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Green Building Assessment on Arena Innovation UGM Creativity Based on BGH Method and Greenship

Bayu Purnomo[1], Agung Wahyudi Biantoro[2]

[1,2] Civil Engineering Department, Mercu Buana University, Indonesia

ABSTRACT: This study aim to know calculation BGH values on development GIK UGM building and review study previously discussed about evaluation building green. This research use type study descriptive that explains about utilization theme green building in this research. The results during ten year final there is more of 1000 studies that discuss about BGH theme and evaluation building green. Results search theme building green with utilise Publish or Perish app and Google Scholar website and crossref with set time search for 10 years, researchers get results of 19.50 cited papers per year and every researchers at least make two papers per year. Furthermore done mapping the themes presented in form graph. Results BGH assessment on implementation the construction of GIK UGM shows that development has fulfil BGH criteria according with the indicators that have been set . The development of GIK UGM meets part BGH's achievements with criteria greenship especially on indicator EEC, WC, IHC, and BEM, are shown through conservation energy and water, management quality buildings, as well as implementation management safety Work . Results BGH assessment with criteria greenship show that development has in accordance with applicable criteria.

KEYWORDS: Green Building, Greenship, BGH Method

I. INTRODUCTION

Today's growing urban population has long-term impacts on the environment and natural resources. Buildings account for 32% of total global energy use (Wang et al., 2021a) . Global energy consumption, particularly in high-rise buildings, is expected to increase by 70% between 2000 and 2030, with an even greater percentage thereafter. The concept of green buildings , or environmentally friendly buildings, helps slow the rate of global warming by modifying the microclimate (Geng et al., 2019) .

Green buildings (GWs) are designed for economic and environmental sustainability, taking into account local climate and cultural needs, which can facilitate the health, safety, and productivity of occupants (Singh et al., 2024) . The green building movement is now mature enough to demonstrate the value of the green economy in the real estate market for building owners and tenants, as evidenced by the rapid increase in the use of renewable energy and the conversion of information technology and technology development into smart city developments, eco-districts, and green campuses.

green building concept has developed and been implemented in various countries worldwide, including cities such as Jakarta, Surabaya, and Yogyakarta. To support green building applications in Indonesia, the government has implemented various regulations related to green buildings. One such regulation is the Regulation of the Minister of Public Works and Public Housing of the Republic of Indonesia Number 02/PRT/M/2021 concerning Green Buildings. However , the *green building concept* has not yet achieved its intended success (Kadek et al., 2021) . The slow adoption of the green building concept is partly due to a lack of investment interest from developers in *green building construction* due to the alleged high costs involved (Warsito & Rokhmawati, 2021a) . Referring to PUPR Ministerial Regulation No. 21/PRT/M/2021, green building assessments are based on the percentage achievement of technical indicators. Meanwhile, the GBCI assessment uses a points system. The comparison can be seen in Table 1.

Table 1 Comparison of assessments from PUPR and GBCI 2021

Certification	Level	Percentage/Points
PUPR (BGH)	Primary	45% - <65%
	Middle	65% - <80%
	Main	80%
GBCI (*GREENSHIP*)	Bronze	≥35 points
	Silver	≥46 points
	Gold	≥57 points
	Platinum	≥73 points

Buildings intended for international use are best served by a green building certificate. The certification chosen is the *Greenship certification* issued by the Green Building Council Indonesia (GBCI) (Sutikno et al., 2023) . To obtain a platinum rating from Greenship certification, it is necessary to examine the factors influencing the rating. Generally, there are two differences between green buildings and gray

buildings. First, green buildings relate to or mimic natural ecosystems, while gray buildings are the result of human engineering or thinking that does not take inspiration from or follow natural ecology. Second, green buildings are multifunctional, meaning they can provide more than one type of service to the community (Fagan, 2020) .

The UGM Creative Innovation Center (GIK UGM) has been subject to controversy over its location both before and after construction. Although a feasibility study was in place before construction, no further research was conducted to verify the location of the center.

