Space utilization optimization of new campus of Halu Oleo University

La Ode Amrul Hasan\(^*\), Yudhi Dwi Hartono\(^2\), Arif Saleh\(^1\), Alim Bahri\(^1\)

\(^1\) Architecture Department, Universitas Haluoleo, 93232 Kendari, Sulawesi Tenggara, INDONESIA
\(^2\) Architecture Department, Muhammadiyah University of Kendari, Southeast Sulawesi 93127, Indonesia

*Corresponding author’s e-mail: ld.amrul@gmail.com

Abstract. The New Campus of Halu Oleo University (UHO) is one of the state universities included in the term of the largest university in Eastern Indonesia with an area of more than 252 Ha. Located in the central government development area, UHO's New Campus has become an attractive campus, shown by the increasing number of prospective students from year to year. This increasing number causes the university to provide educating facilities as the main need. The existing buildings and future development projects have not considered the concept of good spatial planning. This threatens the availability of land, especially the availability of open space and also affects the arrangement of related elements such as vehicle circulation, building utilities, drainage systems and mechanical-electrical. The purpose of this research is to provide a recommendation about the design of the UHO campus spatial layout which optimizes 60% open space availability proportionally with a more directed structuring concept. This research employed a qualitative method and data was collected through questionnaires and observations. The results indicate that the current space utilization is not well arranged, therefore affects other elements. Through the concept of cluster eco, campus area will be more organized.

1. Introduction

The existing buildings of the New Campus of Halu Oleo University (UHO) and its future development have not considered a good spatial planning. These buildings were constructed following the availability of land, therefore grow and develop without clear direction. It can affect the availability of open space and related elements such as vehicle circulation, building utilities, drainage system, and mechanical and electrical.

The existence of building for education facility at university is crucial to support the learning activity as the number of students is increasing year by year. Without considering good spatial planning, the development can affect the availability of green open space. Green open spaces are important for not only being an ecological balancer but also for the function of shared recreational activity spaces including social activity.

The importance of optimizing the building layout for the New Campus of Halu Oleo University (UHO) is to maintain the effectiveness of the land based on the comparison between the area of open space and built land, where the minimum requirement is 30% of open space available. If the current and future development is uncontrolled and does not have a clear spatial concept. Drainage, cabling systems, and street lighting are affected because of their presence following the pattern of road lanes within the region. As a result, the function of the area as higher education facilities will not be optimal due to the problems arising as the effect of poor conceptual spatial planning. Therefore, this research
aims to produce a recommendation of spatial layout for the New Campus of Halu Oleo University by optimizing land use by considering the open space of at least 30% and a maximum of 60%.

2. Literature Study

2.1. Literature Study

"Optimizing the Layout of Buildings for New Campus Space Utilization of Halu Oleo University (UHO)" can be interpreted as an effort to compile, organize, and integrate elements of the building with the aim of maximizing space effectiveness and efficiency. Considering that the new campus space is in the form of an education area with the existence of a building with space in it and the related regional elements, normatively the arrangement of the area is guided by the Regulation released by the Ministry of Public Works [1]. This regulation becomes the General Guidelines for Building and Environmental Planning which main foundation consist of:

a. The Structure of Land Allocation
It is an area design component that plays an important role in the allocation of use and land tenure/land use that has been determined in a particular planning area.

b. Intensity of land use
It is the level of allocation and distribution of the maximum floor area of the building to the land/site of its designation.

c. Building arrangements
It is a product of building construction and its environment as a form of space utilization, covering various aspects including the formation of the physical image/character of the environment, the size and configuration of block elements, plots of land, buildings. The other aspect is the height and elevation of building floors which take place in public spaces.

d. Circulation systems and connecting lines
It consists of road and movement networks, circulation of public vehicles, circulation of private vehicles, circulation of local informal vehicles and bicycles, pedestrian circulation (including disability and elderly) transit systems and facilities, parking systems, environmental service planning, and connecting network systems.

e. Open Space and Green System
It is a regional design component that is not only formed as additional elements or residual elements after the architectural design process is completed, but also created as an integral part of a wider environment.

f. Environmental quality management
It refers to efforts to engineer regional elements in such a way as to create an area or sub area with an informative environment, distinctive character, and having a specific orientation.

g. Environmental infrastructure and utility systems
It relates to completeness of the physical basis of an environment whose procurement allows an environment to operate and function properly.

As a supporting theory, [2] stated that a theory of environmental and building elements as elements of regional design consists of land use, building form and massing, circulation and open space, pedestrian ways, activity support, signage, and preservation.

