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Analysis of The Availability and Identification of Public Green Open Spaces in GKU 1 and GKU 2 at Institut Teknologi Sumatera Campus

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Abstract: Institut Teknologi Sumatera (ITERA) is a higher education institution located in the village of Way Huwi, South Lampung Regency. It was established to fulfill the educational needs centered on the island of Sumatra. ITERA campus was formerly a green area used for rubber plantations and forests which underwent transformation due to the demand for academic buildings. This transformations is ecidenced by the construction of the General Lecture Building (GKU) and Engineering Laboratory Building (Labtek) 1-4. This reserarch focuses on GKU 1 and 2, which serve as the central academic hubs for three faculties of ITERA. The aim is to identify issues related to the availability of public green open spaces in each building. Both GKU building have the potential to function as communal zones that can be utilized for discussions, relaxation, and studying due to their distinct characteristics in terms of green space forms and types. The research methodology employs both quantitative and qualitative methods, such as parameters of Responsive Environments, The Likert Scale, and interviews related to the questionnaire, with the primary target audience being ITERA's students. The research results highlight various shortcomings and advantages in each GKU building. Recommendarions for improvemenr are expected to refine the research outcomes for ITERA.

Keywords: college students, communal zones, likert scale, needs, public lecture building, responsive environments.

Introduction

Institut Teknologi Sumatera (ITERA) is one of the state universities located on the island of Sumatra, established on October 6, 2014, in the Jati Agung District, Way Huwi Village, South Lampung Regency. The impact of ITERA's development can be observed through the transformation of its function from a rubber plantation and forest area into a developed educational zone. Consequently, within a significant period, the ecosystem within it has also undergone changes. According to [1], The current vegetation condition of ITERA is dominated by rubber trees (*Hevea brasiliensis*) in the former plantation area and acacia trees (*Acacia mangium*) as reforestation in the area, resulting in diverse vegetation cover in ITERA. The development of ITERA has been outlined in the Strategic Masterplan ITERA 2020-2027, which is linked to the Masterplan for Acceleration and Expansion of Indonesia's Economic Development (MP3EI). This involves providing educational and research infrastructure accompanied by sustainable maintenance, fostering collaboration and

interaction facilities for users within a specific structural body. Currently, the ITERA campus has facilities including four student dormitory towers, two cafeterias, four Engineering laboratory buildings, two mosques, and four lecture buildings. Alongside this, the ITERA campus still needs to pay attention to supporting facilities for the academic community. The creation of Public Green Open Spaces (PGOS) on this campus also needs attention in its development as a communal space accommodating various student activities, both academic and non-academic. The research area is focused on active lecture buildings that serve as the active learning and spending time for students, such as GKU.

The objective of this research is to identify and analyze the availability of PGOS, especially in GKU 1 and 2, which are relatively newly built in 2023. These buildings have a strategic location but have limitations in green space. This research is conducted to measure the opinions and perceptions of students and staff/lecturers regarding the PGOS of GKU based on Public Space Criteria from the



Responsive Environments Book, including Permeability, Variety, Legibility, Robustness, Visual Appropriateness, and Richness. The results of this research are expected to provide recommendations for providing good public green spaces for GKU 1 and 2, which can accommodate the needs of ITERA students and lecturers with sustainable environmental values.

Indicators and Parameters of Public Open Spaces

Public spaces have been a fundamental part of community life for several centuries. Public spaces function as places for individuals or groups to rest, meet, and exchange ideas. Public spaces are places for the community to gather and play in the context of a free society stated in [2]. According to [3], public spaces should be responsive, democratic, and meaningful, accommodating a variety of activities, interests and desires of the users, and serving as points for urban communities to meet, gather, and express themselves. It was shown in [4] explains that public spaces are formed by two important factors: the physical factor related to the form of the surrounding buildings, and the psychological factor that is an individual's perception of an open space. One characteristic of public spaces is easy accessibility, being open, and may or may not contain green elements [5]. Public spaces have unique value and potential for sustainability for individuals and communities to stimulate positive activities, usually free of charge. This is one of the understandings that public spaces can be freely enjoyed by the public. A good indicator of the quality of public space, besides being a discussion space, is a space that can create expressions and positive activities within it, whether through the presence of music, art, food, or celebratory activities.