Therefore, this study will prove the implementation of environmentally friendly GIK UGM buildings that focus on the BGH and *Greenship aspects* and are expected to meet the BGH and Greenship criteria in accordance with PUPR Ministerial Regulation No. 21/PRT/M/2021 and Greenship issued by GBCI . *Green building* assessments in Indonesia are currently still guided by the *greenship standards* issued by *the Green Building Council Indonesia* and until now there are no specific assessment standards for Gelanggang *green buildings* , so the determination of research variables is based on the BGH and *greenship aspects* and literature studies.

II. METHOD

This research is a literature review, where researchers conducted a literature review of journals discussing green buildings over the past 10 years. The search for journals related to green buildings was assisted by the Publish or Persish application, using data obtained from Google Scholar and Crossref. The collected data will then be presented in the form of a VOS diagram based on the most frequently used keywords.

III.RESULT

A. Publish or Perish Results

This research used Google Scholar and CrossRef as search tools. The researchers set the search period to the last 10 years, using keywords such as green buildings, green building assessment, BGH, and greenship. The search results can be seen in the table below.

Table 2 Search Results using the Publish or Perish Application

No	Description	Data
1	Publication Years	2015 - 2025
2	Citation Years	10 (2020 – 2025)
3	Papers	1000
4	Citation	195
5	Cites / Year	19.50
6	Cites / paper	0.20
7	Authors/paper	2.38
8	H index	4
9	G Index	4

The search results above show that over the past ten years, discussions about green buildings and green building assessments have remained highly sought after. This is driven by the need for green building assessments and public awareness of the importance of protecting the environment and using environmentally friendly materials. The government's green building assessment criteria are a crucial part of efforts to preserve the environment.

B. VOS Viewer Results

After searching for journals using the Publish or Perish application, the next step is to map journals based on the keywords used. This is to determine the number of keywords used and to determine whether the topic is still worthy of research. The results of the mapping using network visualization can be seen in the image below.

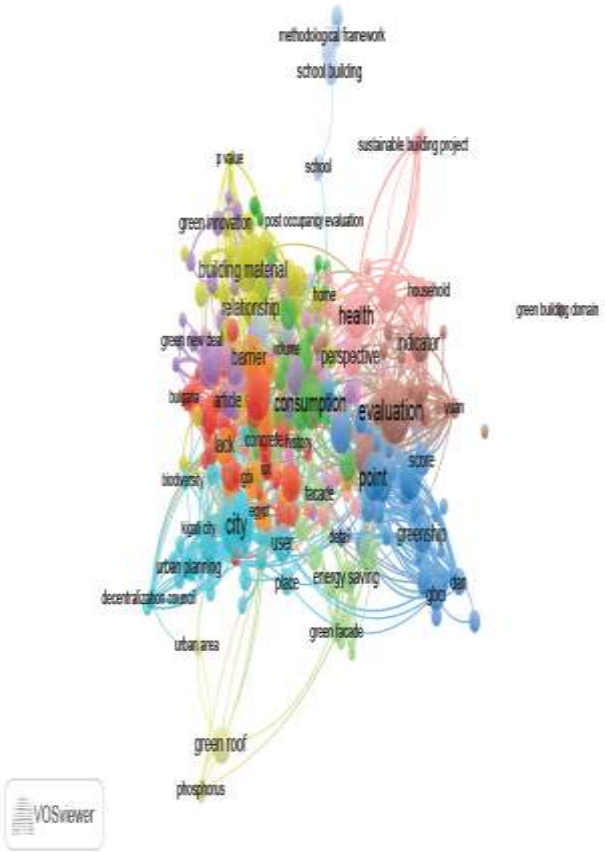

Figure 1 Mapping Results Based on Network Visualization

After mapping using network visualization, it was apparent that many words could not be considered keywords. Furthermore, there were words that did not overlap with other keywords. Therefore, the obtained keywords were reduced by examining their close relationship to the topic being used. The results can be seen in the image below.

