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GREEN CAMPUS IMPLEMENTATION IN THE MALAYSIAN PUBLIC UNIVERSITIES: CHALLENGES AND SOLUTIONS

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Abstract

Green initiatives had been taken seriously by all parties including higher education institutions. Many researchers believed that university is an essential institution to find solutions to the complexities of current global environment issues. Indeed, university should be the key hubs for innovation and environmental education, as well as the execution of human behavioural change towards sustainability. Most universities worldwide nowadays including Malaysia starts to implement various green campus initiatives to combat global warming and fostering sustainable campus growth. However, there are several challenges encountered throughout the implementation. Thus, this research attempts to examine on the current green campus implementation practices in the Malaysian public universities. Three Malaysian public universities participating in the UI GreenMetric 2021 World University Ranking had been chosen as the case study. Each university is represented by a senior representative to participate in the semi-structured interview conducted. The interview questions were constructed based on the most common and relevant chosen indicators from all six categories of UI GreenMetric. The research findings revealed that although most Malaysian public universities had implemented green initiatives as outlined in the UI GreenMetric, numerous challenges occurred. But there are solutions to push green campus initiatives to the forefront. The university management and the communities should play major roles towards realizing Sustainable Development Goals, as well as assuring more sustainable practices in the future.

Keywords: Green Campus Initiatives, UI GreenMetric, Sustainability, Challenges

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INTRODUCTION

Green Campus rewards long-term obligation to continuous environmental improvement from the campus community. Green Campus status is attained by making significant improvement in across campus community collaboration under one or several of the themes outlined in The Universitas Indonesia GreenMetric Rankings. According to Omar et al., (2010) green campus refined the quality of human life while living within the carrying capacity of supporting ecosystems. Its implementation in higher education institutions can give many benefits to the campus community by living in a harmonious environment and green lifestyle. Indeed, universities hold responsibility in implementing sustainable universities on campus to promote sustainability culture among their students and staff.

Besides the 17 pillars of Sustainable Development Goals (SDGs), the Malaysian Green Technology Master Plan 2017-2030 is among Malaysia government strategies to further endeavour sustainability. One of its main goals is improving sustainable construction with major collaborations with higher institutions in building capabilities through the university's Centre of Excellence. The Ministry of Higher Education Malaysia through Conducive Ecosystem in Public Sectors urges immediate efforts to be taken by Malaysian public universities towards green campus initiatives. Echoing into this, numerous leading universities across the world including Malaysia have been actively implementing this agenda (Mohd Isa et al., 2021; Gholami et al., 2020; Gomez et al., 2019; Marrone et al., 2018; Benjaoran and Parinyakulset, 2018). However, despite several green campus initiatives taken, there are also challenges.

This research aims to examine the current green campus implementation practices in the Malaysian public universities. Two research objectives were established (1) to examine the challenges in implementing green campus in the Malaysian public universities and (2) to propose possible solutions towards green campus implementation in the Malaysian public universities. The research will assist green campus practitioners to enhance the sustainability of campus towards a healthier lifestyle among campus communities as well as reducing global warming effects and harmful waste within the campuses. Moreover, it also highlights on the current issues regarding green campus implementation to be acknowledged by the relevant authorities, education ministry and other related government bodies.

LITERATURE REVIEW

Definition and the Importance of Green Campus

Most researchers have similar definitions on green campuses. Green Office Movement (2021) view green campus as an educational institution that fulfils its natural resource demands, such as energy, water, and materials, without jeopardizing people's capacity in other nations and future generations to satisfy

their own. Green campus seeks to build university campuses with tangible effects on the environment, economy, and society towards as reducing negative impacts on environment pollution and human health to promote environmental sustainability (Ribeiro et al., 2019; Uche et al., 2013; Omar et al., 2010). These effects will be attained through campus community participation, sustainable infrastructures, education, research, management, and outreach. Meanwhile, Hosna (2014) and Husaini and Jusoh (2017) defined green campus as a condition in which people and nature can exist productively, permitting social, economic and environment to advance. Kay et al., (2012) stated that education for sustainable development also empowers individuals to build up the learning, value and aptitudes to make decisions on the method in which they were done by an individual or grouping, locally or globally that enhance personal satisfaction without harming the planet. Concurring into this, Xiong et al., (2013) emphasized that knowledge and information about green campuses can be distributed to all individuals through a green curriculum. Universities should map their curriculum against the SDGs pillars towards a world class programme. Agreeing to this, Du et al., (2013) and Castro et al., (2013) added that green curriculum requires alternate teaching approaches such as online learning rather than traditional, lecture-based pedagogy and commitment from the university administration. Likewise, Ragazzi and Ghidini (2017) added that in promoting green campus, the university should use their resources and experiences in teaching, research, and stewardship in approaches to enable society to make changes to a green lifestyle.

There are several benefits in implementing a green campus as stated by many scholars. According to Yiing, et al., (2013) and Sahoo (2008) green campus initiatives confirm the well-being of humans by integrating economic viability, conservation and protection of environment and social equity throughout construction, operation design, maintenance and waste. In addition, green campus will also minimise negative environment, economic, society, and well-being impacts of the campus communities towards a better practical lifestyle (Kristanto et al., 2017; Ragazzi and Ghidini, 2017; Foo, 2013) as well as engaging with others to implement and execute sustainable development (Yuan et al., 2013). Sustainable campus can create teaching future experts and improve skills and knowledge on sustainability development. It also enhances energy proficiency on campus, moving to renewable energy, food and other possessions used on and off campuses. Mongkoldhumrongkul and Sukkanta (2022) added that by understanding trends and important aspects helped a green university operate well to plan and enhance performance for optimum effectiveness.

University Sustainability Ranking System: UI GreenMetric

There are various global sustainability rating tools available such as GREENSHIPS, The Sustainability, Tracking, Assessment and Rating System (STARS), The College Sustainability Report Card @ Green Report Card and UI

GreenMetric. Amongst these rating tools, UI GreenMetric is the most widely used in Asian, European and U.S. universities (Lauder et al., 2015). Ragazzi and Ghidini (2017) also acknowledged that this is the most important global sustainability ranking for universities as it allows universities to share their experience and best practices on sustainability issues, as well as to measure their sustainability policy, facilitating a comparison between them.

