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Implementation of The Green Campus Concept Based on The UI GreenMetric Guidelines Approach

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Abstract. Climate change and rapid urban development have increased the urgency of sustainable practices in higher education institutions. Green areas on campuses play a vital role in reducing carbon emissions, improving microclimate, and supporting ecological balance. This study analyzes the implementation of green area criteria based on the UI GreenMetric World University Rankings 2023 guidelines. A descriptive-analytical method was employed, combining field observations, documentation review, and interviews with campus facilities management. The Green Campus assessment results based on the UI GreenMetric guidelines, UMB is ranked 72nd among universities in Indonesia and 756th in the world based on the UI GreenMetric Ranking 2020. These results suggest that while the campus demonstrates strong compliance with the UI GreenMetric benchmarks, further improvement in conservation and community engagement is necessary.

Keywords: biodiversity, green campus, green open space, sustainability, UI GreenMetric

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1. Introduction

The construction industry in developing countries is facing challenges due to its failure to mitigate its impact. The building sector accounts for more than 40% of worldwide energy usage and almost one-third of global emissions of greenhouse gases. Typically, the production, transportation, building, and dismantling stages of materials and maintenance processes account for 10-20% of energy use [1]. The impacts of climate change, including rising global temperatures, have intensified the occurrence and severity of droughts, particularly in arid and semi-arid regions, thereby reducing water availability for multiple needs [2]. In response, Indonesia classified as a developing nation in the construction sector has adopted planning and building practices aligned with Green Building principles as part of its vision for Indonesia Construction 2030 [3]. Current research shows that buildings contribute nearly 30% of

worldwide energy consumption, with energy use itself generating close to 30% of CO_2 emissions. Moreover, about 80% of a building's lifetime energy consumption occurs during its operational stage, while the construction stage contributes significantly less [4].

Adopting the Green Building concept offers substantial benefits, particularly in enhancing efficiency and lowering carbon emissions by as much as 38%. To realize these gains, systematic processes are required to minimize carbon contributions throughout both the implementation phase and the operational lifespan of buildings [5]. Within this context, university campuses hold a vital position in promoting sustainable development. Yet, most current green campus assessment frameworks emphasize physical infrastructure and technological aspects of buildings, while often neglecting user perceptions and the influence of these factors on the effectiveness of green campus strategies [6]. Moreover, integrating green measures such as energy-efficient technologies, optimized lighting, water-saving practices, and recycling programs typically leads to an additional 10.77% in construction expenses, commonly recognized as retrofitting costs [7].

In 2010, Universitas Indonesia introduced the UI GreenMetric World University Rankings (UIGM) as a global benchmark for evaluating sustainability efforts in higher education institutions. This framework assesses universities based on six categories: Setting and Infrastructure, Energy and Climate Change, Waste, Water, Transportation, and Education and Research, with a total of 51 indicators [8]. To advance this agenda, Green Campus Initiatives (GCIs) were created to foster sustainability on campuses and in the surrounding communities. These initiatives aim to minimize environmental harm, increase public awareness of sustainability issues, and incorporate ecological principles into campus operations [9]. Furthermore, the application of photogrammetric data has enabled cost-effective and highly detailed three-dimensional modeling for estimating UIGM indicators. A case study demonstrated that the evaluated campus not only offsets its own CO_2 emissions but also generates a net surplus [10].

The UI GreenMetric World University Rankings, conducted by the University of Indonesia, are based on the idea that leading universities must take social responsibility for the environment. Its results contribute to social awareness of development and environmental sustainability, helping change people's lifestyles to conserve energy and natural resources under the 'Three Es' principle – environment, economy, and equity. The system includes six main categories – location and infrastructure, energy and climate change, waste management, water management, transportation, and education – which together provide a comprehensive tool to assess institutional sustainability performance [11].

Universities can act as frontrunners in urban greening by transforming campuses into living laboratories where education, research, and operations converge to tackle sustainability challenges and biodiversity loss [12].Exposure to campus greenery has been shown to alleviate stress, enhance attention restoration, and contribute to emotional stability among students, reaffirming the psychological value of integrating natural landscapes in university design [13].

Urban green spaces are critical components of sustainable development, serving not only ecological but also social functions. They mitigate urban heat, promote biodiversity, and enhance community cohesion, while simultaneously improving mental and physical well-being among urban residents [14]. Green infrastructure is increasingly conceptualized as a multifunctional system that delivers ecosystem services, supports biodiversity, and contributes to climate regulation, stormwater management, and urban livability through nature-based solutions[15].

Higher Education Institutions (HEIs) are pivotal in advancing sustainable development through dual responsibilities—educating future generations and exemplifying environmental stewardship. Green campus initiatives integrate renewable energy use, efficient water and waste management, sustainable building practices, and eco-friendly landscaping into institutional operations. Studies highlight that HEIs function as microcosms of sustainable urban systems, fostering innovation and policy diffusion beyond campus boundaries. The establishment of sustainability offices, stakeholder participation, and measurable indicators are key to achieving long-term institutional transformation aligned with UI GreenMetric dimensions[16].

The 'living laboratory' model has emerged as a transformative approach for embedding sustainability

into university campuses. By integrating teaching, research, and operations, campus landscapes become experiential learning environments that foster ecological literacy and student engagement. Evidence shows that such laboratories not only strengthen stewardship and mental well-being but also bridge the gap between theoretical sustainability goals and practical implementation. This aligns closely with the UI GreenMetric framework's emphasis on education, research, and community involvement as integral dimensions of a sustainable campus [17].

Recent studies emphasize that universities adopting the UI GreenMetric principles have effectively linked institutional policies with measurable sustainability outcomes. The GreenMetric's six pillars—environment, economy, equity, education, energy, and infrastructure—encourage universities to address sustainability both operationally and culturally. This holistic framework promotes the integration of environmental awareness into governance structures and supports the development of smart, climate-resilient campuses. The approach has proven effective in aligning academic institutions with global sustainability targets, reinforcing their role as catalysts for environmental transformation [18].

