

MAKING BETTER PUBLIC BUILDINGS: OPEN SPACE ISSUES RELATED TO SPATIAL NETWORKS IN SEJONG CITY

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ABSTRACT

Nowadays, public buildings for residents' everyday life are recognised as a community centre for improving the quality of their life and communicating with local society. In the major countries, it is suggested that its open space should be arranged as social spaces easily accessible and convenient for everyone. However, in South Korea, the importance of such buildings is recognised, but more discussion of its planning direction is needed. Therefore, this study selected three public buildings in Sejong City, a new administrative city of South Korea, and from regional perspectives, research directions are derived from significant discussions on the public buildings in South Korea: 1)accessibility, 2)connectivity, 3)occupancy was analysed using Visibility Graph Analysis(VGA), and the improvement directions and renovation strategies were derived in connection with the site survey. In the results, improvements in terms of connectivity, integration, and user's clustering efficiency to the open space area around the building are expected to have a positive effect on the formation of the spatial relation between residents and the region, reducing negative factors such as lack of walking space, large step to the building entrance, high fences and walls. To create public buildings as a central space for residents, communities, and regions, it is crucial to establish its open space for citizens' lives more positively.

Keywords: open space, public building, Sejong City, Visibility Graph Analysis, Space Syntax

INTRODUCTION

1. Research background and objectives

Currently, the importance of public buildings in South Korea is continually being discussed. Public buildings for various purposes have been constructed, and numerous programs are being operated. The influence of public buildings on citizens has also increased (Lim, Lee & Kim, 2019). Accordingly, today's public buildings are not only required to function as a public service but also to enhance the quality of daily life as a base for local communities and to give vitality to the region. Besides, the open space of public buildings that will accommodate them is recognized as a major space of public buildings that anyone should easily access and use conveniently (Lim, Lee & Kim, 2019). However, there is a short discussion on its importance and plan direction. In particular, in order to improve the quality of public buildings from the perspective of spatial networks, in-depth discussion and research on how to solve the problem and in what direction is required. Mainly, it should be discussed how to transform the space into a space for people and communities. In turn, the purpose of this study is to change the perception of the open space of public buildings and to form a consensus on the importance of it.

2. Research scope and methodologies

This study was conducted following the process. First, through the analysis of previous studies, the research direction was established. Second, the study cases were selected, identifying the outline of

the space and the status of the open space. Third, through spatial analysis of the public building cases and user behaviour, improvement directions and renovation strategies on the target spaces were set. Fourth, the spatial situation before and after the renovation of the target space was analysed through Visibility Graph Analysis (VGA). Fifth, the discussion before and after the renovation of the target areas was grasped from a spatial network perspective, and finally, the conclusion of this study was derived.

Category	Research Stages	Methods
<i>The Spatial Strategies for Renovation</i>	<i>Research Direction</i>	<i>Literature review</i>
	▼	
	<i>Case studies</i>	<i>The analysis of Spatial condition</i>
	▼	
	<i>Improvement Directions and Renovation Strategies</i>	<i>Visitors' behaviour and Site survey</i>
	▼	
	<i>The Evaluation of Result</i>	<i>Visibility Graph Analysis (VGA)</i>
	▼	
<i>The meaning of open space of public space</i>	<i>Discussion</i>	
▼		
<i>Conclusion</i>		

Figure 1. Research scope and methodology

RESEARCH DIRECTION

The way of looking at the open space of public buildings has changed with the times. In the past, public buildings were viewed as a continuous space from the out realm of the city (Lim, Lee & Kim, 2019;15). Besides, in medieval and modern Europe, public buildings were recognised as monuments of cities and essential elements of streets (Lim, Lee & Kim, 2019;16). However, from the beginning of the 20th century, public buildings were recognised as independent entities from the outer space and gradually became an interior-oriented space (Lim, Lee & Kim, 2019;17). Moreover, these forms began to appear in various forms in each society. As citizens' interest in the quality of life increases and the importance of urban spaces as a place where social activities take place, a new relationship between public buildings and open spaces according to each society has been discussed (Lim, Lee & Kim, 2019;18). Therefore, in order to clarify the importance of the open spaces of public buildings today, the spatial characteristics of domestic public buildings were derived as the research goal based on prior research. As a result, accessibility, connection, and occupancy, which are the most frequent, were set as the aims for this study.