UI GreenMetric was created by Universitas Indonesia in 2010. Its ranking instrument was based on the 3E's of sustainable development concept: Environment, Economics and Social (Suwartha & Sari, 2013) and (Benjaoran & Chunko, 2018). There are six categories used in the ranking with their weighting and indicators. A total of 39 indicators are provided for the categories and a specific score is assigned to each indicator. These are (i) Setting and Infrastructure (*Weighting*-15, 6 indicators), (ii) Energy and Climate Change (*Weighting*-21, 8 indicators), (iii) Waste (*Weighting*-18, 6 indicators), (iv) Water (*Weighting*-10, 4 indicators), (v) Transportation (*Weighting*-18, 8 indicators) and (vi) Education (*Weighting*-18, 7 indicators). The final score is the sum of the scores achieved for each indicator.

Green Campus Implementation in The Malaysian Public Universities

Green campus initiatives have generally been adopted by most Malaysian universities. There are 17 out of 20 Malaysian public universities participating in the UI GreenMetric 2021. Table 1 presents the list of Malaysian public universities that participate in the UI GreenMetric World University Rankings 2021. The top five ranked Malaysian public universities are Universiti Putra Malaysia (8425 points), Universiti Malaya (8375 points), Universiti Malaysia Sabah (8025 points), Universiti Utara Malaysia (7725 points) and Universiti Teknikal Malaysia Melaka (7700 points).

Each university practices different green campus approaches (A.Afiq, 2022; Mat Taib, 2022; Gholami et al., 2020; Gomez and Yin, 2019). These universities strive toward sustainability and conduct several strategies that can accommodate the need to become greener and more sustainable. Among the universities and their strategies are:

Table 1: List of Malaysian Public Universities Participated in UI GreenMetric World University Rankings 2021

No	World Rank	Malaysian Rank	Institution
1	27 th	1st	Universiti Putra Malaysia
2	32 nd	2nd	Universiti Malaya
3	67 th	3rd	Universiti Malaysia Sabah
4	109 th	5 th	Universiti Utara Malaysia
5	110 th	6 th	Universiti Teknikal Malaysia Melaka
6	128 th	7 th	Universiti Malaysia Pahang
7	149 th	8 th	Universiti Teknologi Malaysia

8	150 th	9 th	Universiti Teknologi MARA Shah Alam
9	165 th	10 th	Universiti Tun Hussein Onn Malaysia
10	168 th	11 th	Universiti Sains Malaysia

Source: Universitas Indonesia, 2021

- a) Universiti Sains Malaysia - implemented a future sustainable platform to support the major international goals such as the Millennium Development Goals and Education for Sustainable Development. In doing so, the university opted to venture forward based on the “Blue Ocean Strategy”, which requires a unique and innovative way of thinking, taking actions and setting goals compared to the norms.
- b) Universiti Utara Malaysia - won the global gold medal at the Green World Award 2016 for education and training and is known as the Ambassador of Green World 2016/2017. The university had implemented Electric Pedal Assisted Bicycles as its initiative towards promoting a green campus.
- c) Universiti Teknologi Malaysia - introduced preservation policy and framework of a comprehensive programme to give ordinary balance on the environment, reduce carbon, practice to protect resources, waste/garbage reduction and increase recycling.
- d) Universiti Teknologi MARA - has established the Institute Sustainable Initiatives UiTM, which consists of ten faculties and 39 excellence entities to initiate Greenation @ UiTM. This institute was undertaken to stimulate and encourage students and visitors on sustainability, experience, and interaction toward a healthy lifestyle.
- e) Universiti Putra Malaysia - owns a reserve forest named Sultan Idris Shah Forest Education Center (SISFEC) as a centre for research and Education, organise tree plantation programme, rainwater catchment reused for watering plants and cleaning works, fully equipped with LED lighting with sensor system, utilises timer system for power cut off system of HAVC, solar energy, initiated greenhouse gas emission reduction programmes, Biorefinery@UPM to treat organic waste, Waste Bank@UPM, Red Cube recycling centre, promotes recycling campaign, implemented water reservoir system, water filtration system and water harvesting system, shuttle service in the campus, car-free day and car-pooling campaign, provide efficient pedestrian facilities and offers sustainability-related courses/syllabus/programmes.
- f) Universiti Malaya - develop a green space i.e Rimba Ilmu, organise tree planting programme, underground flood retention pond in the campus to reduce the risk of flooding and improve water absorption system, replacing all lighting appliances into LED bulbs and LED street lighting, utilise Variable Refrigerant Volume (VRV) for HAVC system, smart building systems, greenhouse gas emission reduction programme, clean biomass, wind and hydropower, solar, UM Eco Campus Blueprint, UM Zero Waste Campaign, Takakura Composting, collaborating with other institution, cash or redeem

Mesra Card points for waste recycle, UM Safety Handbook on managing toxic waste in the campus, providing adequate number of recycling bins, double-sided printing policy, displaying water usage bills and records in the website, water harvesting system, UM Water Warriors initiatives, shuttle service in the campus, bicycle and electric scooters rental, MRT feeder bus, efficient pedestrian facilities, organise programs/events related to sustainability.

- g) Universiti Sains Islam Malaysia - USIM's Smart University Blueprint (2018-2025), tree planting programme, had its own team responsible for the landscape and biodiversity in the campus, maintaining existing forest and lake on the campus, PTJ Lestari project, solar, launched Go Green Ambassador and Green Caliphs programme, emphasise on Maqasid Syaria', collaborating with an external organisation, adequate recycle bin, cooking oil recycling project and biodiesel project, water harvesting, shuttle service, double-sided printing policy, water harvesting system, shuttle service in the campus, bicycle and electric scooters rental, efficient pedestrian facilities, organise programs/events related to sustainability.