The implementation of the Green Campus concept in Malaysian public universities demonstrates a growing institutional commitment to sustainability, guided primarily by the six UI GreenMetric indicators: Setting and Infrastructure, Energy and Climate Change, Waste, Water, Transportation, and Education & Research. While most universities have integrated several green initiatives—such as renewable energy adoption, waste reduction programs, and sustainable transportation—challenges persist in financial allocation, community participation, and administrative coordination. The study highlights that although awareness of sustainability has increased, actions remain fragmented, often dependent on top-down management approaches. Strengthening policy frameworks, fostering cross-stakeholder collaboration, and integrating sustainability education into curricula are key to aligning university practices with the comprehensive and measurable UI GreenMetric framework for achieving long-term institutional sustainability[19]

The integration of sustainability principles into higher education, particularly within engineering programs, has become central to transforming universities into green and socially responsible institutions. Chasokela (2025) emphasizes that embedding sustainability across curricula, infrastructure, and campus culture strengthens environmental awareness while enhancing the reputation and community impact of universities. Practical strategies—such as energy-efficient design, renewable energy adoption, sustainable transportation, and the inclusion of experiential learning—enable students and lecturers to address real-world challenges related to climate change and resource conservation. The study highlights that successful green campus implementation requires leadership commitment, adequate institutional support, and active student participation. This comprehensive approach aligns with the UI GreenMetric framework by ensuring that universities serve as living laboratories for sustainability and cultivate environmentally conscious graduates equipped to advance global sustainability goals[20].

Figure 1. UI GreenMetric dan SDGs

A number of studies have utilized the UI GreenMetric framework to assess the sustainability performance of universities both within Indonesia and internationally. The UI GreenMetric, also known as the Sustainable University World Ranking has emerged as a widely used tool for this purpose, assessing institutions in six categories aligned with the United Nations Agenda 2030 and the Sustainable Development Goals (SDGs) [21]. First introduced in 2010, the UI GreenMetric World University Rankings (UIGWUR) was shaped by elements of idealism, existing benchmarking models, practical realities, prevailing challenges, and guidance from subject-matter experts [22]. For instance, while research has highlighted the role of green infrastructure in promoting campus sustainability, comprehensive assessments at the level of individual campuses remain limited [23]. A recent systematic review of sustainable campus concepts also emphasizes the need for holistic approaches to integrating ecological, social, and governance aspects in higher education institutions [24].

Table 1. Research Gap

State of the Art	Research Gap	Novelty of This Research
Green Campus studies in Indonesia focus on UI GreenMetric ranking achievements at the national level [6], [9].	Evaluation remains ranking-oriented, lacking deep analysis on green area implementation.	This research analyzes the implementation of green area indicators at the campus level.
Fidali (2023) evaluated campus layout and infrastructure using the GreenMetric scoring system [10].	Few studies explore a comprehensive evaluation of all green area indicators.	This research applies the 2023 UI GreenMetric green area indicators comprehensively
Research using Greenship Neighborhood (Rahmad Syah Putra, 2023; Meyvira, 2021) mainly evaluates non-campus areas [21], [22].	Lack of integration between Greenship and UI GreenMetric in campus assessment.	Research using Greenship Neighborhood (Rahmad Syah Putra, 2023; Meyvira, 2021) mainly evaluates non-campus areas [21], [22].

Abdul Malek (2015) examined community participation in green open space [23].	Limited studies linking academic community participation to GreenMetric indicators.	This research emphasizes the role of academic community participation in implementing green areas.

Therefore, this study aims to analyze the implementation of green area criteria on campus based on the UI GreenMetric guidelines. The analysis focuses on identifying the current condition of campus green areas, evaluating compliance with GreenMetric indicators, and providing recommendations for improvement. The findings are expected to serve as both a scientific contribution to the discourse on sustainable campuses and a practical reference for university management in enhancing their sustainability performance.

The UI GreenMetric framework assesses university sustainability policies and practices across six key dimensions: Setting and Infrastructure (SI), Energy and Climate Change (EC), Waste (WS), Water (WR), Transportation (TR), and Education and Research (ED). Each of these categories is assigned a specific weighting, as presented in Table 1.

Table 2. Categories used in GreenMetric UI ranking

No	Variables	Percentage of Total Poins (%)
1	Setting and Infrastructure (SI)	15
2	Energy and climate change (EC)	21
3	Waste (WS)	18
4	Water (WR)	10
5	Transportation (TR)	18
6	Education and Research (ED)	18
	Total	**100**

Table 3. National Universities that Occupy the Top 10 National Rankings of the UI GreenMetric World University Rankings 2024

Rank		University	Score						
Indonesia	Asia		SI	EC	WS	WR	TR	ED	Total
1	24	Universitas Indonesia	1,325	1,850	1,575	950	1,425	1,800	8,925
2	27	Universitas Diponegoro	1,250	1,750	1,500	900	1,675	1,800	8,875
3	30	Universitas Gadjah Mada	1,350	1,725	1,425	900	1,650	1,800	8,850
4	34	IPB University	1,375	1,475	1,575	950	1,650	1,800	8,825
5	37	Universitas Negeri Semarang	1,275	1,775	1,575	900	1,550	1,700	8,775
6	43	Universitas Sebelas Maret	1,225	1,725	1,575	900	1,425	1,800	8,650
7	44	Institut Teknologi Sepuluh Nopember	1,350	1,725	1,500	900	1,375	1,800	8,650
8	57	Universitas Airlangga	1,350	1,600	1,425	850	1,625	1,750	8,600
9	71	Universitas Islam Negeri Raden Intan Lampung	1,100	1,875	1,425	900	1,550	1,700	8,550
10	81	Universitas Padjadjaran	1,175	1,650	1,575	850	1,575	1,675	8,500

2. Methods

This study employed a methodological framework designed to evaluate the implementation of campus green infrastructure systematically and measurably. The research method was structured to ensure that both quantitative and qualitative aspects of green area indicators could be captured comprehensively. In line with previous sustainability assessments in higher education [6], [9], [24], the method integrates field observation, institutional document review, and stakeholder interviews, followed by a scoring and gap analysis based on the UI GreenMetric 2023 framework. This approach allows for a robust evaluation of the current conditions of campus green areas and provides insights into areas that require improvement for sustainable development.