According to [6] stated in their book titled "Responsive Environments" that a good and friendly public space can be assessed by paying attention to several supporting points, including permeability, variety, legibility, robustness, visual appropriateness, and richness. These six supporting points serve as the basis for assessing PGOS, i.e., permeability, variety, legibility, robustness, visual appropriateness, and richness.

Perception of Green Open Space in Campus

Green spaces are one of the ways to escape from crowded conditions to find tranquility in daily campus life. Individuals can experience peace through green spaces is an important aspect in design, where the perception of green spaces is defined as the interaction between individuals and the environment they inhabit, viewed differently towards the landscape. Green open

spaces require even better planning to maintain the balance of environmental quality, both on campus and in urban areas. In campus life, the physical and non-physical aspects of green spaces can determine how students respond and react within them. With one of the distinctive values of the campus having the potential for a forest and green space path, public spaces become an important highlight sought and favored by students, especially at ITERA Campus. The presence of green open spaces becomes a basic preference needed and desired in every individual's different social and physical psychological context, as a space to relieve stress in daily life. Therefore, individual perception plays an important role in shaping green open spaces.

According to literature, the affective quality of places such as on campus can be measured from user perception, experience-related responses to the place and preferences for the desired landscape style. In these response values, contact with nature and opportunities for social interaction are considered positive experiences of green spaces. Therefore, research on students' perceptions of campus green spaces is important in achieving sustainable outdoor spaces on campus. The research was conducted to assess the availability and value of outdoor spaces in campus buildings that indicate the need for green open spaces on campus. In this research, a survey was conducted to gather opinions on the need for green open spaces and trees. Because the perception of green spaces plays a major role in overall green space sustainability, this research emphasizes on the perception and use of green spaces located at the center of GKU 1 and 2. The development and progress of the education system are considered as one of the indicators of a nation's success. This can be seen from the amount of data obtained from various countries that provide information related to the excellence of the education sector such as learning models, facilities and infrastructure, research results, and graduates' products. Currently, Indonesia is considered to still experience gaps in the education [7]. This is influenced by management, teaching systems, the role of the government and society, human resources as educators, funding capabilities, infrastructure, and learning accessibility. As a developing country, Indonesia continues to make efforts to improve its quality in various sectors, including education. According to [8], to improve the quality of the nation, there needs to be a well-decentralized education system. This decentralization aims to improve the efficiency and

effectiveness of public services in meeting the needs of better education stated in [9].

Method

This research method used stratified random sampling technique. This sampling method helped to conduct a more in-depth analysis on a specific sub-population within a larger population. The target in this study is limited to the academic community of ITERA because it is the primary user, and the perception location is intended only for students and campus staff as users of GKU 1 and 2. The subpopulation is focused on the primary users of the space, namely students as active users who conduct lectures almost 75% each semester and have a more intense and in-depth experience of space, and ITERA lecturers/staff as passive users who visit the space during specific processes or teaching class interests.

Research Parameters

According to [6], the determination of research indicators is taken from Responsive Environments which use two parameters, namely dependent and independent parameters. Independent parameters are user perceptions visiting an area at the research location, while dependent parameters are assessments of a good and friendly public space in accommodating all user activities, including permeability, variety, legibility, robustness, visual appropriateness, and richness. Factors influencing the level of a good public space as a framework in determining the evaluation process in the preparation of research instruments through parameters and sub-parameters are:

1. **Permeability:** The variety of accesses that can lead visitors to the desired public green open space, corridor dimensions for user comfort during activities, the connection of public green open space occupied with surrounding spaces through visualization, the ease of parking vehicles to the public green open space to be occupied, and the condition of the area and public facilities if reached by people with disabilities
2. **Variety:** The level of user comfort with the ability of public green open space to accommodate private activities, the level of user comfort with the ability of public green open space to accommodate group activities, the condition of the visual effects unity through created landscapes and buildings (gardens,

buildings, gazebos, parking lots), and the form and physical material of public facilities used in supporting public comfort.

