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COMMITMENT TO SUSTAINABILITY: A CASE STUDY OF GREEN ENERGY AND SUSTAINABILITY INITIATIVES AT AN AMERICAN UNIVERSITY

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ABSTRACT

Research, teaching, and involvement at an American university in the areas of green energy and sustainability has placed it at the forefront of international leadership. Its campuses serve as living laboratories for the creation, testing, and implementation of ideas that solve some of the world's most difficult problems. However, very few literatures recorded the approaches made by American universities and most available information are either by European or Asian universities. Therefore, this article aims to provide an overview of the sustainability initiatives that are currently being carried out at this university using the qualitative case study method. We draw from interviews with the stakeholders, documents and observations to capture the information from collective viewpoints that is able to position the views aligned with the ongoing green energy and sustainability initiatives at this university. Some of the key components of this initiative include a realistic goal of Quadruple Bottom Line Sustainability Framework, University Radical Collaboration Priorities in Sustainability and Climate Action Plan. It was discovered from this study that many relatively prominent institutional assets, such as a living laboratory for sustainability and campus activities on wellbeing, played crucial roles in the process of getting the initiative off the ground. In this particular path of development, the initial physical assets have been transformed into complementary potential for research, teaching, and institutional growth. In spite of the fact that the case study is limited to a specific university in a particular geographic location, which makes it difficult to reproduce the findings, it does offer a fresh perspective on the topic of green energy and sustainability adoption by university through the interaction with the stakeholders.

Keywords: Sustainability, Environmental Education, Energy, Climate Action, Policy.

1.0 INTRODUCTION

Sustainability has been an integral aspect of many corporate social responsibility agendas for various organisations including universities in recent years. The results and data presented at the United Nations Climate Change Conferences in Spain and the United Kingdom have highlighted the need for a paradigm shift towards the development of a low-carbon, sustainable society in order to combat climate change [1,2]. In order to establish economies with minimal carbon emissions, it is imperative that all levels of society evaluate their behaviours and endeavour to be better stewards of our natural resources.

Up until this point, the vast majority of efforts made in this regard have been centralised, with policymakers serving as the principal initiators of sustainability-related initiatives. The proposed policies and initiatives, on the other hand, have as their ultimate goal the modification of the consumption patterns of

industries and communities. In addition to this, the development of social media technologies has considerably contributed to a heightened awareness of environmental concerns among the public [3]. It is imperative that the vast majority of people are made aware of the necessity of maintaining environmental consciousness.

However, in a field study done amongst high school students with 927 respondents in Malaysia by Ilham et al. (2022) showed that majority of students have low level of knowledge in environmental issues particularly energy conservation, despite their acceptable level of positive attitude and practice [4]. On the other hand, another study involving 2863 university students showed that more attention and focus on environmental education must be directed to students from low-income background and students from non-science background [5]. It implies that environmental awareness activities alone will not alter present consumption patterns. To engage the community in sustainable behaviours, a holistic plan is required [6-8].

Universities in the modern era can be compared to "little cities" because of their size, population, and the myriad complex activities that take place on campus. These activities have considerable direct and indirect effects on the surrounding environment [9]. As a result, the higher education industry has come to the realisation that the activities it engages in and the physical structures it builds can have significant effects on the surrounding environment. As a result, it has begun investigating ways to organise these activities and reduce the negative effects they have on the surrounding environment. Through the implementation of an appropriate combination of organisational and technical measures, the environmental pollution and degradation caused by universities in the form of energy and material consumption as a result of activities and operations in teaching and research, the provision of support services, and in residential areas could be significantly reduced. These activities and operations are the result of activities and operations in teaching and research, the provision of support services, and in residential areas [10]. Some institutions have environmental protection measures, but most do not have a more organised and long-term plan to reduce the negative effects of these activities and make campuses more environmentally friendly [11]. Green campus, eco-campus, green building, green construction, high-efficiency buildings, and others are used to characterise the green agenda by various universities although universities may implement the idea differently. The green buildings initiative promotes energy-efficient building design, waste reduction, and energy efficiency.

