be conducted.

ACKNOWLEDGEMENT

This research was supported by the National Research Foundation of Korea Grant funded by the Korean Government (NRF-2017S1A5B8066096).

REFERENCES

Anonymous, 2015. Space creates thought 'endless transformation of the university library 10 years new construction, extension, renovation. Sacred Heart University, Fairfield, Connecticut. <http://news.unn.net/news/articleView.html?idxno=147084>

- Anonymous, 2017. Education basic statistics announcement decrease in school-age population and decrease in enrollment rate. Ministry of Education, Sejong City, South Korea. <http://news.unn.net/news/articleView.html?idxno=178653>
- Bacon, E.N., 1974. Design of Cities. Thames & Hudson Ltd, London, England, ISBN:9780500340516, Pages: 336.
- Brolin, B.C., 1976. The Failure of Modern Architecture. Van Nostrand Reinhold Publishers, New York, USA., ISBN:9780442210724, Pages: 127.
- Im, G.S. and G.H. Choi, 1999. A study on renovation. J. Bucheon Univ., 20: 23-42.
- Kim, J.P. and K.J. Park, 2002. The constitution of process model for renovation system of university building: Focused on the preparation for the constitution of renovation system by analyzing the performed projects. Korean Inst. Inter. Des. J., 32: 105-112.
- Kim, S.S., W.B. Choi, W.C. Kim and S.J. Jang, 2001. M university student hall renovation programming evaluationa case study for university building renovation programming. Archit. Inst. Korea, 21: 303-306.
- Kim, Y.S. and W.D. Choi, 2000. A study on the model of renovation feasibility analysis of the building. J. Archit. Inst. Korea, 20: 151-154.
- Lee, W.S., 2002. Architecture Remodeling. Kimoondang Publishers, Korea.
- Oh, J., E. An and H. Lee, 2017. Factors influencing the mobility of malnourished rural elderly women a preliminary study on exterior renovation trends focused on university buildings. Intl. J. ICT. Aided Archit. Civ. Eng., 4: 13-18.
- Yeo, J.K., E.H. Ko and M.H. Choi, 2002. A study on tendency of the exterior renovation in a city. Archit. Inst. Korea, 18: 47-54.
- Yeo, U.Y., Y.S. Yoon, S.W. Suh and B.W. Lim, 2004. Improvement of construction management for building remodeling projects. Korea J. Constr. Eng. Manage., 5: 122-129.
- Yoon, Y.S. and C.H. Park, 2011. Growth trends and outlook of building remodeling market remodeling market. Cerik Issue Focuse, 2011: 2-34.
- Young, K.S., Y.S. Won, K.J. Pil and P.G. Joon, 2001. A study on the constitution of process model for renovation system of university building. Archit. Inst. Korea, 21: 547-550. Anonymous, 2015. Space creates thought 'endless transformation of the university library 10 years new construction, extension, renovation. Sacred Heart University, Fairfield, Connecticut. <http://news.unn.net/news/articleView.html?idxno=147084>