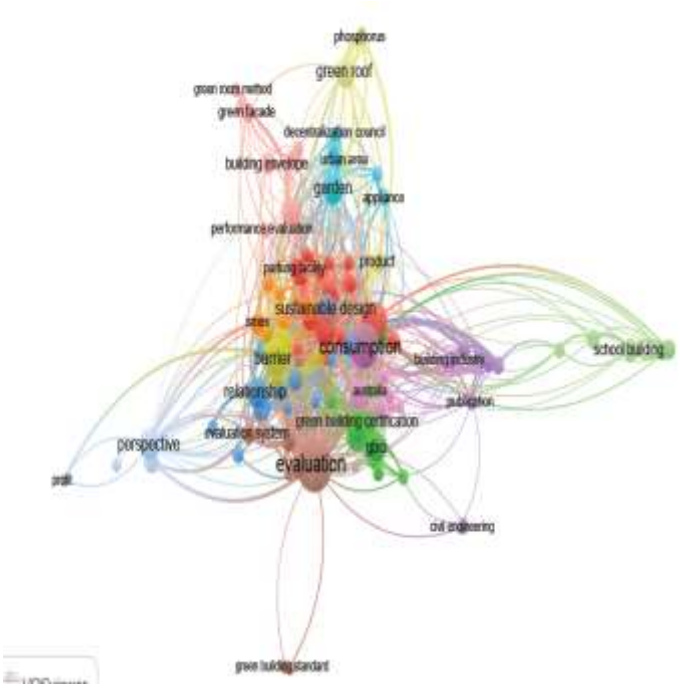

Figure 2 Mapping Results Based on Network Visualization after keyword reduction

Using the VOS Viewer application, researchers can identify the most recent keywords. This can be seen by the keywords appearing in a lighter color. The results can be seen in the image using the overlay visualization.

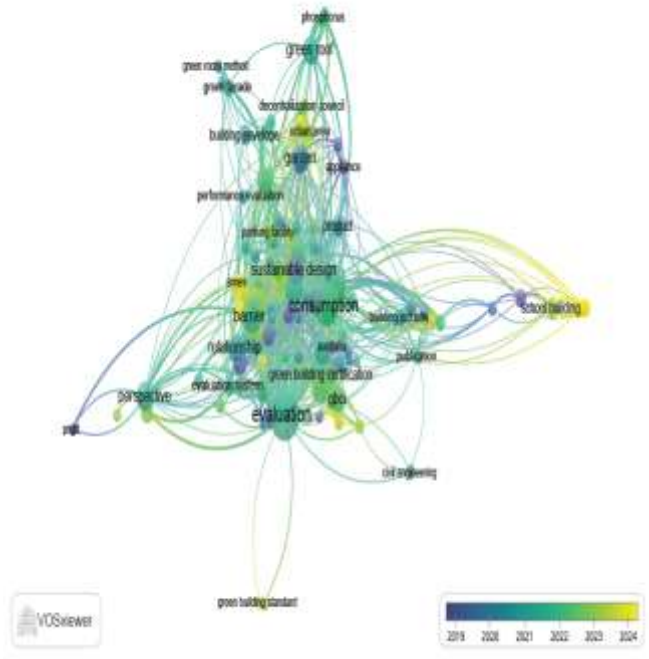

Figure 3 Mapping Results Based on Overlay Visualization

The image above shows that "business environment" has become one of the latest buzzwords. This indicates that green building assessments are no longer solely about environmental protection but also about protecting the business environment. Mapping using density visualization shows that research on buildings and structures remains a trend, particularly in terms of green building assessments.