Changing attitudes and behaviours is a complex and difficult subject. Current research indicates that knowledge transmission alone is insufficient to bridge the gap between attitudes and actions [6-8]. Despite the fact that a large amount of study has been conducted on this topic across a variety of fields, such as psychology, marketing, and urban planning, the abundant knowledge surrounding it has been gathering in silos. Therefore, the purpose of this study is to provide an overview of the sustainability initiatives at an American university through a number of essential components that serve as the plan's foundation and generate the best practices as learning points [9-13]. Due to the expectation that universities, as originators of cutting-edge research, will be at the forefront of new and innovative sustainable practices, the focus of this research is on universities and their surrounding communities. In addition, the demographic diversity of the professors, staff, and students at the university serves as a microcosm of society. Consequently, it has the potential to serve as an outstanding testing ground, constituting an ecosystem for community involvement. In this study, the case study method [14] is used to explore the green energy initiatives done in a leading American research university. Limited case studies are available with regards to how American universities conduct green energy and sustainability approaches in comparison to European and Asian universities [12]. Therefore, although the case study only focuses on one specific university without any comparison, our case study provides a comprehensive outlook by utilizing qualitative insights into green energy and sustainability initiatives within this university. This viewpoint is still relatively uninvestigated, and our intention is to offer comprehensive insights that are not frequently addressed in the existing literature.

2.0 METHODOLOGY

2.1 Research Approach

This is a contextual study that uses the case study method [14]. In the field of sustainability study, it has been argued for a long time that we need to reframe our methodology and assumptions, which are typically based on information scarcity and knowledge gaps, and instead develop a reflexive research strategy that welcomes contextual and emergent modes of knowing. As a result, we believe that the research problem that we are confronted with in the present day is not necessarily to solve information deficits alone, but rather to provide information that is both timely and useful within the context of an excess of information and an accelerated

circulation of knowledge. Therefore, the case study is a good way to look at new things and illustrate how the sustainability framework variables influence stakeholders participation in their sustainability activities. Because the relationship between universities and the concept of sustainability has only been researched relatively lately, it is an appropriate issue for the present study [11, 12]. Further, there are limited case studies about how universities in the United States of America (USA) contribute to green energy and sustainability. Normally, most research on the topic is based on evidence from European countries [12]. In light of the growing number of calls to accelerate and make green energy and sustainability approaches mandatory in universities around the world, we would like to emphasize the significance of bringing to the forefront the implementation of real-world practices in order to gain an understanding of the shifting roles that stakeholders play in universities and the challenges that they face. The majority of this viewpoint has not been investigated, and we intend to offer a wealth of insights that are not typically taken into consideration in the context of sustainability literature. More specifically, we draw on the concrete case study of an American university as an opportunity to co-create new knowledge and bridge official accounts of practice with the more in-depth and context-rich versions of university stakeholders. All of this is accomplished by utilizing a concrete case study. We place a strong emphasis on the productive characteristics of stakeholders-led reflections as theories-in-the-making that emerge from the everyday application of concepts, learning by doing, and contextual views on future perspectives of sustainability in the university. The research steps taken in this study have been simplified as depicted in **Figure 1**.