This research employed a descriptive-analytical approach to evaluate the implementation of green area criteria on campus based on the UI GreenMetric World University Rankings Guidelines. The research method is structured into the following stages:

2.1. Research Design

The research employed a case study approach, focusing on one selected campus as the unit of analysis. This approach was chosen to allow an in-depth assessment of the implementation of green areas and their alignment with the UI GreenMetric indicators [8], [9]. Data were analyzed descriptively by comparing the actual conditions of the campus with the benchmarks set by UI GreenMetric.

2.2. Research Location and Object

The research was conducted on the main campus area of Universitas Mercu Buana, located in Kembangan, Jakarta Barat. The campus covers approximately 6,8 hectares. with academic, administrative, and residential facilities. The research object focused on green areas, including open spaces, vegetated areas, and conservation zones, which are key indicators in the UI GreenMetric framework [9].

2.3. Data Sources

The data was gathered from both primary and secondary sources:

- Primary data were obtained through field observation of campus green areas, photographic documentation, and interviews with campus facilities management.
- Secondary data were collected from campus master plans, land use maps, and sustainability-related policy documents [6], [21].

2.4. Research Instrument

The main instrument of this study was the UI GreenMetric 2023 Guideline [8], which consists of six major categories and 51 indicators. This research focused on the green area indicators included in the "Setting and Infrastructure" category, such as:

- Total campus area (m^2).
- Green open space area (m^2)
- Ratio of green open space to total area (%).
- Existence of a conservation area or protected vegetation
- Vegetation diversity and tree planting programs.

These indicators were selected because they directly reflect the extent of ecological and spatial sustainability at the campus level [10].

2.5. Data Collection Techniques

Data were collected through:

1. Observation and measurement: direct survey of campus green spaces using manual measurement tools.
2. Documentation review: analysis of university master plans, land use blueprints, and official sustainability reports [22]
3. Interviews: semi-structured interviews with facilities management and sustainability task force staff to

validate data consistency.

2.6. Data Analysis

The collected data were analyzed using the following steps:

- Scoring: Calculation of each indicator's score based on the UI GreenMetric methodology [9].
- Gap analysis: Comparison of the actual condition of the campus green areas with the required standards and benchmarks [10], [21].
- SWOT analysis: Identification of strengths, weaknesses, opportunities, and threats in implementing campus green area management [8], [23].

This mixed descriptive and comparative analysis method allows for a systematic evaluation of campus green areas while identifying gaps and opportunities for improvement. The results are then interpreted in light of the broader literature on sustainable campuses and global sustainability goals (SDGs 11 and 13) [4], [6].

3. Results and Discussion

This chapter provides detailed guidelines for composing the complete text, covering the structure of the article, the organization of chapters, and their respective content.

This research was conducted on a case study of the Mercu Buana University campus at Jalan Meruya Selatan Raya No.1, West Jakarta, Indonesia. Researchers conducted field observations and interviews with the campus managers of Mercu Buana University to identify the extent of the implementation of the UI GreenMetric concept as shown in Table 4.

Table 4. Existing Land Area

	Measured Land Area	Area
1	Total campus area	68,000 m^2
2	Total area of the building base	12,659 m^2
3	Total building area of all floors	46,833 m^2
4	Green open space	
	- Forest Vegetation Area	0
	- Plant Vegetation Area	13,848 m^2
5	Water Catchment Area (other than forest vegetation and plants)	25,579 m2

The research will be conducted in the Meruya Campus area of Mercu Buana University, located at Jalan Meruya Selatan No. 1, Kembangan District, West Jakarta, Special Capital Region of Jakarta 11650. The research location plan can be seen in (Figure 2) below.

The case study campus covers a total land area of 6.8 hectares, consisting of academic buildings, student housing, administrative offices, and green open spaces. Based on field observations and spatial documentation, the total green open space (parks, vegetated areas, tree corridors, and conservation sites) was estimated at 5.534 hectares, or approximately 81.383% of the total campus area. This value exceeds the national regulation requiring at least 30% of urban land area to be dedicated to green open spaces [25].

Figure 2. Location Map of the Mercu Buana University Campus Area

3.1. Assessment

UI GreenMetric evaluates university policies and performance based on six categories: Setting and Infrastructure (SI), Energy and Climate Change (EC), Waste (WS), Water (WR), Transportation (TR), and Education and Research (ED).

In the initial phase, researchers conducted field observations and interviews with Mercu Buana University campus administrators to identify the extent of the UI GreenMetric concept implementation.

3.1.1. Assessment for Setting and Infrastructure (SI)

The first category assessed in UI GreenMetric is Setting and Infrastructure (SI). This category provides an overview of the campus's greening tendencies by providing more green open space for reforestation. The results of the Setting and Infrastructure (SI) assessment are shown in Table 5.