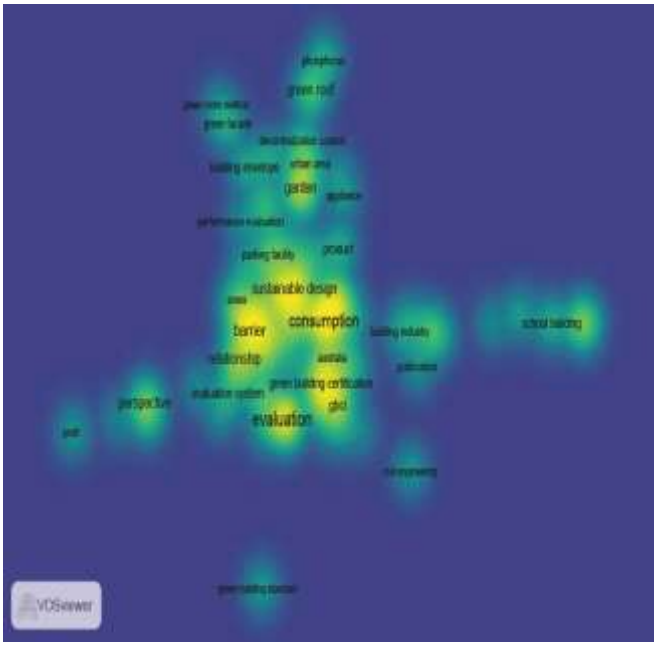

Figure 4 Mapping Results Based on Density Visualization

Analysis bibliometrics with use visualization density give deep insight about connection between various nodes in something network research . From the results visualization shown on Figure 4, seen the existence of an area with density high , especially between nodes that are connected to each other relate .

C. Green Building Assessment Results

A green building assessment was conducted on the construction of the GIK UGM building, and the results showed that the building demonstrated a commitment to implementing green building practices. The BGH evaluation resulted in a total realization score of 114.01 out of 165 points, equivalent to 69.10%. Compared to the initial plan of 149 points, this realization reflects that most aspects of green building have been implemented, although there are still shortcomings in several parameters.

In addition, the construction of GIK UGM fulfills some of the BGH achievements with greenship criteria, especially in the EEC, WC, IHC, and BEM indicators, demonstrated through energy and water conservation, building quality management, and the implementation of work safety management. The MRC (*Material Resources and Cycle*) aspect has not been optimally fulfilled, especially in the management of construction waste and the selection of certified materials. ASD (Appropriate Site Development) has not been evaluated in the BGH assessment, so an additional audit is required if you want to apply for full Greenship certification.

This research has several similarities with previous research. Research conducted by Wang et al (2021b) accurate electricity demand predictions that account for impacts of extreme weather events are needed to inform electric grid operation and utility resource planning, as well as to enhance

energy security and grid resilience. Three common data-driven models are used to predict city-scale daily electricity usage: linear regression models, machine learning models for time series data, and machine learning models for tabular data.

Another study conducted by Rizki et al., (2023) applied green building assessment to create a green campus. Changing the micro-scale climate is one method in implementing the Green Campus concept, namely through the Greenship assessment approach method at the Design Recognition stage established by the Green Building Council Indonesian (GBCI). Design recognition implements Building Information Modeling (BIM) in 3D modeling. The results obtained by UMSIDA Campus 3 received a Bronze predicate. It can be concluded that a Technical Recommendation with a total index of 61.17 is needed to achieve the platinum predicate.

Research by Sutikno et al. (2023) found that energy is the most influential factor in obtaining platinum rating certification, which requires value engineering and lifecycle cost analysis to achieve optimal investment costs with additional costs ranging from 7,494% to 4,689%. Green building research has also developed, with 53 scientific publications. This cutting-edge review shows that green building implementation in Indonesia has been implemented in various aspects of buildings. Going forward, integrated strategic policies and regulations at the national and regional levels are needed to implement green buildings comprehensively in Indonesia (Warsito & Rokhmawati, 2021b) .

Results of the evaluation show that, in the category of Appropriate Site Development, the planning of Gianyar Public Market obtains 41.18% points. It means that the planning has not yet fully fulfilled the criteria. Therefore, some efforts and improvements need to be taken and made to fulfill the criteria of the categories in which the planning has not yet obtained maximum points. One of such categories is technology application (Agusintadewi et al., 2021) .