3. **Legibility:** The character and conditions of the landscape that characterize ITERA Campus, facilities and directing elements for the public to carry out activities (signboards, guiding blocks, directional vegetation, etc.), the variety and strata of vegetation in public green open spaces that are occupied and can fulfill the concept of ITERA Campus as a "forest campus."
4. **Robustness:** The ability of public green open space to accommodate various user activities, both academic and non-academic, and the comfort of visitors when doing activities with other activities in the surrounding space being occupied (noise from motorized vehicles).
5. **Visual Appropriateness:** The number of public facilities in public green open spaces to accommodate user activities, the condition of public facilities in public green open spaces to accommodate user activities, and the condition of the appropriateness of public green open spaces and the level of safety of parking vehicles around the location.
6. **Richness:** The level of cleanliness of public green open spaces occupied, the condition of shading elements during hot and rainy weather, the condition of lighting in public green open spaces at night, and the perceived wind/ventilation conditions by users.

Assessment's Data Sampling

The calculation and data processing technique for sampling used the Likert scale assessment. The Likert scale is a psychometric scale commonly used in questionnaire calculations and is the most widely used type of scale in survey-based social research [10]. Because the research conducted is of a public nature, it can be interpreted that all the characteristics or characteristics that exist in the population are reflected in the sample. To determine the number of samples, the researcher used the Lemeshow formula with a sample limitation of 100 people consisting of ITERA students and faculty/staff each day, with an assumed reliability level of 95%, with a standard value of the population proportion being 1.96 if the number of visitors is not known exactly. Based on the Lemeshow formula, the researcher determined the number of respondents as

±96 respondents. The sampling is limited by the researcher's available time and resources. The following is the analysis of questionnaire scoring:

1. Determining respondent scores by analyzing data from a ranked questionnaire from 1 to 5. The researcher interprets each answer alternative with the following categories:
 - a. "Very Easy," "Very Diverse," "Very Connected," "Very Clean," "Very Comfortable," and "Very Good." This category indicates the highest rank with a score of **5**.
 - b. "Easy," "Clean," "Comfortable," and "Good," "Diverse," "Connected" indicate a lower rank than those with the added word "Very." This category indicates a score of **4**.
 - c. "Fairly Easy," "Fairly Clean," "Fairly Comfortable," "Fairly Good," "Fairly Connected," "Fairly Diverse." This category has a score of **3**.
 - d. "Less Easy," "Less Clean," "Less Comfortable," "Less Good," "Less Connected," "Less Diverse." This category has a score of **2**.
 - e. "Not Easy," "Not Clean," "Not Comfortable," and "Not Good," "Not Connected," "Not Diverse." This category has the lowest rank with a score of **1**.
2. Summing up all the scores obtained from each respondent.
3. Calculating the percentage of scores obtained using the formula (1) below:

$$\% = \frac{n}{N} \times 100\% \quad (1)$$

with:

n = Number of respondent scores

N = Total maximum scores

Next, the calculation continues with the determination of percentage intervals to establish success criteria. The interval value settings can be seen in **Table 1**.

Table 1. Interval Value Settings

No	Presentation Class Interval	Criteria
1	≥ 84,00% - ≤100%	Very Successful
2	≥ 68,00% - <84,00%	Successful
3	≥ 52,00% - <68,00%	Fairly Successful
4	≥ 36,00% - <52,00%	Less Successful
5	≥20,00% - <36,00%	Not Successful

Results And Discussion

Based on the outlined requirements, the improvement of infrastructure and facilities is a crucial element for success in the field of education, considering its impact on sustaining ecosystems. This is particularly relevant for ITERA, which exhibits diverse ecosystems. Beyond its environmental aspects, ITERA faces challenges in providing interaction spaces for students to engage in discussions. The results and discussion of perceptions and the use of GPOS in GKU 1 and 2 are presented through the assessment of Public Green Open Space levels as follows.

Perception Results of Users Toward PGOS of GKU 1

1. Permeability

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 1, based on Permeability parameters, is 63.8% (Fairly Successful). The breakdown of values is as follows:

- a. Variety of access routes leading visitors to desired public green open spaces with a percentage value of 74.2% (Diverse).
- b. Corridor dimensions concerning user comfort during activities with a percentage value of 66.2% (Sufficiently Comfortable).
- c. Connection of occupied public green open spaces with surrounding areas through visualization with a percentage value of 66.0% (Adequately Connected).
- d. Ease of parking vehicle towards the desired public green open space with a percentage value of 64.0% (Reasonably Easy).
- e. Accessibility of public area and facilities for people with disabilities with a percentage value of 49.0% (Less Easy).