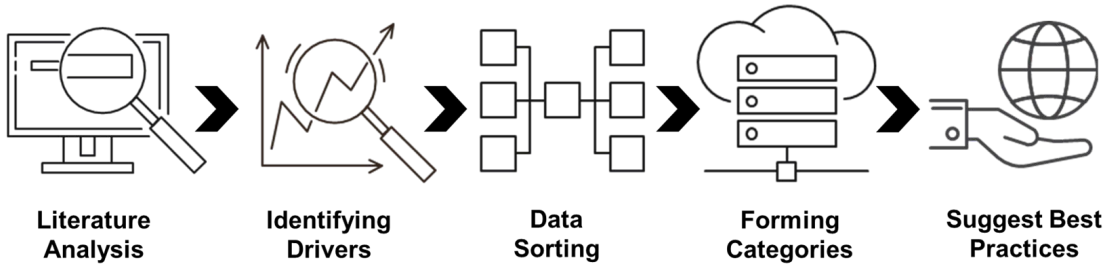

Figure 1. Research steps in this study

2.1 Data Collection

Data collection for the case study was done at a North American university, which was called "University A", in this study. University A was selected because, in its official records, it expressed a commitment to sustainable ideals, including the improvement of social and environmental aspects. University A was classified as a large research university due to its 2900 faculty members, 7655 staff members, and 26,000 students at the time of the study. The fieldwork was conducted in the United States between August and November of 2022. The authors spent at least one semester observing the reality at University A, interviewing 6 respondents (2 professors, 2 students, and 2 university employees) about sustainability issues using open-ended questions and collecting documents for a multidisciplinary literature analysis [12]. The triangulation approach has been used in this study to confirm that we are not relying on a single perspective to draw a conclusion. In this study, the triangulation approach means that multiple data collection methods which are interviews, observations, and document analysis were used to gather diverse perspectives and reduce the influence of any single method or bias. In addition, we utilize open-ended questions in the interviews done in order to avoid leading questions that push respondents towards desired answers. We used neutral wording and allowed them to freely express their experiences and opinions. On the other hand, the utilization of case studies is a widely recognized approach that aims to enhance understanding by combining complementary data sources that offer a diverse and contextually rich viewpoint. Despite the fact that case study insights are case-specific and context-dependent, they are indispensable for learning and constructing expertise. Qualitative case studies provide a valuable opportunity to conduct thorough analyses of details and nuances that are frequently disregarded in alternative approaches to data acquisition. In order to ensure the reproducibility and multiplicative effects of case study results, a more comprehensive examination and the extrapolation of potentially applicable findings are necessary. A summary of the data collection activities at University A is shown in **Table 1**.

Table 1. Summary of data collection activities during research at University A

Contents of Interview			Documents	Observation by the author
Professors	**Students**	**Staffs**		
Motivation	Perception	Relationship	Website	Field study
Teaching practices	Representation	Perspective	Historical annals	Lectures
Sustainability concepts	Contributions	Practices	Teaching data	Laboratories
Research activities	Interest	Supporting activities	Pamphlets	Libraries
	Support		Brochures	Attendance to sustainability events
			Posters	
			Reports	Living labs

3.0 RESULTS AND DISCUSSION

3.1 University A as a Sustainable Campus

University A, which is located in the northeastern region of the USA, promotes sustainability via research, education, outreach, and campus management. The campus sustainability activities are comprehensive, engaging not only students, but also faculties and staff members. University A students are the catalysts for change, and they have founded numerous groups based on their interest such as in local food, renewable energy and composting benefits [13]. In addition, University A introduced a Climate Action Plan called for its home city to be carbon neutral by 2050 [14]. In 2016, the Senior Leaders Climate Action Group advocated studying energy sources for the city to reach carbon neutrality by 2035 [15]. Carbon neutrality means that there are no net direct releases of carbon dioxide. This is done by balancing the amount of carbon dioxide released and stored [16]. University A carbon-neutral campus in the future could be made possible by decisions and investments made now, which shields the campus from the volatility of the fossil fuel market and carbon levies. Over the years, University A facilities team has traditionally designed campus energy systems using heuristic techniques instead of a formal optimization approach [17]. Current campus energy systems include the Combined Heat and Power (CHP) plant, networked solar farms, solar systems on campus, a hydroelectric plant, and lake source cooling. In 2008, a 30 MW coal plant was replaced by a CHP unit that runs on natural gas. The CHP plant's yearly carbon emissions dropped by 25% after it was fixed up. University A also has 16 projects which utilise solar energy. Solar energy accounts for nearly 20% of campus electricity usage [17].

3.2 Quadruple Bottom Line Sustainability Framework

University A employs a sustainability paradigm called the Quadruple Bottom Line (QBL) to evaluate decisions, initiatives, and comparable costs and benefits for decision making comparison. The framework enables University A to view sustainability as a challenge and an opportunity that encompasses not only environmental concerns, but also social justice, economic equity, and our unique academic potential as equal factors in the creation of a more just and sustainable campus, community, and world [17,18]. By introducing a fourth component which is "Purpose", its academic, research, and land-grant mission could be aligned with the conventional Triple Bottom Line for sustainability which are "People, Prosperity, and Planet", commonly utilised by organisations, institutions, and businesses [18]. The simplified framework is depicted in **Figure 2**. Instead of three components in the common sustainability framework, the QBL framework considers four impact areas in a balance.