Based on an extensive literature review, a hypothetical framework, incorporating Pakistan's unique local contexts and adding cultural and governmental dimensions to the widely adopted social, environmental, and economic dimensions of sustainability, was proposed in this paper. This framework was further validated by in-depth interviews with multiple stakeholders in Pakistan. A qualitative analysis of the interview results was carried out, and the final framework was proposed with key indicators, reflecting all five dimensions of sustainability. The verified sustainability framework can be used to improve or develop green building rating tools for Pakistan, and it can also inform other developing countries' rating tool development (Khan et al., 2021) .

The use of green buildings to achieve water, material, and energy conservation can not only ensure environmental benefits, but also improve ecological benefits. In order to further improve the environmental benefits of green buildings from the perspective of carbon emissions, it is also necessary to conduct a specific analysis combining the development advantages and environmental benefits of green buildings (Chen & Luo, 2020) .

The green building concept has been adopted as the main approach in the development of this project. Evaluation was conducted to assess the level of compliance with applicable regulations. In the implementation stage, it includes the selection of environmentally friendly materials, optimization of energy use through the installation of solar panels and the use of energy-saving equipment, efficient water management, and utilization of recycling and organic waste. The results of this final project are expected to provide a deep understanding of the implementation of the green building concept (Noviyanto & Biantoro, 2024) .

Rainwater harvesting is the collection of rainwater that falls in a water catchment area. Artificial Aquifer Rainwater Storage is one of the rainwater harvesting technologies designed and developed by the Water Resources Research and Development Center of the Ministry of Public Works and Public Housing, Indonesia. Rainwater is a water source that can be used to recharge groundwater and/or used directly to overcome water shortages during the dry season and flooding during the rainy season. As well as increasing development activities that result in reduced water catchment areas that can cause environmental damage (Biantoro et al., 2025) .

Using a small chamber test (American Society for Testing and Materials (ASTM)-D5116) for VOC investigation and SimaPro software modeling with the ReCiPe method for evaluating human health impacts. Life cycle assessment (LCA) methodology is used, and the results indicate that switching the fully hybrid bio-based biocomposite with the fully petroleum-based composite could reduce more than 50% impacts on human health in terms of indoor and outdoor. Our results indicate that the use of biocomposites as GBMs can be an environmentally friendly solution for reducing the total indoor and outdoor impacts on human health (Khoshnava et al., 2020) .

The results found general contractors in Vietnam are facing the four components of challenges, namely "Planning activities-related challenges", "Organizational activities-related challenges", "Onsite management and control activities-related challenges" and "Greensupplychain-related challenges"; and all of them have statistically significant effects on the success of GB projects in Vietnam. Furthermore, the most dominant component was related to the non-readiness of external GB supply chain (Tran & Huang, 2022) .

The result is the silver predicate, with the lowest value being Material Resource and Cycle (MRC) and the highest being Energy Efficiency Conservation (EEC). After improvisation, a maximum point was obtained (95) with a platinum predicate. Based on the analysis of the Life Cycle Cost (LCC) calculation for the next 15-20 years, the BINUS Syahdan

campus building can save costs of Rp. 7,515,719,282 (Sujana & Jeremi, 2024) .

CONCLUSIONS

Based on the BGH method assessment, GIK UGM successfully achieved a realization of 114.01 out of 165 points or equivalent to 69.10%. This result indicates that most of the green building principles have been implemented in the GIK construction process, although there is still a gap between the planned value (90.30%) and the realization in the field. The implementation of energy conservation, quality management, and occupational safety and health systems have been carried out well. However, aspects of construction waste management and the use of environmentally friendly vendors still require strengthening to meet overall *green building standards. When examined based on the Greenship system* , most parameters *such as Energy Efficiency and Conservation* (EEC), *Water Conservation* (WC), *Indoor Health and Comfort* (IHC), and *Building and Environmental Management* (BEM) have been accommodated in the implementation of the GIK project.

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