



## Managing University of Sharjah Setting and Infrastructure Towards a Sustainable and Livable Campus

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**Abstract.** This paper describes the setting and infrastructure management at the University of Sharjah (UoS) as a continuous effort towards a livable and sustainable campus. The UoS has been participating in the UI GreenMetric World Universities Ranking (UIGWUR) since 2017 to measure its performance in the field of sustainability for continuous improvement. During the last three years, the UoS has succeeded in being among the best 150 universities in the SI category by achieving 70% of the score. However, the UoS managed to get 75% of the total score in this KPI and 100% in the open space per person KPI ratio. To become one of the leading universities, the Landscape and Building Management Sustainability Circle (LBMSC) at the Sustainability Office has analyzed the KPIs and suggested an action plan for continuous improvement. Two KPIs can be improved: sustainability efforts and the total area covered in plants. The UoS shall increase the sustainability efforts and budget and increase the internal and external planting in the coming years. For some KPIs, it cannot be applied to desert regions. It is recommended that the UIGWUR revisit its KPIs and make them more flexible and applicable worldwide. Furthermore, for the open space ratio to the total area KPI, it is recommended to revisit the distribution of the points to have fair comparison. Action plans to improve the sustainability and livability of the campus have also been addressed.

### Keyword:

Setting and infrastructure, LBMSC, livable campus, open area, forest, water absorption, green area, sustainability efforts/budget, and GreenMetric

## 1. Introduction

Since the Stockholm Declaration in 1972, the concept of sustainability has merged to cope with environmental degradation and minimizing the effects of climate change [1]. Global warming and climate change impacts on different sectors result from the increased concentrations of greenhouse gases in the atmosphere due to environmentally unfriendly practices such as burning fossil fuel [2-4]. In this regard, Sustainable Development Goals (SDGs) were adopted by 193 countries at the Sustainable Development Summit to eliminate discrimination and inequality, end poverty, and overcome climate change by 2030. SDGs included higher education institutions (HEIs) achieving their SDG targets by 2030, encouraging various sectors to become aware of the need to implement sustainability efforts. Without the contributions of higher education and research, none of the 17 SDGs can be met. HEIs can positively impact teaching, research, community engagement, awareness, or advisory services. Also, by creating initiatives to engage students, raise awareness, and educate on sustainability's importance. These initiatives will promote sustainability and provide a holistic approach to how education contributes to sustainability [5, 6]. Universities' distinct functions are crucial for overcoming the wide range of interconnected social, economic, and environmental challenges. Furthermore, HEIs have a significant role in transforming societies, particularly in contributing to a more sustainable society, as part of their mission and activities. Universities participate in the GreenMetric system online and respond to subjects in their institutions. These institutions can implement sustainable development in various ways, according to a holistic approach, education and curricula, campus operations, assessment, communication, etc. To track and monitor improvement HEIs seek to standardize observation tools. Therefore, different sustainability ranking systems were developed [7]. The UI GreenMetric is a global sustainability ranking for universities developed by Universitas Indonesia (UI) since 2010. It tackles six categories: Setting and Infrastructure, Energy and Climate Change, Waste, Water, Transportation, and Education and Research. The GreenMetric GM index focuses on characteristics and capabilities that assess educational campuses and have positive sustainability impact. Thus, universities through such network, can develop and share their best practice on sustainability and its implementation. Many of the 17 SDGs are relevant to the six categories of UI, Table 1 shows the related categories to SDGs [8].

Table 1: Green Metric UI categories and related SDGs

UI Categories	Related SDG
Setting and Infrastructure	SDG 9: Industry, Innovation and Infrastructure SDG 11: Sustainable Cities and Communities
Energy and Climate Change	SDG 7: Affordable and Clean Energy SDG 12: Responsible Consumption and Production SDG 13: Climate Action
Waste	SDG 3: Good Health and Well-being SDG 12: Responsible Consumption and Production SDG 14: Life Below Water
Water	SDG 6: Clean Water and Sanitization
Transportation	SDG 13: Climate Action SDG 15: Life on Land
Education and Research	SDG 4: Quality Education SDG 1: No Poverty

### 1.1. Sustainability Office

Sustainability Office was formed in October 2017 at the University of Sharjah to ensure sustainable growth, environmental preservation, and achieving an optimum balance between economic and social development following the UAE national agenda and the UAE Vision 2021. The vision of the Sustainability Office is “the University of Sharjah becomes a leading regional and global benchmark for sustainability excellence in higher education”. The heart of the Sustainability Office is the Sustainability Circles which has been developed from the well-known notion of Quality Circles, where the structure of the office (Figure 1) consists of top management, steering committee, facilitator and coordinator, leaders, members, i.e.