3. Method

This research was conducted in the New Campus area of Halu Oleo University with an area of 277 ha. A qualitative research approach was employed, and the data was collected through observations and questionnaires. The observed objects included the layout of buildings, vehicle and human circulation, utility infrastructure, mechanical, electrical and drainage system. The indicator to see the priority of the condition of the area is based on seven spatial parameters in accordance with Ministerial Regulation [1]. The questionnaires were distributed randomly to 40 students and 10 employees whose activities are within the campus area.

The collected data were then tabulated to find out the tendency of user perceptions of the priority of building problems that exist within the campus environment. The information was then categorized based on its priority elements in accordance with 7 parameters [1] as the indicator. The next step is
analyzing the area based on the existing problems and then provide responses and design directives with the aim of optimizing space in the form of short-term to long-term design concepts.

4 Results
4.1. Analysis and Finding
4.1.1. Land Allocation Structure

Based on the existing condition, the UHO new campus land allotment is divided into macro and micro. The macro condition shows zoning function is based on each zoning. The western side is a Public Activity Zone (ZAP), an area dominated by public activities such as exercise, and sports games like football, futsal, basketball and tennis.

The Central Zone (ZP) is a campus core zone in the form of rectorate buildings and buildings that have similar functions as private status (have high privacy). Educational Service Zone (ZLP) is a zone of the education area containing educational faculties that have semiprivate status. The South is the Andalan Hutan Kampus (HAK) which is an ecological barrier, a forestry research area and the development of private gardens. The Ecological Responsive Zone (ZRE) is a control zone for surface water movement, allowing for retention lakes to accommodate excess water with semi-private status.

Based on the visible pattern, the region has a tendency to be centrally oriented so that it can potentially organize the form to be ring in ring system (a circle in a circle). This circle will later function as a road as well as barrier of the area that can later separate the public, semi-public and private areas including regulating circulation public transport.

The area has the main road character forming an imaginary axis line from the west, which is the main gate, then the core area of the campus to the road in the east. This has the potential strength of the regional character that can be used as a guideline for structuring the main building.

4.1.2. Intensity of Land Use

Based on the results of observations and data obtained, the following information is found:

Table 1. Open Space and Building Comparison Ratio

| Open space (OC)           | Size (M2) | Built Area (BC) | Size (M2) |
|---------------------------|-----------|-----------------|-----------|
| Experimental Garden       | 30000     | Office building | 33346     |
| Auditorium                | 50000     | Lecture hall    | 26666     |
| City Forest               | 460000    | Seminar room    | 5920      |
| Foot ball field           | 17600     | Lecture rooms   | 7067.66   |
| Outdoor Futsal field      | 5600      | Laboratory      | 37791     |
| Tennis field              | 582.4     | Auditorium      | 1600      |
| Basketball field          | 720       | Student dorms   | 4398      |
| Green open space          | 1579851   | Sports hall     | 260.87    |
| Rock climbing area        | 25        | Sports center   | 1755      |
| Mosque                    |           | Mosque          | 6585      |
| Prayer room               |           | Prayer room     | 1450.2    |
| Workshop room             |           | Workshop room   | 500       |
| Power house               |           | Power house     | 275       |

| Semi Total                | 2149886.4 | 627117         |
| Total                     | 2791185.40| 6027117        |

O.C to B.C ratio: 3.44% to 22.6%

The minimum size of open space of 10% area has been met.
The table shows that the allocation of land use for buildings is 627,117 m² or 22.6%, while the open space area is still very large, with 2,143,986 m² or 77.4% of the total land owned by UHO. Therefore, the minimum requirements for the current condition are more than 30% so that they have been fulfilled.

4.1.3. Building arrangements

Based on the data obtained, the number of students in 2015 was 36,701 while the building area of education facilities was 70,377 m² so that the building area per student ratio was 1.92 m² (rounded to 2 m²). With such results, the UHO's New Campus conditions are not in accordance with UNESCO standard which should be 8 m²/student. Each building is found to have a different appearance in the sense that the unity of the building character has not been seen properly. The buildings of the faculties tend to grow and develop forming a stand-alone area.

4.1.4. Circulation systems and connecting lines

The circulation conditions of vehicles in the area at this time are still found to be mixing the function of the road lanes where public vehicles are still free to enter and access the lane in the campus area including the rector's core zone.