Table 5. Assessment Setting and Infrastructure (SI)

No	Indicator	Score	Points achieved
SI-1 The ratio of open space area to the total area	≤ 1%	0.05x200	-
	1 - 80%	0.25x200	-
	80 - 90%	0.50x200	100
	90 - 95%	0.75x200	-
	> 95%	1.00x200	-
SI-2 Total area on campus covered in forest vegetation	≤ 2%	0.05x100	0
	2 - 9%	0.25x100	-
	9 - 22%	0.50x100	-
	22 - 35%	0.75x100	-
	> 35%	1.00x100	-
SI-3 Total area on campus covered in planted vegetation	≤ 10%	0.05x200	-
	10 - 20%	0.25x200	-
	20 - 30%	0.50x200	100
	30 - 40%	0.75x200	-

	> 40%	1.00x200	-
SI-4 Total area on campus for Water absorption besides the forest and planted vegetation	≤ 2%	0.05x100	-
	2 - 10%	0.25x100	-
	10 - 20%	0.50x100	-
	20 - 30%	0.75x100	-
	> 30%	1.00x100	100
SI-5 The total open space area divided by the total campus population	≤ 10 m^2/person	0.05x200	10
	10 - 20 m^2/person	0.25x200	-
	20 - 40 m^2/person	0.50x200	-
	40 - 70 m^2/person	0.75x200	-
	> 70 m^2/person	1.00x200	-
SI-6 Percentage of university budget for sustainability efforts	≤ 1%	0.05x200	-
	1 - 5%	0.25x200	-
	5 - 10%	0.50x200	-
	10 - 15%	0.75x200	-
	> 15%	1.00x200	200
SI -7 Percentage of operation and maintenance activities of building in one year period	≤ 25%	0.05x100	-
	25 - 50%	0.25x100	-
	50 - 75%	0.50x100	-
	75 - 100%	0.75x100	-
	> 100%	1.00x100	100
SI-8 Campus facilities for disabled, special needs, and/or maternity car	None	0	-
	Policy is in place	0.25x100	-
	The infrastructure is still at the conceptual and planning stage	0.50x100	-
	The infrastructure is only partially functional and available for use	0.75x100	-
	Facilities are present throughout every building and remain completely operational	1.00x100	100
SI-9 Security and safety facilities	Embedded safeguarding framework	0	-
	All security infrastructure, namely CCTV and emergency alert devices, is accessible and in proper working order	0.25x100	-
	The institution is equipped with integrated security infrastructure, encompassing CCTV, emergency response devices, on-site personnel, and fire protection systems (extinguishers and hydrants), all of which are operational.	0.50x100	-
	While all security infrastructure is installed and operational, the average response time to incidents (accidents, crimes, fires, or natural disasters) surpasses 10 minutes	0.75x100	75
	Security infrastructure is fully available and functional, with response times to accidents, crimes, fires, and natural disasters maintained under 10 minutes	1.00x100	-
SI-10 Health infrastructure facilities for students, academic and administrative staff 's wellbeing	First aid facilities are currently absent on the premises	0	-
	First aid services, emergency rooms, clinics, and healthcare personnel are present and accessible	0.25x100	-
	First aid services, emergency rooms, clinics, and certified healthcare staff are present and operational	0.50x100	50
	First aid facilities, emergency rooms, clinics, hospitals, and certified medical staff are present and operational	0.75x100	-
	First aid stations, emergency rooms, clinics, hospitals, and certified medical personnel are present, operational, and publicly accessible	1.00x100	-

SI-11 Conservation: plant (flora), animal (fauna) or wildlife, genetic resources for food and agricultural resources preserved in medium- or long-term conservation facilities	Conservation program in preparation	0.05x100	0
	Conservation program 1 -25% implemented	0.25x100	-
	Conservation program 25 -50% implemented	0.50x100	-
	Conservation program 50 -75% implemented	0.75x100	-
	Conservation program fully implemented	1.00x100	-

3.1.2. Assessment for Energy and Climate change (EC)

The Energy and Climate Change category covers different factors that assess a university's dedication to energy sustainability and efforts in addressing climate change. This category encompasses efficient energy use, greenhouse gas emission management, and campus-based renewable energy initiatives. Energy conservation efforts and green building management are also key components of this category.

All of these aspects aim to encourage the university to become an agent of change in addressing global challenges related to energy and climate change, as well as to raise environmental awareness among students and staff. This category includes 10 assessment indicators, as shown in Table 6.

Table 6. Assessment Energy and Climate change (EC)

No	Indicator	Score	Points achieved
EC-1 Energy efficient appliances usage	≤ 1%	0.05x200	-
	1 – 25%	0.25x200	-
	25 – 50%	0.50x200	-
	50 – 75%	0.75x200	200
	> 75%	1.00x200	-
EC-2 Smart building implementation	≤ 1%	0.05x300	-
	1 – 25%	0.25x300	75
	25 – 50%	0.50x300	-
	50 – 75%	0.75x300	-
	> 75%	1.00x300	-
EC-3 Number of renewable energy sources on campus	None	0	-
	1 Source	0.25x300	-
	2 Source	0.50x300	150
	3 Source	0.75x300	-
	> 3 Source	1.00x300	-
EC-4 Total electricity usage divided by total campus population	≥ 2,424 kWh	0.05x300	-
	1,535 – 2,424 kWh	0.25x300	-
	633 – 1,535 kWh	0.50x300	-
	279 – 633 kWh	0.75x300	225
	<279 kWh	1.00x300	-
EC-5 The ratio of renewable energy production divided by total energy usage per year	≤ 0.5 %	0.05x200	-
	0.5 – 1 %	0.25x200	-
	1 – 2 %	0.50x200	100
	2 – 25 %	0.75x200	-
	> 25 %	1.00x200	-
EC-6 Elements of green building implementation as reflected in all construction and renovation policies	None	0	-
	1 Element	0.25x200	-
	2 Element	0.50x200	-
	3 Element	0.75x200	-
	>3 Element	1.00x200	200
EC-7	None	0	-

