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**SUSTAINABLE BUILT
ENVIRONMENT**

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ENVIRONMENT**

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GREEN INITIATIVES IMPLEMENTATION IN UiTM PERAK

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ABSTRACT

The Green Initiative in Perak showcases a region-wide commitment to environmental sustainability and conservation. This study intends to identify the green initiatives in UiTM Sri Iskandar Perak. Green initiative is crucial for reducing greenhouse gas emissions, climate change, and the effects of global warming. The Green Initiative exemplifies an all-encompassing strategy for sustainable practises, incorporating a range of eco-friendly components to address environmental issues. This research objective is to identify green initiatives which implemented in UiTM Perak. The data collected through literature review and cases study at UiTM. The finding shows various of green initiatives have been implemented in UiTM Perak such as green roofs, harvesting rainwater, reduce reuse and recycle (the 3Rs), LED lighting, E-scooters and smart sensor. The significance of this study is to in guide other universities towards implementing green initiatives and creating sustainable, eco-friendly campus buildings. The green building is good for the technology of the environment and more efficient and more benefits for student, people and campus.

Keywords: green initiatives, sustainable, UiTM Perak

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INTRODUCTION

A green initiative is one that is sustainable and priorities comfort, usability, economy, and durability. It is a practice to design and build a building or structure utilizing sustainable and eco-friendly practices at every stage. By utilizing the 3R's (reduce, reuse, and recycle) practices, which are to use fewer natural resources to prevent waste, pollution, and degradation of the environment quality; reuse or recycle the materials in the construction process; or use materials made from renewable resources, a green building is intended to improve human health, quality of life, and the natural environment (Chin Yee et al., 2020). Many universities attempt to implement green initiatives, particularly in their operations, to reduce their operational environmental impacts. Universities are integrating environmental awareness and green initiatives using various dimensions in their activities (Tshivhase & Bisschoff, 2023). One pressing issue is the constraint of limited budgets, which can hinder the adoption of environmentally friendly technologies and sustainable infrastructure. Moreover, a lack of awareness and education among students, faculty, and staff about the significance of these initiatives

can impede progress. Resistance to change is another hurdle, as individuals accustomed to conventional systems might resist transitioning to eco-friendly practices. Bureaucracy and the complex decision-making processes characteristic of public institutions can slow down the implementation of timely and effective initiatives. Additionally, balancing green initiatives with competing priorities like academic programs and student services poses a continuous challenge. Overcoming these obstacles requires cohesive leadership commitment, interdisciplinary collaboration, and comprehensive educational campaigns to create a culture of sustainability on campus.

GREEN INITIATIVES

Green initiatives refer to proactive and intentional efforts taken by individuals, organizations, communities, or governments to promote environmental sustainability, conserve natural resources, reduce pollution, and mitigate the negative impacts of human activities on the environment. These initiatives are aimed at fostering a more eco-friendly and sustainable way of living and conducting business. Green initiatives refer to actions and programs taken by individuals, organizations, or institutions to promote environmental sustainability and reduce their impact on the environment. It is also a business improvement approach that intends to transform inputs into outputs using fewer natural resources, with lower negative environmental impacts and high efficiency. This practice focuses on reducing and eliminating different wastages along the value chain. It will likely minimize negative environmental impacts and achieve resource efficiency (Tshivhase & Bisschoff, 2023).

LITERATURE REVIEW

Greenhouse effect

By retaining heat in our atmosphere, the greenhouse effect raises the Earth's temperature. This keeps the Earth's temperature higher than it would be if the Sun were the only source of warming. Some of the sunlight that reaches the Earth's surface is absorbed, warming the surface, while the remainder escapes as heat back into space. The majority of greenhouse gases in the atmosphere absorb heat before reflecting part of it back toward the Earth. The greenhouse effect plays a crucial role in keeping the Earth warm by preventing some of the heat from escaping the atmosphere and into space. The In a letter to Stanford's president, Stanford students called for the institution to stop receiving research funding from energy companies and cited the fossil fuel industry's long history of lying about climate change (Loi et al., 2021).