The Sustainability Office has been assigned with the following responsibilities to achieve sustainable development at the University:

- Become a leading institution in the field of sustainable development
- Create collaborative relationships to enhance long-term sustainability
- Increase the production and use of effective research related to social, economic, and environmental issues.
- Obtain knowledge and adequacy in the teachings of sustainability on a regular basis.
- Integrate and blend sustainable development concepts into various academic activities
- Establish appropriate alternatives for actions that may have negative impacts on social, environmental, or economic advancement
- Find appropriate solutions and plan accordingly to achieve sustainability within the campus
- Provide sustainable solutions for students, staff, and faculty members

The Sustainability Circles concept has been established by the Sustainability Office. Each of these Sustainability Circles is linked to a specific sustainable field and has its own set of goals, Key Performance Indicators (KPIs), accomplishments, and initiatives. Totaling of 30 Sustainability Circles in different fields within the campus. Herein, Landscape and Building Management Sustainability Circle (LBMSC) is one of those circles emphasizes the significance of the University's indoor and outdoor environments and assist in improving campus designs to promote a friendly home-like setting. The LBMSC strives to protect the indoor environment by ensuring that university buildings operate in a resource-efficient manner and the outdoor environment by sustaining a healthy and safe environment and promoting a physically and mentally healthy lifestyle to campus users. Moreover, Mushtaha [10] studied UoS campus to increase the walkability within the university as a prerequisite for sustainability and to help achieve maximum satisfaction of the users.

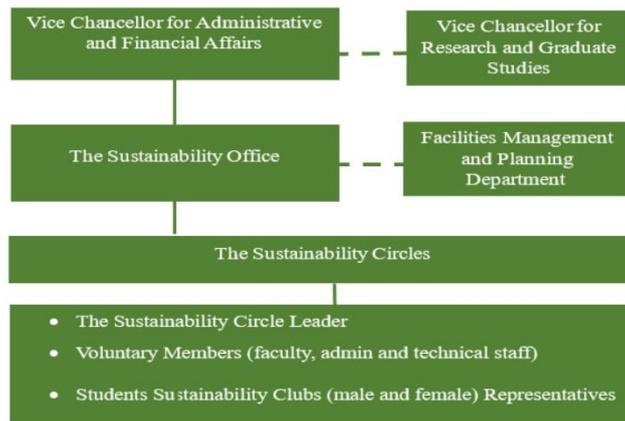


Figure 1. Structure of Sustainability Office [9]

## 2. Research Background

The University of Sharjah strives to accomplish its expressed vision, mission, and goals. UI GreenMetric maintains the present condition by continuous development and enhancement in terms of campus setting and infrastructure. The improvements shown at campus setting and landscape are reflected on the score on the UI GreenMetric result. Considering these accomplishments, some concerns and a strong commitment to sustainability policies must be adopted in the following years to retain the UI's objective of being a "world class sustainable institution". Therefore, the campus setting is important in providing a more convenient and better academic environment. The infrastructure is undeniably crucial in supporting diverse operations for any organization to function properly. Better management of campus and related infrastructure can significantly develop the spirit of learning and strengthen the community on the campus. Therefore, this research aims to improve the performance of the campus in the SI category at UI GreenMetric using the approach of the PDCA cycle. Going beyond the UI GreenMetric, there will be another study aiming to evaluate the user's satisfaction and find ways to improve the campus to support a better community and learning environment.

## 3. Research Objectives

UoS ultimate objective is to become one of the leading universities in sustainability. This concerted drive shows the importance of the entire University on sustainability within the campus. In order to achieve the anticipated goal, Sustainability Office developed a culture of sustainability, seek incremental improvements and create initiatives to raise sustainability awareness and sustainability culture to students, staff, and faculty members. This paper aims to improve the performance of the campus in the SI category at UI GreenMetric using the approach of the Plan-Do-Check-Act (PDCA) cycle.