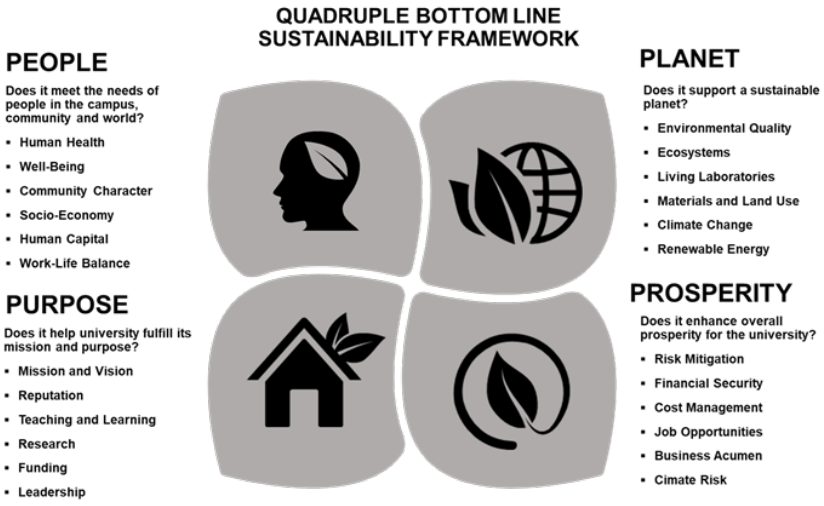

Figure 2. Simplified Quadruple Bottom Line Sustainability framework, questions and its relevant criteria

The framework is used to evaluate all proposed sustainability projects using the sustainability evaluation steps which starts with choosing the suitable criteria for evaluation followed by qualitative and quantitative ranking of the overall impact area [19]. This approach will ensure due diligence met via the systematic evaluation as well as carbon neutrality and sustainability impacts documentation. In addition, stakeholders could be well-informed of the early identification of risks and unseen benefits, making decision making easier particularly on projects that cover complex costs and benefits [17-19]. At University A, the QBL approach is constantly monitored by the sustainable council and evaluated quarterly, and the strategies were adapted and adjusted as needed based on learnings and changing circumstances. By doing this, University A continuously innovate and seeks new ways to improve sustainability performance.

3.3 Radical Collaboration Priorities in Sustainability

University A Sustainability Plan is administered by its Sustainable Council (SC), which serves as the university's governing body for campus sustainability and climate change leadership [17]. The SC is responsible for leading and coordinating University A role as a global leader in tackling climate change and sustainability, making real progress within operations, and encouraging campus-wide engagement. Three steering committees, a leadership team, and working groups make up the Council. Each year, Steering Committees will identify working priorities and oversee short-term groups made of a broad campus membership in order to improve sustainability activities and campus research [18]. These operational priorities comprise a plan for living sustainability. Having a dedicated SC at University A comes with a multitude of positive implications, both for the university itself and the broader community. Among its important roles is to be a centralized body with unified voice for sustainability within the university, guiding and coordinating campus-wide efforts. It also develops and oversees the sustainability plan as well as allocating resources and tracking progress. As a result, it could drive progress towards sustainability goals, enhances the university's reputation, and play a crucial role in advancing sustainability knowledge and solutions by serving as a model for other institutions and contribute to broader efforts to address global challenges like climate change.
In 2019, University A also came up with a set of core ideals that will help make all of its campuses more inclusive [20]. There are six core values which are Purposeful Discovery (C1), Free and Open Inquiry and Expression (C2), A Community of Belonging (C3), Exploration across Boundaries (C4), Changing Lives through Public Engagement (C5) and Respect for the Natural Environment (C6). Among these values, C3, C5 and C6 are the most relevant towards campus sustainability activities. This is further strengthened by the university's status as a land-grant university, with the main campus located in the ancestral homelands of indigenous Americans and a long history of national and international connections [21].