2. Variety

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 1, based on Permeability parameters, is 63.8% (Fairly Successful). The breakdown of values is as follows:

- a. User comfort level regarding the ability of public green open spaces to accommodate private activities with a percentage value of 47.4% (Less Easy).
- b. User comfort level regarding the ability of public green open spaces to accommodate group activities with a percentage value of 75.2% (Comfortable).
- c. Unity of visual effects through created landscapes and buildings (gardens, buildings, gazebos, parking spaces) with a percentage value of 61.2% (Reasonably Good).
- d. Form and physical material of public facilities used to support public comfort with a percentage value of 63.8% (Reasonably Comfortable).

3. Legibility

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 1, based on Legibility parameters, is 54.4% (Fairly Successful). The breakdown of values is as follows:

- a. Character and condition of landscapes that characterize ITERA Campus with a percentage value of 60.2% (Reasonably Good).
- b. Facilities and guiding elements for the public in activities (sign boards, guiding blocks, directional vegetation, etc.) with a percentage value of 52.6% (Reasonably Good).
- c. Variety and strata of vegetation in occupied public green open spaces that can fulfill the concept of ITERA Campus as a "forest campus" with a percentage value of 50.6% (Less Diverse).

4. Robustness

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 1, based on Robustness parameters, is 55.8% (Fairly Successful). The breakdown of values is as follows:

- a. Ability of public green open spaces to accommodate various user activities, both academic and non-academic, with a percentage value of 63.8% (Adequately Capable).

- b. Visitor comfort during activities concerning other activities in the surrounding space (motor vehicle noise) with a percentage value of 47.8% (Less Comfortable).

5. Visual Appropriateness

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 1, based on Visual Appropriateness parameters, is 53.4% (Fairly Successful). The breakdown of values is as follows:

- a. Number of public facilities in public green open spaces to accommodate user activities with a percentage value of 50.0% (Less Diverse).
- b. Condition of public facilities in public green open spaces to accommodate user activities with a percentage value of 57.4% (Reasonably Good).
- c. Feasibility of public green open spaces and the level of vehicle parking security around the location with a percentage value of 53.0% (Reasonably Good).

6. Richness

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 1, based on Richness parameters, is 57.3% (Fairly Successful). The breakdown of values is as follows:

- a. Cleanliness level of the occupied public green open space with a percentage value of 75.4% (Clean).
- b. Shade elements' condition during hot and rainy weather with a percentage value of 48.4% (Less Good).
- c. Illumination condition in public green open spaces at night with a percentage value of 46.8% (Less Good).
- d. User-perceived wind/ventilation conditions with a percentage value of 58.6% (Reasonably Good).

Perception Results of Users Toward PGOS of GKU 2

1. Permeability

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 2, based on Permeability parameters, is 62.5% (Fairly Successful). The breakdown of values is as follows:

- a. Variety of access routes leading visitors to desired public green open spaces with a percentage value of 64.2% (Fairly Diverse).
- b. Corridor dimensions concerning user comfort during activities with a percentage value of 54.2% (Reasonably Comfortable).

- c. Connection of occupied public green open spaces with surrounding areas through visualization with a percentage value of 71.8% (Connected).
- d. Ease of parking vehicle towards the desired public green open space with a percentage value of 46.7% (Less Easy).
- e. Accessibility of public area and facilities for people with disabilities with a percentage value of 75.0% (Easy).

2. Variety

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 2, based on Variety parameters, is 61.9% (Fairly Successful). The breakdown of values is as follows:

- a. User comfort level regarding the ability of public green open spaces to accommodate private activities with a percentage value of 47.4% (Less Comfortable).
- b. User comfort level regarding the ability of public green open spaces to accommodate group activities with a percentage value of 75.2% (Comfortable).
- c. Unity of visual effects through created landscapes and buildings (gardens, buildings, gazebos, parking spaces) with a percentage value of 61.2% (Reasonably Good).
- d. Form and physical material of public facilities used to support public comfort with a percentage value of 63.8% (Fairly Successful).