## 4. Research Methodology

To achieve the Sustainability Office vision and ambition, the UoS is taking steps to integrate various aspects of sustainability into education and research and physically apply such notions across campus. The Sustainability Office strives to create a sustainable culture by lessening environmental impact and implementing sustainability into the UoS campus life and operations. These efforts are made possible by implementing the continuous

improvement methodology – the plan–do–check–act (PDCA) cycle [9]. Figure 2 shows the framework of the research methodology. This promotes a culture of sustainability within the campus, working together to minimize the environmental impact and integrate sustainability in activities, curriculum, research, and more. PCDA is an excellent tool in continuous improvement, recognizing opportunities and planning for changes, implementing these changes, and investigating and measuring these changes' effectiveness. Nevertheless, it is critical to involve all university stakeholders; thus, sustainability circles idea has been welcomed and developed. Thirty sustainability circles have been developed in various sustainable areas. Each sustainability circle is led by a faculty member or a specialist in the field. These circles have inclusively participated in different sustainability ranking systems such as the UI GreenMetric World University rankings and the Sustainability Tracking, Assessment, and Rating Systems (STARS). However, there is a need to assess sustainable campus performance further.

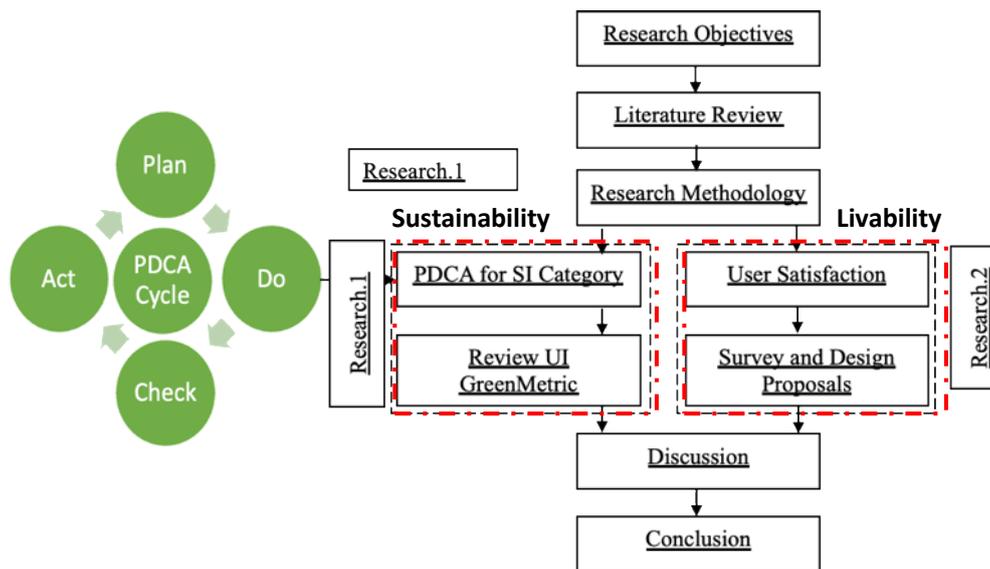


Figure 2. The framework of the research methodology

## 5. The Case Study: the University of Sharjah (UoS)

The University of Sharjah was established as a non-profit institution for higher education in 1997 by His Highness Sheikh Dr. Sultan Bin Mohammed Al Qassimi, member of the Supreme Council, Ruler of Sharjah, and President of the University to be the first University in the Emirate of Sharjah, United Arab Emirates (UAE). The UoS has several campuses that are located in all the Sharjah regions. The UoS is continuously working towards reducing the effects of global warming, support sustainability projects, and stimulate different aspects of sustainability within the curriculum. The UoS architecture reflects its Islamic and Arabic heritage, with magnificent structures and captivating landscapes. The total area of the main Sharjah campus is 2.26 millions-m<sup>2</sup>, including planted vegetation over 1.5 millions-m<sup>2</sup>, tall and palm trees more than 500m<sup>2</sup>, and a total floor area of 517,000m<sup>2</sup>. The campus has high-quality facilities that incorporate multimedia lecture rooms and halls, advanced scientific and research laboratories, dedicated libraries rich with information resources, state-of-the-art IT infrastructure and computer labs, theatres, clubs, two major sports complexes for students (Figure 3). Its spacious campuses have various trees

and green places, and buildings created in harmony, reflecting the serenity of the surrounding environment and fostering innovation. The campus environment aims to provide a lifelong learning experience to students with the highest quality. One of the UoS primary goals is to become a pioneering educational institution in the field of sustainable development. Therefore, UoS has participated in UI GreenMetric and was ranked the first in the country for the second consecutive year. It has consecutively maintained first place in the UAE for the third year in a row (2017- 2019). The University of Sharjah achieved a world ranking of 452 and 398 in 2018. In 2019, the best year among the three, UoS developed its performance to be globally ranked 294 out of 780 participating universities. UoS has succeeded in being among the best 150 universities in the SI category by achieving 70% of the score. By implementing a continuous improvement methodology, UoS was able to preserve outstanding results and continuous improvement. Moreover, In addition, a Climate Emergency Letter has been signed, in September 2019, by the Chancellor of the University, and agreed to execute a three-point plan to handle the emergency through the work with students [11].