Light Emitted Diode (LED)

It directly has effect in decrease of greenhouse gas emission. LED technology has gained a massive popularity for its ability to produce specific spectra. In fact, compared to other artificial light sources, monochromatic LEDs show unique spectra outputs in terms of wavelengths, along with an equivalent luminous efficacy, lower operational cost, lack of radiant heat, and longer lifespan. Due to these unique advantages, LEDs are now used in controlled environments, e.g., growth chambers, greenhouses, and vertical farming, as well as in the postharvest storage of many vegetables to support plant growth and to specifically stimulate the synthesis of bioactive compounds(Loi et al., 2021).

Rainwater harvesting

Rainwater harvesting is a sustainable water management technique that involves the collection, storage, and use of rainwater for various purposes. It is an eco-friendly and cost-effective method to supplement traditional water sources, conserve water resources, and reduce the strain on existing water

supply systems. The significance of rainwater harvesting as a backup water source, particularly during water shortages, has been recognized. The success of RWHS depends on a number of factors, including the weather, the building's attributes, the efficiency of the tank size, economy, and ecology (Tan et al., 2017).

Green Roof

Green roof technology, also known as living roof technology, involves the installation of vegetation and growing medium on rooftops. Green roofs provide a range of benefits, including improving energy efficiency, reducing stormwater runoff, mitigating the urban heat island effect, and providing additional green space in urban areas. However, up to this point, these roofs have primarily been used to reduce energy loss and the effects of thermal islands, and there have only been a few studies on the effect of green roofs on the carbon footprint of buildings. Green roofs can influence the climate at a micro scale (urban spaces) and have a positive impact on the carbon footprint of buildings (Seyedabadi et al., 2022).

Air Conditioner Inverter

An inverter air conditioner is a type of air conditioning system that utilizes inverter technology to control the compressor's speed and maintain the desired room temperature more efficiently. The threshold of inverter air conditioner energy efficiency limit has increased to 3.9, the energy consumption lower of inverter air conditioning become a focus point for each manufacturer and universities (Technology et al., 2015). The peak times for using air conditioning for classroom activity is during the day when the temperature is the highest (Island & Sumatra, 2015).

Smart Sensor

Smart sensors are a part of the broader concept of the "Internet of Things," where everyday objects are embedded with sensors and connected to the internet to gather and exchange data. These sensors can monitor and measure various environmental, physical, or chemical parameters and relay that information to a central data hub or cloud server for further analysis and decision-making. Due to how simple and inexpensive it is to deploy sensors, wireless data transfer between the sensor and a viewing or storage site opens up a variety of possibilities. It is unnecessary to run unsightly signal wires across various portions of a built structure, and setting up the sensors may be done much more quickly (Jang et al., 2008).

Student Engagement

Public universities actively include students in sustainability courses, research opportunities, and student-led projects, promoting an awareness of environmental issues and equipping the following generation of sustainability leaders. The current model of economic growth used by many countries is heavily based on the exploitation of natural resources, which is not viable. Evidence shows that a more careful, more sustainable approach to the use of our limited resources, is needed (Jain & Jain, 2019). Taking students to nature builds their understanding of environment and they commit themselves to preserving environment (Jain & Jain, 2019).

Implement Green Building Practices

Use sustainable materials in construction, reduce water consumption, and incorporate renewable energy sources into buildings such as solar panels and geothermal systems. effectiveness on promoting green building development, criticism of current green incentive implementation and strategies for improving green building incentives. Green building incentives are categorized into external and internal incentives. The external incentive is a forced choice whereby beneficiaries are required to fulfil specified conditions or requirement before benefitting, while the internal incentive allows beneficiaries to be incentivized out of volition because of the appeal of the benefits of green buildings (Olubunmi et al., 2016).