This notable strategy is an effort made by the universities not only to improve or achieve a high sustainability level, but also to improve the university's ecosystem and environment and to educate future generations to become more aware of sustainability practices (Dagiliūtė et al., 2018; Sahoo, 2013; Alshuwaikhat and Abubakar, 2008). Universities should also encourage students to actively participate or initiate a movement to preserve the environment to the public.

Challenges in Implementing Green Campus

Even though universities worldwide have taken several steps to ensure that their campuses run sustainably, emerging impediments are beginning to develop that provide significant difficulties for practitioners and ultimately prevent their implementation (Gholami et al., 2020). The main obstacles to develop green campus is lack of funds and insufficient administrative experience in carrying out green university incentives (Mongkoldhumrongkul and Sukkanta, 2022; Abubakar et al., 2020; Beringer, 2007). Scott et al., (2012) and McMillin and Dyball (2009) stated that there is lack of a systematic framework for the higher education institutions to accurately measure the campus efforts towards sustainability. In Malaysia, the use of sustainability gage is still new and very uncommon in practices (Darus and Atikah, 2012). Thus, most initial strategies to address sustainability in higher education vary substantially and remain fragmented. There is also a lack of construction standards and authority oversight to maintain a sustainable environment and manage high maintenance costs. Amaral et al., (2015) added that the university is shortage of professionals to provide green initiatives input for the university to implement. Individuals are

also not being rewarded for participating in sustainable activities, thus decrease community motivation to implement green campus agenda (Abubakar, 2020). Horhota et al. (2014) and (Foo, 2013) claimed that lack of campus infrastructure is also another challenges ensued. For instance, campus expansion, had changed the mode of transportation to motor vehicles, thus contributing to traffic congestion, reduction of air quality and unhealthy environment in campus. This gradually affects green spaces in the campus.

Nawi and Choy (2020), Hopkins (2016) and Neumayer (2010) concur that a lack of environmental knowledge and awareness among students and employees also contributes to impediments towards green campus. Likewise, there is also a lack of desire from universities to promote green education and activities to campus communities because they solely focus on research, education, community and operations (Tarigan, Prayogo & Mardiono, 2012). Yuan et al., 2013 stressed that the green campus agenda needs support from all university stakeholders such as the management team, faculty members, staff, students, parents and its alumni. Alshuwaikat et al. (2017) asserted that greening the mentality is the next stage after greening the campus failed to achieve societal transition toward sustainability. Tiyyarattanachai and Hollmann (2016) recommended that a green campus may not be the ideal option if the institution is not sufficiently equipped.

Solutions For Challenges on Green Campus Implementation

Sagaran (2022) and Dave et al. (2014) highlighted the needs of a sustainable framework on green campus initiatives. In doing so, universities should incorporate all environmentally friendly practices and education to promote sustainability. The concept of low carbon campus for instance, will provide the university to become the initiator in redefining the current culture towards environment and establish new paradigms through the creation of sustainable solutions for the environment, social, economic and human well-being.

Benjaoran and Parinyakulset (2018) suggested for the universities to place a balanced emphasis between physical development and people's engagement to keep those green initiatives going. More interesting strategies regarding environmental and sustainable education such as green workshop, green curriculum and appointing an experienced committee in sustainability should be planned ahead. With these efforts it will significantly increase their awareness as well as the public towards a more sustainable lifestyle. Osman (2022) emphasized on the benefits of farming and agriculture activities in the campus such as economic, job/professions, sustainable food supply and technological opportunities to improve the environment towards sustainability.

Mohd Taib (2022) outlined several suggestions on the roles of universities on sustainable education. He suggested for energy efficiency, waste, transportation and water conservation to be included in green education. The

universities should enhance education and training programs that incorporate transdisciplinary and upskill/reskill programmes, research orientation on solving the operational activities and city's needs, students' transformation on habit shifting and becoming agent changer in community and expanding networking with other organizations and public. It is critical for the university to develop a green programme that everyone in a community can participate in to improve the quality of the environment. Nawi and Choy (2020) and Hooi et al. (2012) stated that the emphasis on the necessity of sustainable practices will be met if university community and stakeholders play their responsibilities in making it happen.

RESEARCH METHODOLOGY

This research employs the qualitative research approach. Three Malaysian public universities participating in the UI GreenMetric 2021 World University Ranking had been chosen as the case study. Each university is represented by a senior representative to participate in the semi-structured interview conducted. The interview questions were constructed based on the most common and relevant chosen indicators from all six categories of UI GreenMetric. The six categories are (i) Setting and Infrastructure (SI), Energy and Climate Change (EC), Waste (WS), Water (WR), Transportation (TR) and Education and Research (ED). The data from the semi-structured interviews were analysed using content analysis.

ANALYSIS OF FINDINGS

Findings for this research can be divided into two sections: (1) challenges of implementing green campus initiatives and (2) solutions to overcome the challenges. These are explained further in the following sections.

Challenges of Implementing Green Campus Initiatives in The Malaysian Public Universities

Setting and Infrastructure (SI)

Challenges in implementing initiatives to increase forest and plant vegetation area
The most common challenges to increase forest and plant vegetation areas on the campus is lack of finance. The respondents highlighted that the cost of implementing this initiative is very expensive. However, there is limited funds provided by the university to increase and improve nature and green areas in the campus. Thus, the universities decided to only preserve and sustain the well-being of the existing campus green areas as the university's budget is only allocated for maintaining the current landscape, forest and plant vegetation area in the campus.

Table 2: Challenges in implementing initiatives to increase forest and plant vegetation area

Respondents	Feedbacks
R1	Limited availability of land areas and funds. However, the university has a special project regarding forest and plant vegetation initiatives.
R2	Limitation of spaces and areas in the campus as well as the university's current financial situations. Currently, the university intends to preserve and maintain the wellbeing of existing green areas in the campus.
R3	Lack of cost and budget. The cost for implementing an initiative to improve forest and plant vegetation is quite high. Furthermore, the university's budget allocation is limited and only to maintain or to preserve plant vegetation in the campus.