Greenhouse gas emission reduction program	Program in preparation	0.25x200	-
	The initiative focuses on mitigating emissions within a single scope among the three defined scopes	0.50x200	-
	The program targets a reduction in two of the three emission scopes	0.75x200	150
	The initiative targets comprehensive emission reductions in all three emission categories	1.00x200	-
EC-8 Total carbon footprint divided by total campus' population	≥ 2.05 metric tons	0.05x200	-
	1.11 – 2.05 metric tons	0.25x200	-
	0.42 – 1.11 metric tons	0.50x200	-
	0.10 – 0.42 metric tons	0.75x200	-
	< 0.10 metric ton	1.00x200	200
EC-9 Number of the innovative program(s) in energy and climate change	None	0	-
	1 program	0.25x100	-
	2 programs	0.50x100	-
	3 programs	0.75x100	-
	> 3 programs	1.00x100	100
EC-10 Impactful university program(s) on climate change	None	0	-
	Program in preparation	0.25x100	-
	Facilitate capacity-building through training, educational content, and community-based activities for residents in the vicinity	0.50x100	-
	Offer training programs, educational resources, and engagement activities for both local communities and at the national scale	0.75x100	-
	Offer training programs, educational resources, and engagement activities for local communities, as well as at national, regional, and international levels	1.00x100	100

3.1.3. Assessment for Waste (WS)

Effective waste management and recycling play a crucial role in supporting environmental sustainability. The daily activities of staff and students contribute to considerable waste production on campus, making it essential for universities to focus on comprehensive programs that address both organic and inorganic waste, ensure proper treatment of hazardous materials, and implement strategies aimed at minimizing paper and plastic usage.

In the "Waste" category, evaluation is carried out by examining how effectively the campus reduces overall waste generation. This includes the extent to which the institution enforces initiatives to limit single-use consumption, encourages practices of reuse, establishes clear waste-reduction policies, and develops recycling systems. The outcomes of these evaluations, based on six key indicators, are presented in Table 7.

Table 7. Assessment Waste (WS)

No	Indicator	Score	Points Achieved
WS 1 3R (Reduce, Reuse, Recycle) program for university's Waste	None	0	-
	3R program in preparation	0.25 x 300	-
	3R program 1 – 50% implemented	0.50 x 300	-
	3R program 50 – 75% implemented	0.75 x 300	-
	3R program > 75% implemented	1.00 x 300	300
WS 2	None	0	-
	1 program	0.25 x 300	-
	2 programs	0.50 x 300	-

Program to reduce the use of paper and plastic on campus	3 programs	0.75 x 300	-
	More than 3 programs	1.00 x 300	300
WS 3 Organic Waste treatment	Open dumping	0	0
	Partial (1 - 25% treated)	0.25 x 300	-
	Partial (> 25 - 50% treated)	0.50 x 300	-
	Partial (> 50 - 75% treated)	0.75 x 300	-
	Extensive (> 75% treated)	1.00 x 300	-
WS 4 Inorganic Waste treatment	Burned in open	0	0
	Partial (1 - 25% treated)	0.25 x 300	-
	Partial (> 25 - 50% treated)	0.50 x 300	-
	Partial (> 50 - 75% treated)	0.75 x 300	-
	Extensive (> 75% treated)	1.00 x 300	-
WS 5 Toxic Waste treatment	Not managed	0	0
	Partial (1 - 25% treated)	0.25 x 300	-
	Partial (> 25 - 50% treated)	0.50 x 300	-
	Partial (> 50 - 75% treated)	0.75 x 300	-
	Extensive (> 75% treated) or campus produces a minimum amount of toxic waste	1.00 x 300	-
WS 6 Sewage disposal	Untreated into Waterways	0	-
	Treated with preliminary treatment	0.25 x 300	-
	Treated with primary treatment	0.50 x 300	-
	Treated with secondary treatment	0.75 x 300	225
	Treated with tertiary treatment	1.00 x 300	-

3.1.4. Assessment for Water (WR)

The water awareness paradigm emphasizes that both urban and rural areas can serve as important water reservoirs. Campus water use is another key indicator in UI GreenMetric. The goal of this category is to encourage campuses to reduce water consumption, enhance conservation programs, and protect habitats.

Within the context of UI GreenMetric, five assessment indicators are used to measure the university's commitment to water awareness, the results of which are shown in Table 8.

Table 8. Water (WR)

No	Indicator	Score	Points Achieved
WR 1 Water conservation program & implementation	None	0	0
	Program in preparation	0.25 x 200	-
	1 - 25% implemented at early stage (i.e., measurement of potential surface runoff volume)	0.50 x 200	-
	> 25 - 50% Water conserved	0.75 x 200	-
	> 50% Water conserved	1.00 x 200	-
WR 2 Water recycling program implementation	None	0	0
	Program in preparation	0.25 x 200	-
	1 - 25% implemented at early stage	0.50 x 200	-
	> 25 - 50% Water recycled	0.75 x 200	-
	> 50% Water recycled	1.00 x 200	-
WR 3 Water efficient appliances usage	None	0	-
	Program in preparation	0.25 x 200	-
	1 - 25% of Water efficient appliances installed	0.50 x 200	-
	25 - 50% of Water efficient appliances installed	0.75 x 200	-
	> 50% of Water efficient appliances installed	1.00 x 200	200
WR 4	None	0	0

Treated Water Consumed	1 - 25% treated Water consumed	0.25 x 200	-
	> 25 - 50% treated Water consumed	0.50 x 200	-
	> 50 - 75% treated Water consumed	0.75 x 200	-
	> 75% treated Water consumed	1.00 x 200	-
WR 5 Water pollution control in campus area	Policy and preparation	0	-
	Design and construction	0.25 x 200	50
	Guideline standard available and initial implementation	0.50 x 200	-
	Full implementation and monitor occasionally	0.75 x 200	-
	Full implementation and monitor regularly	1.00 x 200	-

3.1.5. Assessment for Transportation (TR)

Transportation plays a significant role in the carbon emissions and pollution levels present in university settings. Implementing policies that restrict motorized vehicle access while promoting campus shuttle services, ride-sharing options, and zero-emission alternatives can significantly enhance campus air quality. Encouraging walking-friendly infrastructure further motivates students and staff to travel on foot, thereby reducing reliance on private vehicles. Moreover, the adoption of eco-friendly public transportation options helps to lower the overall campus carbon footprint [8].