Authors (Year)	Spatial strategy		
	Accessibility	Connectivity	Occupancy
Jeong, S. et al. (1997)	○	○	○
Jeong, S. (1997)	○	○	
Lee, H, G. et al. (2003)	○		○
Yeom, C, H. et al. (2008)		○	
Shin, S, S. et al. (2009)	○	○	
Shin, Y, K. et al. (2009)	○	○	○
Jeong, T, Y. (2010)	○	○	○
Song, E, A. et al. (2012)	○		
<i>Plus, further previous studies</i>			

Figure 2. Research direction derived from previous studies

ANALYSIS

1. Case studies

In order to understand the current status of open spaces of public buildings in South Korea, research cases were selected from public buildings with high usage rates in Sejong City. In Sejong City, a new multifunctional administrative city has been built, and public buildings for various purposes such as educational facilities, cultural facilities, and sports facilities are scattered from public business facilities such as government buildings. Also, in the process of constructing a multifunctional administrative city, a particular policy has been promoted to improve the quality of public buildings and to establish itself as a landmark of a new city. From the background, three research cases that were frequently used by residents selected by its function and spatial characteristics by utilising the three factors derived from previous studies: accessibility, connection, and occupancy. The outline of each case is shown in the table below, and they showed issues of open space in the following aspects related to the three research perspectives: The long distance between lack of walking space, the long-distance to the buildings from the open space and high fences and walls.

Category		Function	Area	Open space issues
Case1	Sejong Cultural Centre	Culture and education	1,808m ²	Lack of walking space The long-distance to the buildings from the open space
Case2	Jochiwon Youth Centre	Youth health	-	High fences and walls
Case3	BukSejong City Welfare Centre + Jochiwon Complex Community Centre	Welfare	4,866m ²	

Figure 3. Research cases

2. Spatial conditions and visitors' behaviour/Site survey

For open space issues, spatial conditions were analysed for each perspective of accessibility, connection, and occupancy investigating the status through a site survey. The overview of spatial analysis and site survey is as follows.



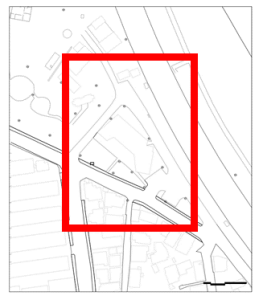

Category	Plan	Visitors Behaviour/Site Survey
Case 1		
Case 2		



Figure 4. Research case overview
(referred from a part of a previous study (Lim, Lee & Kim, 2019))

Category	Spatial Analysis Overview	Visitor Behaviour/Site Survey Overview
Case 1	Since the space between the two buildings was made only as a parking space, pedestrian continuity is insufficient.	Space between buildings where the active connection was difficult due to parking.
Case 2	The space of the building was generally planned not connecting its open space.	The building was disconnected to the open space.
Case 3	A pedestrian space was not connected to the surroundings.	High fences and walls surrounded the building.

Figure 5. The analysis of spatial conditions and visitors behaviour/site survey
(referred from a part of a previous study (Lim, Lee & Kim, 2019))

As a result of spatial analysis, access by most public transportations and bicycles was excellent, and information signs and distance from the site entrance were also good. However, it was challenging to find a well connection from the open space to the interior space, since there are no entrances to the building except for the main entrance and the secondary entrance. Besides, in the case of a front parking lot, the citizen utilisation rate was found low. As a result of the on-site survey, most of the open spaces were used as resting spaces for citizens. Even in remote places, many people were sitting in rest areas such as benches to chat or take a break. However, there were still several problems to access to the open space of the public buildings in terms of accessibility, connectivity, and occupancy.

3. Renovation directions and strategies

Based on the analysis of spatial conditions, visitors' behaviour and site survey, the improvement directions and strategies were derived from analysing the effectiveness of the renovation.

(3) Spatial analysis (VGA)

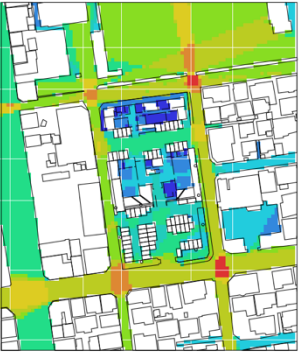
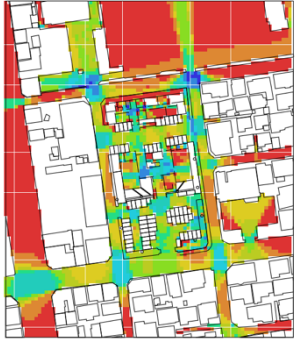
Visibility graph analysis (VGA) is a method of analysing the inter-visibility connections within buildings or urban networks. Turner and his colleague UCL (2001) developed the VGA under the Space Syntax theory, and it can be applied to the open spaces to analyse its spatial networks within architecture or urban area. If the colour in result becomes redder, it means the numerical value of a factor is higher.

Category	Case 1	Case 2	Case 3
Improvement directions	Increasing the area of walking space	Decreasing large steps to the building entrance	Increasing accessibility to the building
Renovation strategies	Transforming parking space	Increasing building entrance	Removing inaccessible fences and walls

Figure 6. Improvement directions and renovation strategies

Category	VGA factors	The Meaning of Factors
Accessibility	Integration	Visual integration is the value that reflects how entire spaces are related to specific spaces. When moving, more people tend to use the spaces with a high integration value and thus, it can mean accessibility within a particular space.
Connectivity	Connectivity	Visual connectivity measures the number of spatial elements, which are connected to a particular spatial element.
Occupancy	Clustering Coefficient	Visual clustering coefficient measures people's decision making by considering all possible existing lines of sight in the neighbourhood of a location in the visibility graph.