Another constraint highlighted for SI is limited spaces and lands to be developed, particularly in urban campuses. However, one of the universities has its own reserve forest that executes numerous research projects towards forest and plant vegetation.

Energy and Climate Change (EC)

a) Challenges in implementing energy saving initiatives

Despite agreeing on full utilisation of renewable energy sources on the campus will maximise energy saving and is a good investment for the university, the respondents also highlighted several challenges faced in implementing this initiative. Although the university is fully equipped with energy saving systems and appliances, R1 and R3 affirmed that excessive energy usage could still occur due to lack of awareness among campus communities on effective ways to consume energy.

R3 also highlighted that the main issue in educating people is that it requires a lot of effort, time, support and cooperation from the campus community itself. Hence, the universities are working tremendously to educate and raise awareness of their communities on energy-saving initiatives.

Table 3: Challenges in implementing energy saving initiatives

Respondents	Feedbacks
R1	Although most of the electrical equipment in the university is energy saving certified, the staff and students are mostly unaware of the importance of minimising the usage of electrical consumption. Hence, the university is working tremendously towards educating the campus community to use energy wisely.
R2	Energy efficiency and energy saving in the campus has not become a major problem with all the energy saving initiatives that have been implemented so far. However, in terms of renewable energy, there is still quite a room for improvement because there is lack of buy-in and support for renewable energy initiatives in the campus.
R3	The main challenge to educate the community is it requires a lot of time, effort, support, and cooperation. Even if the latest technology for energy

saving is available but the users are not aware or have no concern about energy saving, the energy wastage will still happen.

Meanwhile, R2 claimed that energy efficiency and energy saving are not a significant issue in the university due to the availability and implementation of their current energy-saving initiatives. The only problem they are facing is improving renewable energy generation and usage on campus, as there is a lack of buy-in and support from the university’s top management and stakeholders.

b) Challenges to achieve targeted carbon footprint

R1 and R2 indicated that the major challenge towards achieving targeted carbon footprint is the limitation of finance. However, they will continue the efforts to reduce the carbon footprint through its affordable initiatives.

Table 4: Challenges to achieve targeted carbon footprint

Respondents	Feedbacks
R1	Limitation of finance. However, the university is constantly striving to achieve best results in reducing carbon footprint through doable and affordable initiatives
R2	Limitations of funding. Thus, the university is continuing the effort in a more creative and innovative way towards it.
R3	Awareness and knowledge of the campus community on carbon footprint. The university has not yet figured out the best approach to educate the campus community on reducing the carbon footprint since they are relatively new on a green campus. However, the university is working tremendously towards it.

R3 highlighted the issue of lack of awareness and knowledge among the campus communities on carbon footprint. Moreover, the university is relatively new in green campus initiatives. Thus, they have yet to find the best approach to educate their staff and students to reduce carbon footprint. Nevertheless, the university is working tremendously on it.

Waste (WS)

Challenges to improve the effectiveness of waste treatment in the university

R1 explained that the main challenge in waste treatment initiatives faced by the university is the current waste disposal culture practices among staff and students. Furthermore, there is also a lack of waste management policy especially for inorganic waste treatment in the university.

Table 5: Challenges to improve the effectiveness of waste treatment in the university

Respondents	Feedbacks
R1	The current waste management culture and practices among campus communities and lack of waste disposal policy in the campus. The

	management and treatment of inorganic waste treatment must be improved to ensure that it is well separated when transported from the campus.
R2	The implementation of the waste treatment initiatives is already applied and working. However, there is a lack of a well-coordinated team to continuously maintain the current waste treatment initiatives.
R3	The cooperation and contribution from the campus community to manage and treat waste in a more sustainable means

On the other hand, R2 mentioned that although the waste treatment initiatives are currently working well, there is a lack of well-coordinated teams in continuing the efforts of waste treatment projects. R2 also opined that, to improve waste treatment initiatives in the campus, the university needs more funding to enhance and upgrade the existing waste treatment approach.

Meanwhile, R3 highlighted the lack of support and contribution from the staff and students on waste treatment initiatives. There is also lack of coordination and interest among their communities to manage their own wastes in a more sustainable means. He believed that to increase the effectiveness of sustainable waste treatment requires collaborative support and participation from every single person in the campus.

Water (WR)

Challenges in improving the usage of water in the university

R1 and R2 concur on the lack of awareness on water saving practices in the university among their staff and students resulting in high monthly water bills.

Table 6: Challenges in improving the usage of water in the university

Respondents	Feedbacks
R1	The awareness of minimising water usage and water saving practice among campus communities is still lacking. Hence, the university faces difficulties in reducing water bills due to ineffective water usage among students and staff in the university.
R2	The only challenge faced by the university is there is still a need of efforts to raise awareness among campus communities on how to use water wisely.
R3	The cost of acquiring water saving equipment or technology is quite high and there are limited types of affordable water saving systems technology available in Malaysia. The current system used is expensive and uneconomical.

On the contrary, R3 highlighted the expensive and uneconomical initial cost to obtain water saving technology and equipment as the main challenges for this initiative. This is due to limited economical options available for these systems in Malaysia.

Transportation (TR)

a) Challenges to reduce the amount of gas vehicle in the university

R1 and R3 stated that the strict policy regarding bringing vehicles is difficult to be imposed on the staff since the majority of them depend highly on their own vehicles. This also may be due to the uncertainty of weather conditions in Malaysia.

Table 7: Challenges to reduce the amount of gas vehicle in the university

Respondents	Feedbacks
R1	Strict regulation regarding gas vehicles is quite difficult to be impose to the university's staff because they are still heavily reliant on driving their own gas vehicles
R2	Lack of funding, buy-ins, and bureaucracy, it is challenging to implement them.
R3	Generally, Malaysians prefer to use their own gas vehicles to commute rather than walking, cycling or using public transports. Other than that, the uncertainty of Malaysian weather and conditions also causes the people to use cars commuting to the university.