The transportation category is used to assess university policies and strategies for implementing sustainable transportation, as well as the extent to which the campus community uses public transportation. The higher the use of public transportation, the better its impact on the environment. Table 1 shows the assessment results for the eight indicators in the transportation category.

Table 9. Transportation (TR)

No	Indicator	Score	Points achieved
TR-1 Total carbon footprint divided by total campus' population	> 1	0	-
	1 - 0.5	0.25x200	-
	0.5 - 0.125	0.50x200	-
	0.125 - 0.045	0.75x200	150
	< 0.045	1.00x200	-
TR-2 Shuttle services	Shuttle transportation could be arranged, but it is not supplied by the institution	0	-
	A scheduled shuttle service is accessible, provided by the university or external parties, and is not free of charge	0.25x300	-
	A shuttle service is available, operated by the university or third parties, with the university subsidizing a portion of the cost	0.50x300	-
	A university-managed shuttle service runs on a regular schedule and is complimentary for passengers	0.75x300	-
	Regular shuttle service using zero-emission vehicles is available from the university, or shuttle options are not applicable	1.00x300	300
TR-3 Zero-Emission Vehicles (ZEV) policy on campus	Environmentally friendly (zero-emission) vehicles are not accessible	0	-
	The deployment of zero-emission vehicles is not achievable or practical	0.25x200	-
	Zero-emission vehicles exist on-site or nearby, but the university does not operate or provide them	0.50x200	100
	University-operated zero-emission vehicles are available but not free of charge	0.75x200	-

	The campus offers zero-emission vehicles, which are available for free to all users	1.00x200	-
TR-4 The total number of Zero-Emission Vehicles (ZEV) divided by the total campus population	≤ 0.002	0	0
	0.002 - 0.004	0.25x200	-
	0.004 - 0.008	0.50x200	-
	0.008 - 0.02	0.75x200	-
	The campus offers zero-emission vehicles, which are available for free to all users	1.00x200	-
TR-5 The ratio of the ground parking area to total campus area	> 11%	0	0
	11 - 7%	0.25x200	-
	7 - 4%	0.50x200	-
	4 - 1%	0.75x200	-
	< 1%	1.00x200	-
TR-6 A transportation initiative aimed at reducing or limiting campus parking space over the past three years	None	0	0
	he program is currently under development, including feasibility assessment and promotional planning	0.25x200	-
	Implementation of the program decreases parking space by less than 10%	0.50x200	-
	Parking facilities are reduced by 10 to 30% as a result of the program	0.75x200	-
	The program leads to a reduction of over 30% in parking area or reaches the maximum feasible reduction	1.00x200	-
TR-7 Number of initiatives to decrease private vehicles on campus	No initiative	0	0
	1 initiative	0.25x200	-
	2 initiatives	0.50x200	-
	3 initiatives	0.75x200	-
	>3 initiatives, or initiative is no longer required	1.00x200	-
TR-8 The pedestrian path on campus	None	0	-
	Walkways for pedestrians are provided	0.25x300	-
	Safe pedestrian paths are available for use	0.50x300	-
	Safe and convenient pedestrian paths are available for use	0.75x300	-
	Designated walking paths are accessible, prioritizing safety and convenience, and partially equipped with disabled-friendly features	1.00x300	300

3.1.6. Assessment for Education and Research (ED)

In the education category, there are 11 assessment indicators. In this area, it is advised that universities offer an adequate number of courses focused on the environment and sustainability, along with additional elements such as specific research funding for environmental and sustainability studies and related scientific publications. The assessment results for the education category are shown in Table 10.

Table 10. Education and Research (ED)

No	Indicator	Score	Points achieved
ED-1 The ratio of sustainability courses to total courses	≤ 1%	0.05x300	-
	1 - 5%	0.25x300	75
	5 - 10%	0.50x300	-
	10 - 20%	0.75x300	-
	> 20%	1.00x300	-
ED-2	≤ 1%	0	0
	1 - 8%	0.25x200	-

The ratio of sustainability research funding to total research funding	8 - 20%	0.50x200	-
	20 - 40%	0.75x200	-
	> 40%	1.00x200	-
ED-3 Number of scholarly publications on sustainability	0	0	-
	0 - 20	0.25x200	-
	21 - 83	0.50x200	-
	83 - 300	0.75x200	-
	> 300	1.00x200	200
ED-4 Number of events related to sustainability	0	0	-
	1 - 4	0.25x200	-
	5 - 17	0.50x200	-
	18 - 47	0.75x200	150
	< 47	1.00x200	-
ED-5 Number of activities organized by student organizations related to sustainability per year	0	0.05x200	-
	1 - 2	0.25x200	-
	3 – 4	0.50x200	100
	5 - 10	0.75x200	-
	> 10	1.00x200	-
ED-6 University-run sustainability website	Not available	0	-
	The website is currently being developed or is under construction	0.25x200	-
	Website is available and accessible	0.50x200	100
	The website is operational, accessible, and periodically updated	0.75x200	-
	The website is fully operational, accessible to users, and maintained with regular updates	1.00x200	-
ED-7 Sustainability report	Not available	0	0
	Preparation of the sustainability report is underway	0.25x200	-
	The resource exists but is not publicly available	0.50x200	-
	Sustainability report is accessible and published occasionally	0.75x200	-
	The sustainability report is publicly accessible and released on an annual basis	1.00x200	-
ED-8 Number of cultural activities on campus	None	0	-
	1 event per year	0.25x100	-
	2 events per year	0.50x100	-
	3 events per year	0.75x100	-
	More than 3 events/year	1.00x100	100
ED-9 Number of university sustainability program(s) with international collaborations	None	0	-
	1 program	0.25x100	-
	2 programs	0.50x100	-
	3 programs	0.75x100	-
	More than 3 programs	1.00x100	100
ED-10 Number of sustainability community services projects	None	0	-
	1 program	0.25x100	-
	2 programs	0.50x100	-
	3 programs	0.75x100	-
	More than 3 programs	1.00x100	100
ED-11 Number of sustainability community services projects organized and/or involving students	None	0	0
	1 – 5 startups	0.25x100	-
	6 – 10 startups	0.50x100	-
	11 – 15 startups	0.75x100	-
	More than 15 startups	1.00x100	-

3.1.7. The results of the assessment of Mercu Buana University based on UI GreenMetric

The assessment results are based on six categories, namely; Setting and Infrastructure (SI), Energy and climate change (EC), Waste (WS), Water (WR), Transportation (TR), and Education and Research (ED) can be seen in Table 11.