Figure 7. The factors of VGA

Integration	Connectivity	Clustering Coefficient
Before renovation		
		
After renovation		

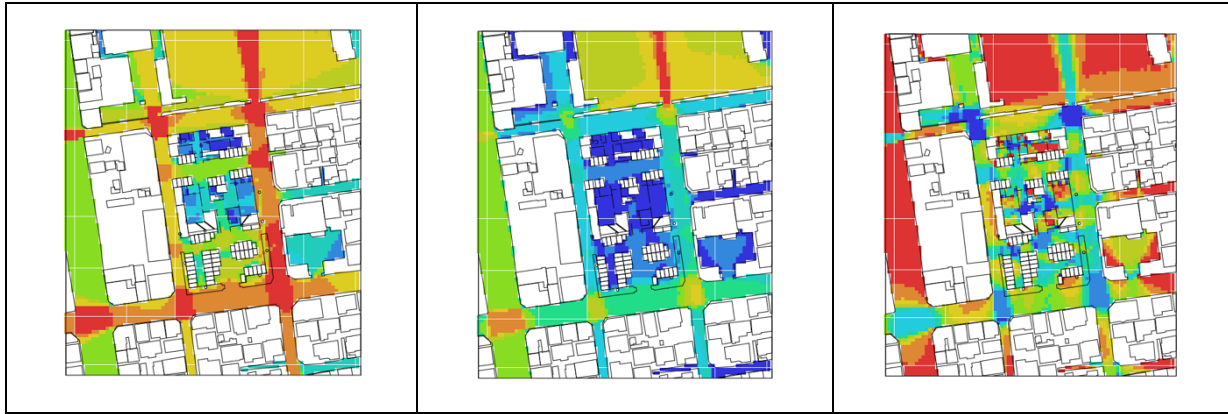


Figure 9. The Example of Visibility Graph Analysis

Case 3. Removing inaccessible fences and walls

Category	Case 1		Case 2		Case 3	
	Renovation					
	Before	After	Before	After	Before	After
Integration	6.34	6.78	4.83	4.86	5.53	6.00
Connectivity	454.78	469.19	431.41	433.41	556.65	602.29
Clustering coefficient	0.86	0.85	0.77(2)	0.77(0)	0.83	0.82

Figure 10. The result of VGA

After conducting VGA, the common results were found before and after renovation analysis of the open space of the public buildings in the three research cases. In terms of integration, after the improvement, it was analysed that the integration values were relatively higher than before renovation in the cases. From the connectivity analysis, it was found that the connectivity values were relatively higher after renovation than before the renovation. In terms of clustering coefficient, before the renovation, the clustering coefficient values were higher than after renovation in all research cases.

DISCUSSION AND CONCLUSION

Based on the analysis, it was found that the renovation would affect the use of open spaces of the public buildings positively. After the improvement, the overall use of the open space would increase, and thus, it can be said that the access to the public buildings was predicted to increase as the use of the open space increased in terms of integration. Thus, it can be said the accessibility to the open spaces would provide more chance of people's usage after the improvements.

From the perspective of connectivity, before the improvement, the connection degrees were relatively low, and it means that the connection between open spaces and public buildings would increase although the impact before and after the improvement was relatively insignificant. Thus, it

can be said the connectivity of spatial conditions would increase for more people's usage after the renovation.

In terms of clustering coefficient, before the improvements, people cannot decide their spatial use easily because of the low level of spatial conditions. However, after the improvements, people can use the open space of the public buildings slightly easier on their own decision with a low level of clustering coefficient. Thus, it can be predicted that the open spaces of public buildings can provide more chance of occupancy to the people for their spatial usage after the improvements.

In the end, it can be said that the improvement of the open space of public buildings will have a positive effect on the formation of spatial relations between residents and the region in terms of spatial access, the connection of each space, willingness to use space related to the further use of public buildings.

Therefore, it can be said that the improvement of open space around public buildings should be implemented for the efficient use of the buildings as a space for the citizen's daily life. Thus, it is necessary to modify the spatial planning centred on citizens in the direction to contribute to their daily life as their regional community. In addition, it is crucial to plan the open space of a public building as an integrated space with the public building, not a space attached to the building. Finally, it is needed to establish an integrated plan with the surrounding space so that the open space of public buildings is recognised as an element of the community.

This study is limited to have users' opinions in the cases from the previous study how to improve the open space of public buildings as their daily space, and it should deal with more aspects and cases to be developed. In further studies, it would be utilised the result of previous users' satisfaction survey on more cases and further aspects from the expanded perspectives with more various research methodologies.

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