Figure 3. The Master plan and Panorma View of the Campus

## 6. Performance of UoS in UI GreenMetric

The University of Sharjah has participated in the UI GreenMetric World University Rankings (UIGWUR) for the last three years, from 2017 to 2019. UoS has consecutively maintained first place in UAE for the third year in a row during that period. The GreenMetric World University Ranking seeks to evaluate and rank institutions worldwide based on their present state and policies related to green campus and sustainability activities. It assesses sustainability in six categories: Setting and infrastructure, energy and climate change,

transportation, waste, water, and education. UoS has succeeded in being among the best 150 universities in the SI category by achieving 70% of the score. Table 2 and Figure 4 show KPIs for the Setting and Infrastructure category from 2018 to 2020. UI GreenMetric World University Rankings was developed in 2010 to support universities in sustainability development. The increasing number of participants from North America, South America, Europe, Africa, Asia, and Australia, and Oceania demonstrates the importance of the UI GreenMetric ranking. Therefore, UI GreenMetric has been recognized globally as an accessible sustainability ranking that provides a benchmark and guide, particularly for assisting universities in creating sustainable universities and sustainable futures.

Table 2: List of KPIs for Setting and Infrastructure category

	KPI	Highest Score	2018	2019	2020	Percentage (%)
SI1	The ratio of open space area towards total area	300	225	225	225	75
SI2	Area on campus covered in forest	200	0	0	0	0
SI3	Area on campus covered in planted vegetation	300	150	150	225	75
SI4	Area on campus for water absorbance	200	100	150	150	75
SI5	The ratio of open space area divided campus population	300	225	225	300	100
SI6	University budget for sustainability effort	200	0	100	150	75
	Total	1500	700	850	1050	70

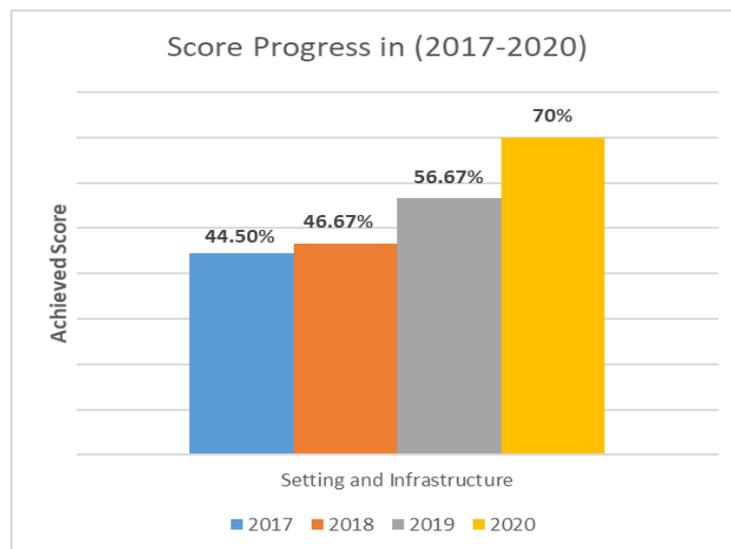


Figure 4. Score progress from 2017 to 2020 in Setting and Infrastructure for UoS

## 7. Discussion

The University of Sharjah (UoS) pays great attention to tackling the global sustainability challenges. Landscape and infrastructure are two main basic aspects that play a significant role in achieving environmental, social-behavioral, or aesthetic outcomes toward a livable campus. This paper describes the setting and infrastructure management at UoS as a continuous effort towards a sustainable and livable campus. According to the UoS

performance in the UI GreenMetric, the highest points were mainly gained from four indicators in the Setting and Infrastructure category: open space area to campus population ratio (SI5) with 100%. The other three indicators were equally gained with 75% from open space area to the total area ratio (SI1), area on campus covered in planted vegetation (S3), and the university budget for the sustainability effort (SI6).

### **7.1. KPIs Analysis**

UoS objective of attaining the highest possible score in the UI GreenMetric should be linked with KPIs stated, and the potential benefits should be clearly defined. In addition, an action plan is necessary to determine the feasible activities that might be taken to keep the campus operating in the right direction of sustainability. The following and Table 3 discuss the KPIs in UoS and propose an action plan for each KPI.