Table 11. The results of the assessment of Mercu Buana University based on UI GreenMetric

No	Indicator	Maximum points	Points achieved
	Setting and Infrastructure (SI)		
SI-1	The proportion of open space relative to the overall campus	200	100
SI-2	The area of the campus covered by natural forest vegetation	100	0
SI-3	The area of the campus covered by planted vegetation	200	100
SI-4	The campus area allocated for water absorption, excluding forested and planted vegetation zones	100	100
SI-5	The total open space area per person, calculated by dividing the total campus population	200	10
SI-6	Proportion of the university budget allocated to sustainability	200	200
SI-7	Percentage of building operation and maintenance activities conducted annually	100	100
SI-8	The accessibility of campus amenities for individuals with disabilities, special needs, and maternity support	100	100
SI-9	Campus infrastructure for security and safety	100	75
SI-10	Health facilities supporting the wellbeing of students, academic staff, and administrative personnel	100	50
SI-11	Preservation of plant species (flora), animal species (fauna), wildlife, or genetic resources for food and agriculture in conservation facilities designed for	100	0
	Total	1,500	835
	Energy and Climate change (EC)		
EC-1	Utilization of energy-efficient devices and equipment	200	200
EC-2	Adoption and integration of smart building technologies	300	75
EC-3	Count and deployment of renewable energy installations	300	150
EC-4	Per capita electricity consumption, calculated as total campus electricity usage divided by the campus population (kWh/person)	300	225
EC-5	Proportion of total energy demand met by renewable energy sources annually	200	100
EC-6	Extent of green building principles incorporated into all construction, renovation, and maintenance policies	200	200
EC-7	Programs and initiatives aimed at reducing greenhouse	200	150
EC-8	Per capita carbon footprint, expressed as total campus carbon emissions divided by campus population (metric tons/person)	200	200
EC-9	Number of innovative initiatives addressing energy efficiency and climate change mitigation	100	100
EC-10	University programs with measurable and significant impacts on climate change adaptation or mitigation	100	100

	Total	2,100	1,500
	Waste (WS)		
WS-1	Implementation of the 3R (Reduce, Reuse, Recycle) framework for managing university-generated waste	300	300
WS-2	Initiatives aimed at minimizing paper and plastic consumption across campus	300	300
WS-3	Management and treatment of organic waste, including composting or bio-processing	300	0
WS-4	Handling and processing of inorganic waste materials for proper disposal or recycling	300	0
WS-5	Treatment and safe disposal of hazardous or toxic waste	300	0
WS-6	Sewage management and disposal systems ensuring environmental compliance and sustainability	300	225
	Total	1,800	825
	Water (WR)		
WR-1	Design and execution of comprehensive water conservation initiatives on campus	200	0
WR-2	Implementation of water recycling programs to reuse treated water for various purposes	200	0
WR-3	Adoption and utilization of water-efficient appliances and fixtures to reduce consumption	200	200
WR-4	Monitoring and measurement of treated water consumption across campus facilities	200	0
WR-5	Programs and measures for controlling and preventing water pollution within campus boundaries	200	50
	Total	1,000	250
	Transportation (TR)		
TR-1	Per capita vehicle density, calculated as the total quantity of cars and motorcycles in relation to the campus population	200	150
TR-2	Availability, frequency, and accessibility of shuttle services on campus	300	300
TR-3	Campus policies and initiatives promoting the adoption and use of Zero-Emission Vehicles (ZEVs)	200	100
TR-4	Per capita availability of Zero-Emission Vehicles, determined by dividing the total number of ZEVs by the campus population	200	0
TR-5	Proportion of total campus area allocated to ground-level parking facilities	200	0
TR-6	Programs implemented over the last three years (2020–2022) aimed at limiting or reducing parking area	200	0
TR-7	Number and type of initiatives designed to decrease reliance on private vehicles on campus	200	0
TR-8	Availability, accessibility, and design of pedestrian pathways on campus, including safety and convenience features	300	300
	Total	1,800	850
	Education and Research (ED)		

ED-1	Proportion of courses or subjects that incorporate sustainability concepts relative to the total curriculum	300	75
ED-2	Share of research funding allocated specifically to sustainability projects compared to total research funding	200	0
ED-3	Total number of scholarly publications focused on sustainability topics	200	200
ED-4	Number of events organized annually that address sustainability themes	200	150
ED-5	Annual count of sustainability-related activities led by student organizations	200	100
ED-6	Availability and accessibility of a university-operated sustainability-focused website	200	100
ED-7	Publication and accessibility of the university's sustainability report	100	0
ED-8	Total number of cultural activities on campus that integrate sustainability awareness or values	100	100
ED-9	Number of university sustainability programs conducted in collaboration with international partners	100	100
ED-10	Quantity of community service projects related to sustainability, organized or involving students	100	100
ED-11	Number of startups or entrepreneurial initiatives originating from the university that are sustainability-focused	100	0
	Total	1,800	925
	TOTAL	10,000	5,185

3.2. Recapitulation of the results of the Mercu Buana University campus assessment based on UI GreenMetric

Recapitulation of the green area assessment results for Mercu Buana University (UMB) based on UI GreenMetric (Table 12) shows various achievements and challenges in sustainability efforts. Overall, the UMB campus earned a total score of 5.185 out of a maximum of 10,000 points, representing 51.85% of the maximum total. The highest score for the energy and climate change indicator reflects that the UMB campus has successfully implemented effective energy efficiency practices and climate change mitigation strategies. Conversely, the lowest score for the water indicator indicates that the UMB campus still faces challenges in water resource management, including water conservation programs and water reuse measures. This indicates the need for further efforts to improve water conservation and management on campus to achieve higher standards of environmental sustainability.