R2 mentioned that although several proposals regarding the use of electric powered vehicles in the campus have been brought forward, there are several obstacles such as lack of funding, buy-ins, and bureaucracy. Consequently, the proposals are to be put on hold until now.

b) Challenges in promoting cycling and walking in the campus

R1 explained that lack of interest among campus communities on cycling and walking is one of the challenges towards promoting cycling and walking practice. There might be students and staff who do not know how to cycle, or they are physically unable to ride or walk for a long distance due to health problems or unfit to do so. Moreover, the uncertain climate and weather conditions make cycling or walking to be impractical. Similarly, this is also faced by R3. He mentioned that due to their busy schedule, most students and staff agree that cycling and walking is time consuming and they prefer to commute using their own vehicles.

Table 8: Challenges in promoting cycling and walking in the campus

Respondents	Feedbacks
R1	Promoting cycling and walking in the campus is quite a challenge to the university as cycling and walking is deemed to be an activity that requires determination and effort. Other than that, another challenge is the uncertainty of Malaysian climate and weather which makes cycling to be impractical at certain times.
R2	The challenge in promoting cycling and walking in the campus is more towards the infrastructure initiatives to encourage cycling. The university also intends to promote the use of bicycle and walking in the campus with several innovative strategies under the latest university transformation plan.

R3	It is quite challenging to attract the community in the campus to commute by walking or cycling. Moreover, most of them opine that walking and cycling is time consuming as most of them have a busy daily schedule.
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R2 explained that the university is unable to provide adequate safe bicycle lanes since there are limited spaces in the campus. Renovating the existing structures in the campus is deemed to be uneconomical and impractical. As of now, the university can only encourage cycling safely and impose strict regulation for other vehicles to ensure the safety of cyclists and pedestrians in the campus. R2 also added that the university is suggesting several initiatives and strategies to promote cycling and walking in the campus under the university transformation plan.

Education (ED)

Challenges faced to educate the campus community on environment and sustainability

R1 revealed that the main challenge to educate the students and staff is lack of interest and engagement among them to participate in education programmes regarding sustainability and environment. They found that educational programmes tend to be less appealing compared to other types of programmes in the university.

Meanwhile R2 mentioned the challenge in re-coordinating the hierarchy and management in certain departments especially faculties and departments that always have frequent restructuring of personnel, subordinates and top management positions. Thus, this makes the continuation of ongoing sustainability programmes in the campus to be quite challenging.

Table 9: Challenges to educate the campus community on environment and sustainability

Respondents	Feedbacks
R1	There is a lack of interest and engagement on educational programmes among the campus communities.
R2	Frequent restructures or changes of personnel and positions makes the continuation and operation of campaigns, events and activities regarding environment and sustainability becomes quite challenging.
R3	To make sustainable education much more systematic is through the top-down approach. There is a lack of education initiatives on environment and sustainability. Lack of funding from the government to carry out educational activities regarding sustainability such as increasing the research grants awards and projects to the public universities in Malaysia is also among the problems that arise.

R3 stated that there is a lack of policies regarding education for sustainability and environment from the Ministry of Higher Education for the universities to follow. In addition, lack of financial allocation from the ministry

to perform better educational programmes regarding sustainability and environment is also one of the critical factors to be considered.

Solutions Towards Green Campus Implementation in The Malaysian Public Universities

Setting and Infrastructure (SI)

R1 stated that the university should consider systematic planning towards green buildings and facilities for future developments in the university. They should also execute more tree planting programmes to increase plant vegetation area as well as improving the landscape in the campus.

Table 10: Innovative solution to improve setting and infrastructure

Respondents	Feedbacks
R1	If there is a need for a new building, it should consider thoroughly planning and developing a much greener building to improve the current setting and infrastructure towards a green campus. Other than that, the tree planting programme is also an innovative way to increase the plant vegetation area as well as improving the landscape in the campus.
R2	Public universities should encourage collaboration and cooperation with outside organisations and the industry to allow for more exchange of ideas and innovations to improve the setting and infrastructure towards green campus especially in the aspect of human capital development and future leaders for sustainability.
R3	The government should provide more budgets to improve setting and infrastructure towards green campus implementation

Based on the university's experience, R2 recommended public universities to look for more opportunities in partnership programmes with various organisations to enhance sustainability. Indeed, it could also improve the individual development of students and increase the student's employability when they graduate. R3 insists for the government to provide more financial assistance to the universities to improve the setting and infrastructure towards green campus.

Energy and Climate Change (EC)

Effective ways to maximise energy saving in the university

R1 and R2 believed that universities should enhance the campaign towards energy saving awareness among students and staff and the impacts of not using energy wisely. R2 also added that, energy saving initiatives and sustainable practices among campus communities should go side by side to ensure the maximum results on energy saving efforts in the university.

Table 11: Effective ways to maximise energy saving

Respondents	Feedbacks
R1	To improve the way of educating the campus community's awareness on the impact of excessive energy usage and how to minimise them in their daily lives.
R2	Education and awareness of the campus community should be the university's focus to maximise energy saving. Lack of education and awareness among campus communities can cause the implementation of latest technology to be pointless for energy saving.
R3	The best way to inculcate energy saving initiatives is to increase the use of renewable energy such as solar energy in the campus to reduce the energy bills. The government must accelerate the implementation of renewable energy initiatives in public universities by providing financial support in terms of research and development projects at university levels. Other than that, the government and university could also perform collaboration MoUs or MoAs with the industry and manufacturers to make the renewable energy system and technology more accessible and affordable.

R3 mentioned that the most effective way of energy saving is through the implementation of renewable energy initiatives. However, it is quite challenging because there is limited funding to kick start this initiative. Thus, the government should initiate more incentives towards the innovation of affordable technology for renewable energy generation in university levels as well as collaboration and support from the local renewable energy industry players or manufacturers.