In addition to developing a living laboratory for climate action, teaching, and research, University A community also engages in productive dialogues about how best to proceed. These discussions include academics across fields, students across colleges, campus-wide staff, and university top administration. For instance, University A also offers a new minor in Climate Change to all of its undergraduate students, and it currently provides 431 courses connected to sustainability across 74 different departments [22].

3.4 Climate Action Plan

University A is also a member of the American College & University Presidents' Climate Commitment (ACUPCC), which have pledged to cut greenhouse gas emissions in their institutions [11]. To officiate this pledge, University A developed a "Climate Action Plan" in 2007 that embeds carbon neutrality as a strategic path for advancing the institution's basic responsibilities, such as teaching, scientific research, and community service [12]. In the proposal, greenhouse gas emissions are planned to reach zero by 2050. All the renovations of existing buildings and construction of new buildings require half energy consumption in comparison to the industry standard baseline. In energy management, University A employs qualified engineers and energy managers to oversee the energy systems as well as the four-tiered approach towards energy efficiency (Figure 4). Optimization of University A energy distribution system has enhanced total energy efficiency and allowed the integration of new energy technology.

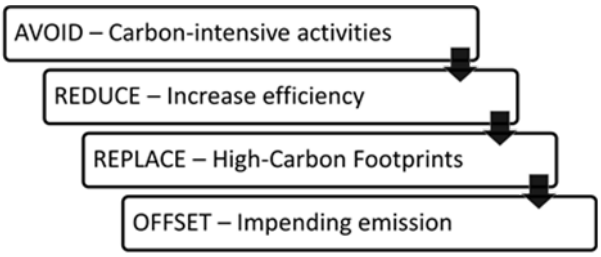

Figure 4. Four-tiered approach towards energy efficiency

University A plans to leverage its existing various technologies which are geothermal, gas, wind and carbon management and plans to demonstrate renewable biological energy sources in the near future [11]. As examples, its Energy Conservation Program, Climate Literacy Outreach, and Sustainability Rating System programs are used as mature experiences or demonstrative technology in nearby communities. Recently, University A geothermal project has also reached its first well's target depth. Earth Source Heat (ESH) is a deep geothermal system that would heat the campus without fossil fuels [23].

3.5 Sustainable University

Based on the interview to the respondents in this study, sustainable university could be defined as "A higher education institution, as a whole or in part, that addresses, involves, and promotes, on a regional or global level, the minimization of negative environmental, economic, societal, and health effects generated in the use of their resources in order to fulfil its functions of teaching, research, outreach and partnership, and stewardship in ways that assist society in transitioning to sustainable lifestyles" [24]. Other definition is "one that acts on its local and global duties to maintain and improve the health and wellbeing of humans and ecosystems." It actively leverages the academic community's knowledge to address the energy and climate challenges we are currently facing. The assurance of sustainability entails identifying, mitigating, compensating, or offsetting the full costs of proposed development [25].

According to the findings of this case study about University A, it is recommended that a sustainable university campus should have a balanced campus environment; have a prosperous economy; achieve these goals through the conservation of energy and resources; reduce waste; and efficiently manage the environment. It is generally agreed that a sustainable university campus demands a better policy which balances between economic, social, and environmental goals and a long-term view of campus activities. This idea is supported by the fact that a sustainable university campus has become increasingly important in recent years.

Numerous studies have highlighted how important it is for college campuses to be environmentally responsible and sustainable. In addition, universities engage in a variety of activities and sophisticated operations that, up until very recently, include their social and environmental responsibilities. These activities and operations have the potential to have a substantial influence on the environment. Monitoring for substantial environmental impacts is required for a variety of activities and operations associated with the university. These include the usage of workshops and laboratories, the maintenance of buildings, as well as the use of energy and resources. In terms of operations, universities can be compared to complex buildings such as hospitals and mega malls. This is because all of these functions have implications for the quality of the environment.