Table 12. Recapitulation of Mercu Buana Campus assessment results based on UI GreenMetric

Category	Point	Percentage of Point to Total Score (%)	Maximum Point	Percentage of Point to Maximum Point (%)
Setting and Infrastructure (SI)	835	16	1,500	55.7
Energy and Climate Change (EC)	1,500	29	2,100	71.4
Waste (WS)	825	16	1,800	45.8
Water (WR)	250	5	1,000	25.0
Transportation (TR)	850	16	1,800	47.2

Education (ED)	925	18	1,800	51.4
Total Score	5,185	100	10,000	51.85

3.3. Visualization of Scoring Results

Figure 3 below compares the UI GreenMetric scores with the actual assessment results.

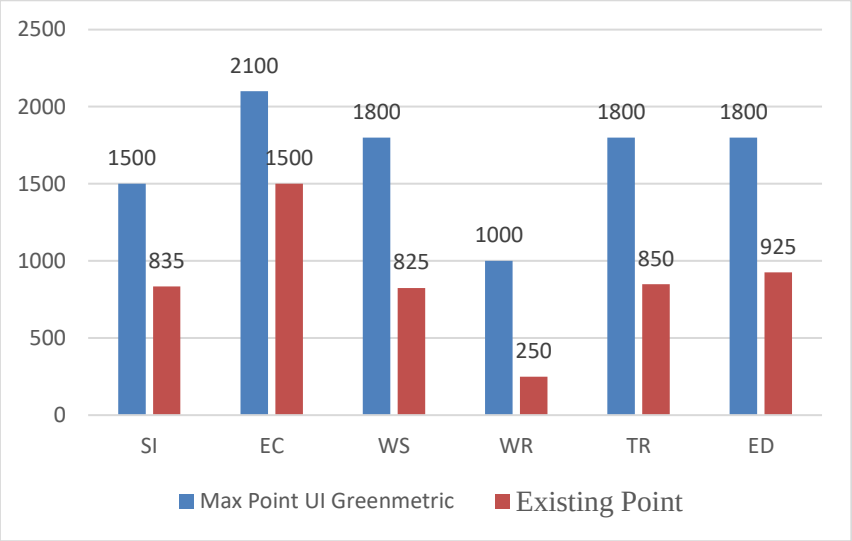

Figure 3. Green area scoring results based on UI GreenMetric indicators

The bar chart above shows that the ratio of green area is the strongest indicator (90% of the maximum score), while the biodiversity program and tree-per-student ratio require further improvement.

3.4. Discussion

The analysis demonstrates that the campus has made significant progress in fulfilling the green open space requirement under both national and international sustainability standards. The ratio of 34% green area exceeds the minimum regulation of 30% stipulated in Indonesian planning policy [25]and aligns with the ecological benchmarks of sustainable campuses [6]

However, two main challenges were identified:

1. Tree-to-student ratio: With 0.85 trees per student, the indicator falls slightly short of the recommended ratio of one tree per student [9]. This condition suggests the need for more structured tree planting programs, particularly in areas surrounding academic buildings and student housing.
2. Biodiversity and conservation programs: Although the campus has designated 10% of its land as a conservation area, biodiversity initiatives remain fragmented. Previous studies emphasize that biodiversity programs enhance both ecological resilience and environmental education for students [7], [23]. Strengthening these initiatives would improve not only the GreenMetric score but also the educational value of the green campus.

Comparing these results with other universities in Indonesia reveals similar challenges. For instance, research at Universitas Lampung indicated that green area management was sufficient in terms of spatial allocation but lacked integrated biodiversity programs [21]. Similarly, studies applying Greenship Neighborhood frameworks highlighted the importance of linking green infrastructure with community participation [22]

The findings are consistent with the broader framework of the Sustainable Development Goals (SDGs), particularly with SDG 11 (Sustainable Cities and Communities) and SDG 13 (Climate Action)

[4]. Thus, the implementation of green area indicators based on UI GreenMetric is not only beneficial for ranking purposes but also contributes to national and global sustainability agendas.

4. Conclusion

This research emphasizes the significance of applying green space standards in universities according to the UI GreenMetric framework. The results show that the campus under review demonstrates a relatively strong adherence, especially regarding the proportion of green open spaces relative to the total campus area. Nevertheless, two critical aspects—tree-to-student ratio and biodiversity initiatives—require further strengthening to ensure ecological resilience and long-term sustainability.

The novelty of this research lies in its focused assessment of green area indicators, which are often overlooked in previous studies that mainly emphasize university rankings. By applying a comprehensive analysis of the UI GreenMetric framework, this study contributes both scientifically and practically: scientifically, by enriching the discourse on sustainable campus evaluation; and practically, by providing actionable recommendations for campus managers to enhance green infrastructure and biodiversity programs.

The Green Campus assessment results based on the UI GreenMetric guidelines, which include 6 criteria with a total of 51 indicators, show that the UMB Campus obtained 5,185 points out of a maximum of 10,000 points. The breakdown of scores by category is as follows: Setting and Infrastructure obtained 835 points, Energy and climate change 1,500 points, Waste 825 points, Water 250 points, Transportation 850 points, and Education and Research 925 points. With these scores, UMB is ranked 72nd among universities in Indonesia and 756th in the world based on the UI GreenMetric Ranking 2020.

In line with the Sustainable Development Goals (SDGs 11 and 13), universities are encouraged to develop systematic strategies for increasing tree planting, expanding conservation areas, and integrating biodiversity education into campus life. Strengthening community participation among students and staff will also be essential in ensuring that the management of green areas is not only policy-driven but also culturally embedded [4], [6], [9].

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