Waste (WS)

Effective Ways to manage and dispose waste in the university

According to R1, one of the most effective and affordable ways for the university to manage and dispose of waste is by turning the wastes such as agricultural waste, food waste, sewage, and livestock manure into various biomass products or renewable energy sources. Apart from this, the university should also strengthen the reduce, reuse, and recycle campaigns and programmes in the campus.

Table 12: Effective ways to manage and dispose waste in the university

Respondents	Feedbacks
R1	One of the affordable ways for the university to manage and dispose of waste is by implementing biomass initiatives in the campus. Other than that, the university should enhance the reduce, reuse, and recycle programme as the world is becoming more polluted with wastes and landfills every day.
R2	The most effective way for efficient waste management in the university is education and awareness. The campus community should understand their roles in sustainable waste management and be aware of the impact of poor waste management on the environment.

R3	Public universities should venture with other recycling companies to improve their waste management and disposal in the campus.
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R2 stated that to improve waste management initiatives, the university should educate the campus community on how to manage waste in a more environmentally friendly approach as well as understand the impacts of bad waste management to the environment. On the other hand, R3 believed that joint ventures with sustainable waste management companies will be very beneficial to the university. These companies could offer better environmentally friendly waste management services, thus could attract and increase interest in sustainable waste management among university students and staff.

Water (WR)

Effective ways to improve the usage of water saving initiatives

All respondents agreed that the universities should enhance the efforts of educating and raising awareness among campus communities on how to use water wisely and the impacts of water wastage. Universities should also encourage students and staff to conduct research and invest in an in-house rainwater harvesting system as this will not only provide a main water source for the campus but also contribute towards the local industry and university recognition at various levels.

Table 13: Effective ways to improve the usage of water saving initiatives

Respondents	Feedbacks
R1	The university should enhance the efforts of educating and raising awareness among campus communities on how to use water wisely and the implications of water wastage. The university could also encourage students and staff to invent and develop in-house rainwater harvesting systems to maximise rainwater collection as a main water source in the campus. Research projects on how to treat rainwater is also highly recommended.
R2	As for water saving initiatives, the most user-friendly way to promote water saving in the campus is through knowledge and awareness besides the application of latest technology as it may cost a lot to the university.
R3	Apart from implementing technology on water saving that is high in cost and requires funding, the university can improve water saving initiatives through water saving campaigns, water saving technology innovation competition, seminars and research projects.

In addition, various education programmes regarding water saving among the campus communities can be organised to promote the knowledge on the sustainability practices for water management.

Transportation (TR)

Effective ways to encourage more students to use bus, cycling and walking to reduce private gas vehicles inside campus

All respondents agreed for their respective universities to strengthen the policies and regulations for using private gas vehicles into the campus especially among students. R1 also mentioned several other initiatives that can be implemented to reduce private gas vehicles into campus such as restriction and reduction of parking spaces, improving the facilities for walking and cycling inside the campus and providing bicycle purchase discounts and rebates voucher for bicycle purchase among students.

Table 14: Effective ways to encourage more students to use bus, cycling and walking to reduce private gas vehicles inside campus

Respondents	Feedbacks
R1	The university should strengthen the regulations on using own motor vehicles inside the campus. The university should also improve the facilities for walking and cycling such as providing covered walkways for pedestrians, safe bicycle lanes, bicycle rental service, and effective bicycle parking. Other than that, the university can provide bicycle purchase discounts and rebates for students to buy their own bicycles.
R2	The university should strengthen the regulations and the criteria for eligibility of using private gas vehicles on campus among students. They should also strengthen the security and monitoring of vehicles and traffic in the campus, utilisation of campus bus as a free transportation and provide adequate facilities for pedestrians and non-gas vehicles
R3	The university can also utilise the university’s buses as public transport for students with a cheaper ticket price or even for free. Other than that, universities should introduce a student cab programme that allows students to offer hailing service inside the campus.

R2 suggested for the university to strengthen the security and monitoring of vehicles and traffic in the campus, utilisation of available campus bus to offer free shuttle service and improve facilities provided for pedestrians, cyclists, scooters, and small electric vehicles. R3 opined on introducing an official student cab or hailing service in the campus to reduce gas vehicles in the campus.

Education (ED)

Effectives ways to educate and increase awareness on sustainability among university community and surrounding society

All respondents agreed that the university should not only focus on educating the students and staff in the university but also to educate the outside community regarding sustainability and environment. R1 and R2 concurred that universities should fully utilise digital media and platforms to promote awareness and education on sustainability as this approach is proven to be much cheaper than

conducting physical activities or campaigns. R2 added that the university should encourage the campus community to take part in sustainability related programmes and competitions that are organised by other organisations to improve their own personal skills and experiences.

Respondents	Feedbacks
R1	The university should fully utilise various internet mediums to promote and educate their students and staff as well as the public on sustainability.
R2	The university should emphasise more on education for sustainability not only to the campus community, but also to the public. University should also consider to fully maximise the use of social media which is becoming very accessible to promote knowledge and awareness regarding sustainability and environment. On the other hand, the university should encourage the campus community to take part in any competition or event regarding sustainability
R3	The university can appoint leaders in green initiatives to educate and increase awareness on sustainability among campus communities and surrounding societies. They should also encourage community engagement through sustainability related events that involve not only the campus community but opens for other neighbouring communities. Other than that, the university should have good policies and blueprints that include sustainability in education.

R3 suggested for other universities that are moving towards green initiatives to appoint green leaders to lead other communities on sustainable lifestyle as well as to educate them regarding sustainable practices. The university should also have a well-established green campus blueprint and policies that include sustainable education in the long term.