Implement Recycling Programs

Recycling is regarded as a practical means of lowering the cost of trash treatment, transportation, and collection. Recycling behavior is defined as the collection of behavioral waste materials for resale to recyclers or the sorting of garbage into designated waste containers. Recycled materials save roughly 75% more energy than those manufactured from scratch and reduce construction costs, therefore recently many nations have begun to rely on them to achieve better environmental performance with reduced energy consumption. Products would be a part of an ongoing process of reutilization and recovery if recycling were the basic method used on materials (Gomaa et al., 2022).

Promote Sustainable Transportation

Encourage students, faculty, and staff to use public transportation, bikes, or carpooling to reduce the carbon footprint of the university. Install bike racks and charging stations for electric vehicles on campus. On campus grounds sustainable transportation planning can be seen as providing incentives for walking, bicycling, ridesharing, taking mass transit, while discouraging the use of single-occupancy cars by passing on the full costs of parking to drivers, and linking transportation planning to land-use planning. Furthermore, in order to minimize the cost of infrastructure and their impact to environment, university campuses can also constitute a laboratory for testing and implementing various alternative transportation strategies (Norzalwi & Ismail, 2011).

Table 1: Types of Green Initiatives

References	Greenhouse effect	Smart Sensor	Rainwater harvesting	BEAM E-Scooter	Student Engagement & Education	Light emitted diode (LED)	Green roof	Air conditioner inverter	Recycling Programs
Loi et al., (2021)	√					√			
Jang et al., (2008)								√	
Korkmaz (2022)			√						
Tan et al., (2017)			√					√	√
Jain & Jain (2019)			√		√				
Moosavi et al., (2022)				√					
Guo & Zhang, (2021)				√					
E. A. & C. O (2020)						√			
Hu et al., (2022)		√					√		√
Seyedabadi et al., (2022)			√				√		
Gomaa et al. (2022)									√
Olubunmi et al., (2016)			√		√				

METHODOLOGY

This research aims to identify the green initiatives implemented by UiTM Perak, with a specific focus on their identification and implementation processes. The pursuit of sustainability and eco-friendly practices in academic institutions constitutes a pivotal objective, and UiTM Sri Iskandar in Perak serves as a compelling example of such initiatives. The study draws from a comprehensive dataset, including an interview with Dr. Huzeima Hussain, a committee member and an expert in green building from Green Campus. During the interview session, the first objective of the research was achieved through inquiries about the green initiatives that have been put into practice at UiTM Seri Iskandar. Additionally, questions were posed to elucidate the university's future plans concerning green initiatives in UiTM Perak. Comprehensive case studies were conducted, alongside referencing the digital book "Green Campus" authored by Assoc Prof Sr Dr Nur Azfahani Ahmad. The chosen focal point for the case study is UiTM Seri Iskandar Perak due to its substantial integration of various green elements and the successful execution of multiple green initiatives. The campus has been honored with the title of the best green campus by the Green Metric assessment, underscoring its commitment to sustainability. Moreover, the campus benefits from a cadre of experts and specialists, facilitating data acquisition through interviews and on-site facility observations. The concept of a "Digital Green Institution" book, though briefly mentioned, seems to propose a comprehensive exploration of UiTM Perak's transformation into a technologically advanced and environmentally conscious campus. Presumably, the book would encompass diverse topics such as digital innovations implemented on campus, smart technologies, green initiatives, and sustainability practices. This publication could potentially provide an exhaustive roadmap for UiTM Perak's journey toward becoming a technologically innovative and ecologically responsible institution.

The research will be concentrated on campus UiTM Perak which is UiTM Sri Iskandar, the surrounding building and the green initiatives that been applied and all others features about green features toward building system or other technology in the campus toward green building features that gave benefits to

the campus itself, The limitation of this cases study is the data collection, there is the limitation for this topic as example the management of the campus and the user for give the corporation about the topic. This is due to the confidential and the restriction on certain department and site according to regularity. Other than that, the data collection access gain and takes time due to private and confidential.