The majority of street users are students who use motorized vehicles and the rest are pedestrians. Pedestrian facilities at some points have not been optimal, most are damaged due to rarely being used. It is found that unspecified pedestrian pathways are mostly formed from user reactions to the need for pedestrian paths in the place. Most of the users who are running want facilities that are equipped with shade and security to protect them from vehicles and time efficiency meaning that the closer destination is, the closer pathway they tend to create.

a. Open Space System and Green Governance

The existing open space system nowadays taking up 77.4% is dominated by green open space area which is not well-ordered. In this sense, the green area is dominated by forests growing wild and swamp. The existence of public open space is dominated by sports areas. The number of parks is significantly limited which is not well-organized for recreation and discussion points which include unorganized open public place in faculty area.

b. Environmental Quality Governance

Halu Oleo University’s area does not have the concept of spatial direction. The strong character of university as an education place cannot be seen clearly through the main gate. The public transportation can easily access any gates to enter university. This makes university’s privatization and characters as an education area decrease.
The university’s forest becoming a botanical garden as a part of future planning is one form of investment to make the area well-ordered and spatial directed. The forest will not only be worth investment but also worth ecological area.

c. Infrastructure system and environmental utility

Infrastructure system in this case, including the management of waste is not clearly visible. Although every building has its own trash bin, the people do not separate the waste based on organic and inorganic categories. Toxic and hazardous waste are also not separated properly.

In the area, treet lightings are no longer active although its existence is in the prone area. Most lightings use solar power which will become an obstacle when the nights.

The existence of a conventional cabling system using stilts in some points may harm pedestrians. It is because the existence of cross-street electrical wiring is directly beneath a shade tree branches which can be more likely broken which may disconnect the electricity wires and harm the pedestrians.

The drainage system at some points is damaged by the deposition of soil covering the channel so that the flow of water that should be through the pathway overflows into the street and the surrounding area especially when the rain comes.

The swamp area in the northern part of the university which collects the surface water has not been optimally processed so that the tendency of water moving over the surface just move naturally toward the swamp area and only a small portion is across the line in the drainage area.

5. Discussion

The optimal use of an open area of Halu Oleo University can happen through the gradual building arrangement with an adaptive and fixed program and timeline. Instead of making radical changes, preparing individuals to change the concept together is crucial. Therefore, not only the buildings are well-constructed, but also the users’ characters can be way better. To reach the optimal use of minimum 30% of open space area, or 60% for the most of it, the optimal and consistent use of the area needs to do. It aims to make the use of open space area felt not only in the environment level, but also the city level. Therefore, the existence of Halu Oleo University as a green campus can stabilize the ecological condition of the city and as the city lung to reduce city pollution.

To create internationally standardized proper education facilities, there should be a commitment to provide 8m² of the education building standard per student. By adhering to the ideal green campus which provides 60% of open space and the provision of educational facilities characterized by structuring the region with the fixed concept included if the condition still requires buildings construction. However, if the construction can take up the 60% of the open space limit, the following buildings need to be constructed vertically in its final stages.

To utilize the space potential and support the space utilities, a green eco university can be applied as the basic guideline to develop the university area. It needs three governance strategies. First, Green Blue eco Belt (GBB) meaning that Halu Oleo University can be a green campus which is
environmentally friendly. It means that the university is designed with the woods (green open space in the southern part) as the ecological barrier, while blue area represented by the swamp area as responsive ecology to create the balance between surface water and rivers to be used as recreation and water research. Second, micro-cluster campus system means to cluster the faculties based on the knowledge similarities in one complex cluster by naming clusters based on the figures who contributed to Halu Oleo University. Therefore, it is expected to create many collaboration programs or research in the future, such as conducting a relevant international conference. Third, a thematic landscape is the arrangement of outdoor space or landscaping the area which has unity of design and concept through thematic design creative. It is manifested through the use of façade appearance of the identical building. In other words, the appearance of the building will be united by the use of the same material that the terms of use of material in the form of a natural material which is durable and easily found such as marble or natural stone, second skin or double facade as the building character in order to have the same patterns, especially in some critical areas. Besides, thematic design can be achieved by using the existing elements in the area such as park benches, garden lights, etc which have the similar concept and form, included the tropical roof which suits the weather in Southeast Sulawesi.

The governance of street circulation needs to consider the existing circular pattern, so the concept of the ring in ring; creating circular as an alternative to the arrangement of the function zone as a commitment and regional control in order to create the core area of the campus that is free from public transportation can be applied. So that the university can have three zones with core area called as center zone (ring 1) in the form of regional rectorate, ring 2 is in the form of clusters of education that is free from public transportation, and ring 3 is a service area and public activity center where the public transportation is allowed to operate.

6. Conclusions
From the discussion above it can be concluded that
a. Halu Oleo University uses a center-oriented pattern with a rectorate as the center and surrounded by faculties as education facilities and the outer layer is the green open (university’s woods) and public open space (football field and parks).
b. The governance of Halu Oleo University is applied with a green eco concept. It applies with the area optimization through the concept of GBB or Green Blue Belt and the concept of regional zones by function and proximity of each faculty putting into particular clusters.

References
[1] Ministry of Public Works and Housing Number 06/PRT/M/2007, On 16 March 2007, about General Guidelines for Building Management and Environment
[2] Shirvani, Hamid, 1985, The Urban Design Process, Van Nostrand Reinhold, New York