DISCUSSION

a) Challenges in implementing green campus initiatives in the Malaysian public universities

Generally, there are several common challenges faced by all the three universities. Limitation of finance is the most recurring challenge faced by the universities in multiple categories namely SI, EC, TR and ED. This is aligned with Hopkins (2015) and Elliott and Wright (2013). The second most common challenge is knowledge and awareness which is mentioned in EC, WS and WR categories. Concurring to this, Velazquez et al (2005), Nejati et al. (2011) and Nur et al. (2019) highlighted the lack of knowledge, awareness and engagement by the campus communities on green campus initiatives. Another common challenge towards green campus implementation is cost barrier. This challenge appears in several categories namely SI and WR. In SI, U3 highlighted the expensive cost of forest and plant vegetation improvement. In WR, the university

also mentioned the expensive cost for water saving appliances and technology acquisition and also added that there are limited choices of affordable water saving technologies. According to several scholars, the costs towards green campus initiatives implementation might be unbearable for some universities (Beringer, 2007; Hoffman, 2008; Horhota et al., 2014 and Hopkins, 2015).

Other than that, another challenge that can be perceived as a common challenge is lack of participation and engagement from the campus community especially in WS and ED. Specifically, in WS, U3 outlined the lack of contribution and cooperation from the campus community in waste management initiatives. Meanwhile in the ED category, U1 stressed on the lack of interest and engagement among campus communities in educational programmes towards sustainability. Nifa et al. (2016) mentioned that campus sustainability has become difficult to achieve since it necessitates the active engagement and cooperation of various stakeholders, notably the campus community. Velazquez et al. (2005) also highlights the lack of engagement from the campus community to be challenging in green campus implementation. Adding to this, participation should be the main focus towards green campus implementation (Kantamaturapoj et al., 2012) and (Benjaoran and Parinyakulset, 2018).

U2 also highlighted the lack of buy-ins and support from the university bureaucracy, management and stakeholders in EC and TR which refer to renewable energy initiatives and electric vehicle initiatives, respectively. Velazquez et al. (2005) and Hopkins (2016) stated that another impediment to the green campus strategy is a lack of understanding and awareness of sustainable development among university managements. Tiyyarattanachai and Hollmann (2016) mentioned that if the university is not adequately prepared, a green campus may not be the best solution. Adding to this, the green campus agenda must be supported by all university stakeholders, including administration, professors, staff, students, parents, and alumni (Yuan et al., 2013).

Apart from that, there are also different challenges towards the implementation of green campus initiatives. In *SI category*, U1 and U2 stressed about the limitation of land area and space in the campus. It has prevented them from improving and increasing the green spaces especially forest and plant vegetation area. According to Nifa et al. (2016), the framework suggests that universities should consider green spaces. This is also agreed by Foo (2013) and Brandli et al., (2020) which stated the importance of green spaces in the campus towards ecological balance and human well-being. The depletion of green spaces in urban areas reduces opportunities for future generations to interact with nature and share their experiences and knowledge (Speake et al. 2013). Under EC category, U3 mentioned the lack of approach to educate and raise awareness of carbon footprint emissions among campus communities. This is due to the fact that most initial approaches to address sustainability in higher education differed greatly and are still often led by individuals (Scott et al., 2012) or fragmented to

this day (McMillin and Dyball, 2009). Concurrently, Alshuwaikat et al. (2017) stated that greening the mentality is the next step after greening the campus proved insufficient to bring about societal transformation towards sustainability.

Another challenge that needs to be stressed in the *WS* category is lack of waste disposal policies which are claimed to be occurring at U1. Velazquez et al. (2005) stated that, there is a lack of policies in promoting green campus implementation. Likewise, Hopkins (2016) also mentioned numerous obstacles that obstruct the implementation of green campus policies in universities. Moreover, the majority of the universities that successfully enlisted in the UI GreenMetric World University Rankings have worked hard and given continuous efforts towards sustainability and environmental policy at their respective campuses (Suwartha and Sari, 2013).

There are also several noteworthy challenges in the *TR* category. U1 and U3 faced a similar challenge in reducing the amount of gas vehicles in the campus i.e., high dependency and preference on using gas vehicles to commute to the campus. As for challenges in promoting cycling and walking in the campus, the majority of the universities agreed that the uncertainty of weather and climate conditions contributes towards lack of interest in cycling and walking in the campus among campus communities. Concurring to these challenges, Shields et al. (2014) stated that lack of environmental interests among students and staff contributes to the barriers towards green campus efforts. Nawi and Choy (2020) also added that the presence of different interests on environment and sustainability leads to different levels of knowledge and awareness among campus communities. Nevertheless, UM stressed on the lack of facilities for cyclists and pedestrians causing the encouragement of cycling and walking to be challenging. According to the framework by Nifa et al. (2016), the universities should consider planning for facilities, improvement of public space, increase accessibility and recreational space. Thus, the presence of adequate facilities and infrastructure can motivate campus communities to practise sustainability (Horhota et al., 2014).

In the *ED* category, the challenge that is worth to be highlighted is frequent restructuring and change in university's departments and bureaucracy that leads to the challenges in executing continuous efforts on sustainability in education. Without strong management and administration in universities, the implementation of green campus initiatives could be challenging (US EPA, 2008). According to Dacin et al. (2002) frequent changes in the organisational setting can clash with existing institutional settings and culture. Thus, the process of modifying the organisation's norms, regulations, culture, and routines must be examined.

b) Possible solutions towards green campus implementation in the Malaysian public universities

From findings, it is clearly shown that there are several common solutions and strategies towards green campus implementation and is suggested by the universities in multiple categories. The suggestion on partnership and collaboration towards green initiatives between universities and third parties are suggested in SI, EC and WS. In SI, UM suggested collaboration with other organisations to improve the settings and infrastructure of the university particularly towards human capital development. USIM suggested this strategy on EC category i.e., to develop affordable technologies on energy saving initiatives, specifically renewable energy generation in the campus. Meanwhile, in the WS category, USIM also suggested the universities to collaborate with recycling companies to improve waste management initiatives in the campus. The green campus framework by Nifa et al. (2016) specifically in sustainable collaborative procurement strategy, encourages the collaboration of universities and local suppliers or contractors to accelerate green campus implementation. Adding to this, SDSN Australia/Pacific (2017) also mentioned that SDGs allow universities to interact and collaborate with various industries and organisations to develop new research and education collaborations towards sustainability.