ANALYSIS AND FINDING

The green campus is a synergy to environmentally friendly practices and education to promote sustainable and environmentally friendly practices among university students. University Teknologi MARA (UiTM) Perak Branch has been active since 2016 in carrying out the efforts of this green campus. Among the ongoing activities implemented are green building design and technology concepts, green offices, green health and recreation practices, modern agricultural efforts, recycling practices based on the 3Rs, which are reduce (reduce), reuse (reuse) and recycle (recycle), as well as sharing environmental sustainability education. A green building is one that is sustainable and priorities comfort, usability, economy, and durability. It is a practice to design and build a building or structure utilizing sustainable and eco-friendly practices at every stage. By utilizing the 3R's (reduce, reuse, and recycle) practices, which are to use fewer natural resources to prevent waste, pollution, and degradation of the environment quality; reuse or recycle the materials in the construction process; or use materials made from renewable resources, a green building is intended to improve human health, quality of life, and the natural environment. (Chin Yee et al., 2020).), the findings illuminate a diverse spectrum of endeavours undertaken to foster sustainability. Central to these endeavours is the innovative incorporation of green roofs into building structures, merging vegetation and infrastructure. The manifold advantages, encompassing improved air quality, heightened insulation, and reduced energy consumption, are complemented by an aesthetically pleasing coalescence of nature and architecture. Furthermore, UiTM Sri Iskandar has championed the "sangkar 3R" concept, revolutionizing waste management through strategically positioned waste collection stations that promote the principles of Reduce, Reuse, and Recycle. By encouraging disciplined waste segregation, this initiative cultivates heightened waste disposal awareness, thereby nurturing a culture of active participation in recycling. The institution has embraced "Makmal Guna Sama FSPU," an ingenious shared facilities approach facilitated by smart sensors. This strategy optimally manages resources, curbing energy wastage and operational expenses while maintaining optimal utilization of equipment and facilities within the Faculty of Science, Technology, and Human Development (FSPU). In tandem, UiTM Sri Iskandar has ushered in e-scooters as a sustainable intra-campus transportation solution. This pragmatic shift aims at mitigating carbon emissions, alleviating traffic congestion, and nurturing an ecologically conscious transportation ethos among students and staff. Water conservation is also prioritized, with the implementation of rainwater harvesting systems that collect and repurpose rainwater for non-potable uses. This initiative curtails dependence on municipal water sources, while also mitigating stormwater runoff to bolster the institution's environmental accountability. In summation, the holistic range of initiatives undertaken by UiTM Sri Iskandar showcases a multidimensional commitment to sustainability. These endeavours underscore the institution's pioneering role in shaping an environmentally responsible and progressive campus ecosystem.

The findings of this thesis offer valuable insights to academic institutions seeking to establish and enhance their eco-friendly initiatives. The identification of specific green building technologies implemented at UiTM Perak serves as a practical blueprint for other campuses aiming to adopt similar approaches. Furthermore, the identify of green implementation encountered by UiTM Perak provides a roadmap for proactively addressing potential hurdles, thereby fostering a more sustainable and environmentally-conscious educational setting. In the research, a case study and literature review from a digital resource on campus were utilized, along with an interview session conducted within the case study context. This session yielded informative details for recognizing green initiatives at UiTM Seri

Iskandar, including insights from a representative of the green campus initiative at UiTM Seri Iskandar. The strategic plan for UiTM Perak (2016-2022) outlines aspirations for developing a green campus. This encompasses five teams: the green office, green lifestyle and leisure support, green entrepreneurship and innovation, and green education and awareness. These teams operate under the committee's oversight, collectively contributing to the realization of the green campus vision.

Green Initiatives in UiTM Perak

Rainwater Harvesting

According to digital book of green campus ("Assoc Prof Sr Dr Nur Azfahani Ahmad", n.d.) The rainwater harvesting initiative at UiTM Perak is a comprehensive and well-thought-out program that focuses on efficiently harnessing and utilizing rainwater to meet various non-potable water demands across the campus. This sustainable practice aligns with the university's commitment to environmental conservation and promotes responsible water management.