3. Legibility

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 2, based on Legibility parameters, is 52.8% (Fairly Successful). The breakdown of values is as follows:

- a. Character and condition of landscapes that characterize ITERA Campus with a percentage value of 60.2% (Reasonably Comfortable).
- b. Facilities and guiding elements for the public in activities (sign boards, guiding blocks, directional vegetation, etc.) with a percentage value of 54.4% (Reasonably Good).
- c. Variety and strata of vegetation in occupied public green open spaces that can fulfill the concept of ITERA Campus as a "forest campus" with a percentage value of 43.8% (Less Diverse).

4. Robustness

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 2, based on Robustness parameters, is 65.6% (Fairly Successful). The breakdown of values is as follows:

- a. Ability of public green open spaces to accommodate various user activities, both academic and non-academic, with a percentage value of 62.8% (Adequately Capable).
- b. Visitor comfort during activities concerning other activities in the surrounding space (motor vehicle noise) with a percentage value of 68.4% (Comfortable).

5. Visual Appropriateness

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 2, based on Visual Appropriateness parameters, is 59.4% (Fairly Successful). The breakdown of values is as follows:

- a. Number of public facilities in public green open spaces to accommodate user activities with a percentage value of 58.6% (Fairly Diverse).
- b. Condition of public facilities in public green open spaces to accommodate user activities with a percentage value of 69.0% (Good)
- c. Feasibility of public green open spaces and the level of vehicle parking security around the location with a percentage value of 50.8% (Less Good).

6. Richness

The percentage of user perceptions and achievements regarding the value of PGOS in GKU 2, based on Richness parameters, is 56.7% (Fairly Successful). The breakdown of values is as follows:

- a. Cleanliness level of the occupied public green open space with a percentage value of 76.0% (Clean).
- b. Shade elements' condition during hot and rainy weather with a percentage value of 40.4% (Less Good).
- c. Illumination condition in public green open spaces at night with a percentage value of 51.4% (Less Good).
- d. User-perceived wind/ventilation conditions with a percentage value of 59.2% (Reasonably Good).

Conclusions

Based on the discussed results, it can be concluded that PGOS GKU 1 and PGOS GKU 2 at ITERA Campus still require more attention from the user's perspective. Some aspects that need improvement are indicated by categories such as "less comfortable," "less good," "less easy," and "less diverse." Recommendations are provided to address these issues and are discussed below.

Recommendation for PGOS of GKU 1

In this area, several sub-parameters of the "responsive environment" indicator still need attention for the success of a PGOS. Recommendations include:

- a. Variety: Consider user-friendly design elements such as guiding blocks, ramps, and non-sharp materials in public facility design to cater to users with special needs.
- b. Legibility: Add shading trees as natural shading to enhance user comfort and install informative elements like signboards or signage. Introduce diverse plant species based on planting strata to stimulate creative thinking and views.
- c. Robustness: Implement a transitional space with secondary facades or vertical green walls to reduce noise and pollutants from surrounding areas during communal student activities.
- d. Visual Appropriateness: Add public facilities such as benches, gazebos, and green spaces with shading plants to accommodate user activities.
- e. Richness: Improve lighting infrastructure for night activities and maximize the potential of public green open spaces as outdoor laboratories for specific academic programs.

Recommendations for PGOS of GKU 2

In this area, several sub-parameters of the "responsive environment" indicator still need attention for the success of a PGOS. Recommendations include:

- a. Permeability: Provide dedicated parking spaces near lecture halls to address the parking issue.
- b. Variety: Introduce new spaces in potential areas, enhance the value of green open spaces, and increase the variety of plant species.

- c. Legibility: Add shading trees for natural shading, improve the variety of vegetation, and install informative elements like signboards or signage.
- d. Visual Appropriateness: Provide dedicated parking areas around buildings with enhanced security.
- e. Richness: Focus on shade elements for daytime activities and improve lighting infrastructure for safety around the campus.

Conflicts of interest

There are no conflicts to declare.

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