#### **SI1: The ratio of open space area towards total area:**

- UoS has more than 92% of its total area as open space.
- UoS has achieved 75% of the available points, with no possible improvements.

SI1 Action plan:

The University City Services, outside the UoS management, manage the UoS campus ground. Thus, the UoS is unable to go any further in achieving more points. Moreover, no possible progress can be achieved as UoS has to increase the open space area by approximately 55,861.02 m<sup>2</sup> to earn the maximum score. The authors believe the GreenMetric committee should revisit the distribution of the points as it is not fair to campus, with 92% open space to receive a percentage of 75%, whereas those with 95% open space will get the total points.

#### **SI2: Total area covered in forest**

- UoS is located in a hot-arid zone and is mostly surrounded by desert terrain. An Approximate area of 500 sqm is covered with forest-like trees and vegetation plants (less than 1%)
- No points were achieved in this KPI in the four applications.

SI2 Action plan:

UoS is distinguished by a wide area of palm trees, heritage and native plants in the campus ( Figure 5). However, according to UI GreenMetric criteria, these plants cannot be classified as forest trees. It would also be great if the GreenMetric committee revisits this KPI, making it more flexible and applicable for the hot zones and considering the heritage and native plants instead of forests.

#### **SI3: Total area on campus covered in planted**

- Almost 1,504,889 sqm is covered with green in UoS.
- In the 2019 application, UoS scored 50% of the points; however, in 2020, UoS scored higher by 25% to 75% total. More investments were made in the sustainable garden ( Figure 5), courtyards, and other greenery.

Though the UoS submitted total area on campus covered in planted more than 40% to achieve 100% of the points, the results revealed the campus received only 75%. However, the University plans to increase the green areas by having vertical gardens and internal planting ( Figure 5). There are many courtyards prepared for such vegetation. In addition to distributing small planters to staff and students to increase the internal planting indoor. This

is to improve the learning and living environments on the campus and turn it into a home-like environment.

**SI4: Total area on campus for water absorption besides the forest and planted**

- UoS reported a concrete block area, which covered 165,174 sqm.
- In the 2018 application, UoS achieved 50% of the points, whereas, in the 2020 application, UoS scored 75% of the points.

SI4 Action plan:

The climate in the UAE is hot and dry, and the rain is scarce. The average precipitation was reported at 78 (mm per year) in 2017 [12]. However, the University submitted a total area on campus for water absorption besides the forest and planted more than 30% to achieve 100% of the points; the results revealed the campus received only 75%. No action plan is specified, but the University will continue its sustainability efforts in achieving more scores.

**SI 5: The ratio of open space area divided campus population**

- 100% of the points were received, no action plan is required.

**SI 6: University budget for sustainability effort**

- UoS submitted percentage of sustainability effort of 12%, however, in order to achieve the full score, 3 percent shall be added next year to the budget in order to receive the total score.

Table 3: List of Action Plans for the Setting and Infrastructure Category

KPI		2018	2019	2020	(%)	Action Plans
SI1	The ratio of open space area towards total area	225	225	225	75	If UIGWUR Revisit it, we can get the full score
SI2	Area on campus covered in forest	0	0	0	0	If Palms are counted, we will receive scores
SI3	Area on campus covered in planted vegetation	150	150	225	75	Submit the evidence, then we will get the full score
SI4	Area on campus for water absorbance	100	150	150	75	Submit the evidence, then we will get the full score
SI5	The ratio of open space area divided campus population	225	225	300	100	Received full score
SI6	University budget for sustainability effort	0	100	150	75	Adding another 3% to get the full score
Total		700	850	1050	70	



Figure 5. Action Plans Progress from 2017 to 2021 for the Setting and Infrastructure Category

## 8. Conclusion

Despite universities' benefit to cities, universities have direct and indirect negative effects on the natural and social environment due to the large areas they cover and the pollutants they release. As a result, sustainability in universities is critical in decreasing pollutants and pioneering and setting an example for society. The UoS will continue to execute the proposed action plan for SI3 to exhibit the maximum possible points by increasing green areas and roofs, and vertical gardens. Another feasible action plan for the SI6 can also be implemented by increasing the sustainability efforts and a budget to around 9-10 million dollars. However, a minimal action plan can be implemented for the KPIs (SI1 and SI2) due to their inflexibilities.

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