Figure 1: Rainwater Harvesting

Recycle 3R

Green Campus Digital Book ("Assoc Prof Sr Dr Nur Azfahani Ahmad," n.d.) states that UiTM Perak has placed recycling 3R bins all across its campus. These containers were made specifically to make it easier to separate recyclable materials in accordance with the 3R principles of Reduce, Reuse, and Recycling. A public relations campaign would also be launched to educate educators, staff, and students on the importance of recycling, the types of materials that go in each container, and the environmental advantages of recycling.



Figure 2: Recycle 3R

E-Scooter

According to Dr Huzeima Hussein, the beam would likely collaborate with an e-scooter business or a supplier of scooter-sharing services to deploy electric scooters on campus. The specifics of the programmed, including security precautions, dedicated parking areas, revenue sharing (if applicable), and other pertinent elements, would be discussed and agreed upon as part of this cooperation. The implementation of electric scooters like Beam aligns with the university's commitment to sustainability and green transportation options. It can contribute to reduced carbon emissions and traffic congestion on campus.



Figure 3: E-scooter

Makmal Guna Sama FSPU dan FSSR

According the Dr Huzeima and digital book from green campus adoption of the ground-breaking shared facilities strategy known as "Makmal Guna Sama FSPU," which stresses resource efficiency, is another

remarkable effort. The Faculty of Science, Technology, and Human Development's (FSPU) diverse facilities and equipment are efficiently maintained, assuring their maximum use while avoiding energy waste and operational expenses. This initiative helps to reduce the material usage in campus and reduce the pollution in material properties.



Figure 4: Makmal Guna Sama FSPU dan FSSR

LED

According to digital book by green campus, all the bulb has been replaced with LED bulb on every building and others. By transitioning to LED lighting and implementing smart controls, UiTM Perak would achieve substantial energy savings. LED lights have a longer lifespan and lower maintenance requirements, leading to reduced operating costs for the university. initiative would contribute to the university's sustainability goals by reducing its carbon footprint. LED lights emit less greenhouse gas and are mercury-free, making them more environmentally friendly than conventional lighting options. UiTM Perak, like many other educational institutions and organizations, may have been utilizing LED technology for various purposes, primarily for energy efficiency, cost-effectiveness, and environmental sustainability.



Figure 5: LED

Smart Sensor

Smart sensor has been installed in selected building in building in UiTM Sri Iskandar. According to Dr Huzaima, the Smart sensors can help optimize energy usage in buildings by adjusting lighting, heating,

and cooling systems based on occupancy and environmental conditions. This leads to energy conservation and cost savings for the university.