Another common suggestion that can be implemented in several categories namely EC, WS and WR is the enhancement of knowledge and awareness among campus communities. It is suggested that to improve the effectiveness of energy saving initiatives in campus, UPM and UM stated that universities should put extra effort in educating and raising awareness among campus communities on the energy saving practices and implications of energy wastage towards the environment. UM also stressed this matter into the initiatives of waste management towards waste reduction in the campus. Other than that, in terms of water saving initiatives, all universities also recommended the same strategy to improve water consumption in the campus. Mohd Isa (2016) and Benjaoran and Parinyakulset (2018) stated that awareness, knowledge and implementation of sustainability principles must be integrated into green campus. It is also added that, universities should conduct and encourage participation in sustainability related campaigns, offline/online events and activities, competitions, innovations, research, exhibitions as well as utilisation of internet mediums. These strategies were suggested as an effective solution towards multiple categories i.e., WS, WR and ED. UPM suggested universities to enhance reuse, reduce and recycle programmes as a solution towards the implementation of green campus initiatives under the WS category. Under WR category, UPM and USIM suggested the innovation and research programmes to be conducted among students and staff towards water saving and effective water management initiatives in campus. As for ED category, UM and USIM proposed universities

to encourage and attract the campus communities to participate in various sustainability related events and programmes to increase the level of knowledge and awareness, as well as gaining personal and university's achievements. Nejati et al. (2011) and Yarime and Tanaka (2012) emphasises that the university is the most strategic place to conduct various sustainable related activities, programmes and education. According to the US EPA (2008) and Mohd Isa et al. (2021), universities should conduct various sustainability related events, activities and campaigns to increase the awareness and engagement of the campus community towards green campus initiatives. Aziz and Said (2018) also added that competition-based programmes and initiatives are also effective strategies towards green campus implementation.

Other than that, another solution towards green campus initiatives implementation is for the government to provide support in terms of finance to speed up the transformation of public universities into green campuses. From the findings, the finance support from the government is important in several categories namely SI, EC and ED which is stressed by the representative from USIM. To improve the university's setting and infrastructure, the government should provide a budget and allocation for the universities to improve current buildings and infrastructures into much greener and environmentally friendly. In EC, it is also stressed that government finance support is required to accelerate the implementation of energy saving initiatives, especially research and development project grants. According to Najafian and Karamidehkordi (2018), developing renewable energy in campuses for the future remains a problem that requires both creativity and investment. Meanwhile in the ED category, government funding is also required to conduct educational activities towards sustainability and environmental awareness. Elliott and Wright (2013) highlighted that, in order to ensure the universities to prioritise sustainability over other operations and planning, financial support from the government is crucial. Cai et al. (2009) and Tan et al. (2014) also added that financial support from the government is important towards sustainable development.

There are also several different strategies suggested by the universities. In SI, UPM and USIM suggested that universities should outline necessary and strategic planning in improving their setting and infrastructure towards green campus. The universities require systematic planning towards the development of green campus (Nifa et al., 2016). Mohd Isa et al. (2016) stated that universities play a role in sustainable development through the processes of management and planning. Other than that, UPM also suggested tree planting programmes to increase and improve green areas in the campus. In EC category, USIM emphasised on the implementation of renewable energy in the campus. Sahoo (2008) stated that the implementation of renewable energy could significantly improve the energy efficiency in campus. Apart from the above, renewable energy can also help to reduce carbon dioxide emission (Fairuz et al., 2013).

Concurring to this, Mat Taib (2022) suggested that the universities should invest in renewable energy initiatives as soon as possible due to the long-term rewarding benefits in terms of cost, environmental and human well-being.

There are also numerous noteworthy solutions recommended in the TR category. It is found that the most common suggestion to encourage cycling and walking in the campus and reduce the amount of gas vehicles in the campus is by establishing or imposing stricter policies and regulations on bringing own vehicles in the campus among campus communities. In UI GreenMetric guidelines, transportation policies in campus are an important matter to be fulfilled by the participating universities, specifically, transportation policy designed to limit the number of motor vehicles used on campus (Suwartha and Sari, 2013). Nifa et al. (2016) also highlighted the transportation policies to be included in the framework of green campus.

Under the same category, UM and USIM suggested enhancing shuttle service, especially free bus shuttle service for campus communities. Benjaoran and Parinyakulset (2018) suggested that smart mobility on public transportation and shuttle services should be considered to reverse the current trend of personal vehicle usage in the campus. UPM and UM also suggested that facilities for cyclists and pedestrians be improved to encourage cycling and walking in the campus. According to Krizek et al. (2007), suitable infrastructure such as pavements, public areas, broad curb lanes, bicycle routes, safe parking, and office showers are required to promote walking and cycling.

Other than that, these universities also suggested other several unique solutions to encourage recycling and reducing gas vehicles in the campus. UPM suggested that the university should consider reducing the amount of car parking in the campus and provide rebates and discounts for bicycle purchases. Meanwhile, UM suggested enhancing and strengthening the security and monitoring of vehicles and traffic in the campus. Finally, USIM proposed a student cab programme which refers to hailing service to be conducted in the campus for students.

CONCLUSION

The present study has addressed the challenges and solutions on green campus implementation in the Malaysian public universities. It is notable that the most common challenge in increasing forest and vegetation areas on campus is lack of funding. It is hoped that the relevant authorities do give their attention in ensuring the importance of the sufficient fund. Thus, universities should be given sufficient funds to maintain and enhance the pivotal process of maintaining and implementation of a green campus environment. Furthermore, another major challenge which was addressed in this study was to educate the campus community on environment and sustainability. As this these are important parties in ensuring the process of implementation of the green campus goes on smoothly.

The present study has addressed a solution which is setting and infrastructure, whereby in the long term these two factors play an important role to ensure the sustainability of a green campus process continues. The present study recommends a different methodology being used to look in an in depth manner on the challenges and solutions on green campus implementation in the Malaysian public universities in a large-scale manner.

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