According to the findings, educational institutions are an essential component of the global landscape, which is characterised by a heavy reliance on automobiles, elevated levels of consumption, and significant amounts of trash. The increasing demand for energy and resources has resulted to an increase in land conversion as well as the erosion of the natural ecosystems in campuses. Taking care of resources and encouraging the sustainable consumption is an essential action that the global community must take in order to ensure its own well-being. This is as an outcome of the fact that maintaining the viability of environmental resources is an essential building block for achieving sustainable development.

The declining environmental concerns occurs not only in academic halls and research laboratories, but also in residential colleges and administrative areas. This problem could be addressed and substantially mitigated by adopting and putting into action a methodical organisational and technical measure [26]. However, because of the large area and variety of potential impacts, the heterogeneous nature of university campuses and its activities, universities have social responsibilities to train and educate the society which require a comprehensive approach similar to the scale of towns and cities. This is because of all of the factors listed above.

Universities also contribute to the growth of our society, and as a result, they have a unique obligation to society, in particular with regard to the education of young people and the raising of public awareness about issues of environmental sustainability [27]. As a result, educational institutions ought to emulate the growth that would not only be compatible with a healthy environment but also with biodiversity system. Sustainability should be used to configure the campus and its operations so that the institution, its members, and its economy may meet their demands and match the strategic planning to maintain these goals over a long-term period. Thus, the university, its community, and its economies should suit their needs and maximise their potential.

4.0 CONCLUSION

In this study, findings showed that University A has pioneered an innovative energy management model to help establish a sustainable campus. They have set up a sustainable campus committee and hired qualified staff to seriously look at current climate change challenges and find ways to help build a sustainable campus. In fact, most colleges and universities either in the United States of America or globally have set up their own leading institutes to start and promote green campus construction [11]. These comprehensive institutes are supposed to come up with policies for college and university campuses and organise, direct, and help colleges and universities establish green campuses.

In terms of the QBL approach, some areas that are recommended to be looked upon are the way to integrate equal justification of inputs from non-experts and incorporation of a final step. In an evaluation process, it is easy that one analysis often brings up to questions without answers. Therefore, availability of data is crucial for the process to be efficient. It is also imperative to ensure that there is flexibility, so that only large projects involve comprehensive evaluation and a scaled-down approach chosen for smaller projects. Other universities could possibly adopt the QBL approach by understanding the dimensions of all the four P's (People, Planet, Profit, Purpose), conduct a baseline assessment, set achievable and measurable targets, implement action plans with timelines and integrate sustainability into all aspects of university operations, from curriculum and research to campus infrastructure procurement. In addition, a university should also communicate the QBL framework and its goals transparently to all stakeholders to engage students, faculty, staff, and the community in developing and implementing sustainability initiatives. However, some considerations are important such as university size and location, regional context or whether financial constraint is an issue before an adaptation started.

University A competence in inter-disciplinary collaboration have afforded it unique advantages in the field of sustainable development. Since climate change challenges can only be resolved on a regional basis, the campus, as a pilot site, can only add value when its positive environmental effect is extended to a larger regional network. Internationally, numerous colleges and universities have realised the significance of public-private sectors partnerships in accelerating the construction of green campuses; meanwhile, they are attempting to practise in a larger community by establishing themselves on campus. Among notable achievements by University A as results of its sustainability commitments in alignment with the United Nations Sustainable Development Goals (SDG) are 6% reduction in carbon emissions from the 2008 baseline exceeding their initial 5% target and 40% of campus members use sustainable transportation to commute to and across campus, including bikes, buses, and carpooling (SDG 13: Climate Action). The campus also boasts 11 Leader in Energy and Environmental Design (LEED) certified building, approaching 100% renewable power years ahead of

their goal, with geothermal, solar, and hydro sources contributing significantly (SDG 7: Affordable and Clean Energy) as well as composting 173 tons of campus food and agricultural waste per year (SDG 12: Responsible Consumption and Production). Such initiatives should also be emulated by universities in other regions in a more realistic manner with proper investment, fundings and strategic planning, rather than just merely completing prerequisites to compete into the hyperbolic and popularity-based global sustainability and green metric rankings. In addition, this study also recommends that future research examine, for the purpose of comparison, the conformity of University A's reality of sustainability with other available frameworks for measuring the contributions of universities towards sustainable development.

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