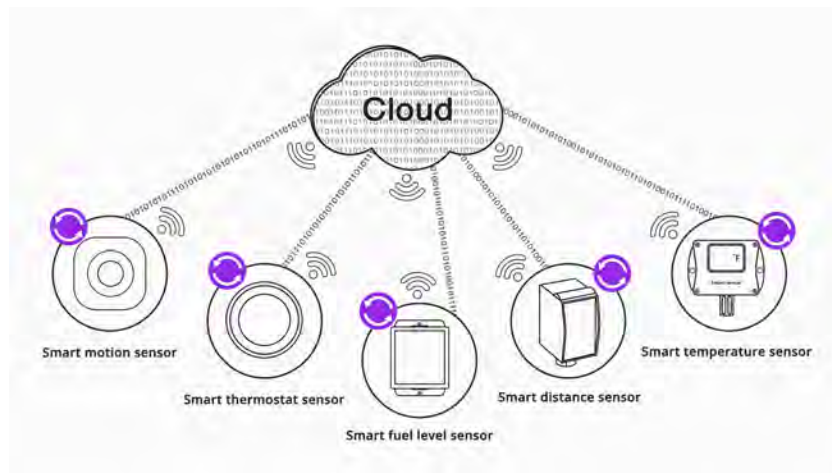


Figure 6: Smart Sensor

Green roof

According to Dr Huzeima Hussain, a green roof initiative in UITM Perak excellent sustainable addition to the campus, offering numerous environmental benefits and enhancing the overall aesthetics of the university. A green roof, also known as a living roof or vegetated roof, involves the installation of vegetation on building rooftops. The green roof located at annex 1. Green roofs can absorb and retain rainwater, reducing stormwater runoff and alleviating pressure on the drainage system during heavy rainfall. This helps to mitigate the risk of flooding and water pollution.



Figure 7: Green Roof

Table 1: Data Collection with Literature Review

References	Greenhouse effect (Loi et al., 2021).	Smart Sensor (Jbees10-410_, n.d.), (Jang et al., 2008).	Makmal guna sama FSPU ("Assoc Prof Sr Dr Nur Azfahani Ahmad", n.d.)	Rainwater harvesting (Korkmaz, 2022), (Tan et al., 2017), (Jain & Jain, 2019b)	BEAM E-Scooter (Moosavi et al., 2022), (Guo & Zhang, 2021).	student engagement and education (Jain & Jain, 2019).	Light emitted diode (LED) (E. A. & C. O., 2020), (Loi et al., 2021).	Green roof (Hu et al., 2022), (Seyedabadi et al., 2022)	Air conditioner inverter (Technology et al., 2015), (Island & Sumatra, 2015).	Implement recycling programs and green building practice (Gomaa et al., 2022), (Armijo de Vega et al., 2003), (Olubunmi et al., 2016)
1. digital book "Green Campus" ("Assoc Prof Sr Dr Nur Azfahani Ahmad," n.d).	✓	✓	✓	✓		✓	✓	✓	✓	✓
2. Doctor Huzeima Hussain		✓	✓	✓	✓		✓	✓	✓	

SIGNIFICANCE STUDY

The significance of this study lies in its aim to ensure the integration of green building initiatives throughout the entirety of UITM Perak's campus. Green initiative practices offer numerous benefits for both the environment and the campus community. These benefits stem from enhanced technological approaches that lead to increased efficiency, subsequently yielding advantages for students, individuals, and the overall campus.

Green initiative brings forth several economic and financial advantages, appealing to a diverse range of stakeholders. Such benefits encompass reduced utility expenses for tenants and households, achieved through energy and water efficiency. This translates to lower construction costs and augmented property value for building developers. Building owners experience heightened occupancy rates and reduced operating costs, further fortifying the economic appeal. Additionally, these initiatives contribute to job creation, amplifying their positive impact.

The initiative to foster green environment not only delivers economic benefits but also fosters environmental betterment. By conserving and restoring natural resources, green building practices contribute to a more sustainable and balanced way of life. This approach minimizes carbon emissions and promotes a healthier environment, aligning with the overarching goal of nurturing and preserving our planet's resources.

CONCLUSION

In conclusion, green initiatives at UiTM Perak play a pivotal role in fostering sustainability, mitigating environmental impact, and establishing healthier and more energy-efficient campus environments. These initiatives encompass a diverse array of strategies, technologies, and practices designed to advance the principles of sustainable design, construction, and operation of university buildings and facilities. Through the implementation of these green initiatives, public universities can effectively underscore their dedication to environmental stewardship while assuming a leadership role in the realm of sustainability. Such initiatives contribute significantly to the reduction of greenhouse gas emissions, the conservation of resources, and the promotion of renewable energy sources. Additionally, they augment the well-being and comfort of students, faculty, and staff by enhancing indoor air quality, optimizing natural lighting, and integrating elements of biophilic design.

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Surat kami : 700-KPK (PRP.UP.1/20/1)

Tarikh : 20 Januari 2023

Prof. Madya Dr. Nur Hisham Ibrahim
Rektor
Universiti Teknologi MARA
Cawangan Perak



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