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Towards Greener Campuses: Assessing Pro-Environmental Behaviours in the University of Bahrain Campus

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Abstract: The significant contribution of building materials and emissions, accounting for approximately 40%, underscores the crucial role that buildings play in addressing climate change. Considering that buildings and transport are among the main contributors of energy-related emissions, Bahrain's greenhouse gas emissions (GHGs) increased from 16 (Mt/year) in 1990 to 54 (Mt/year) in 2020, which requires immediate attention. Pro-environmental behaviours play a significant role in reducing overall emissions and mitigating climate change. Therefore, this research aims to clarify the main factors influencing pro-environmental behaviour in the University of Bahrain campus, in order to create a strategic framework encompassing pro-environmental solutions working towards zero emissions. The problem is analysed through a mixed methodology based on a literature review, questionnaire and photographic analysis. The findings highlight the importance of several internal and external factors in relation to pro-environmental behaviour in higher education environments. The results provide valuable insights for stakeholders and decision-makers to implement change through green initiatives at a policy level.

Keywords: pro-environmental behaviour; sustainability; zero emissions; built environment; green campus

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1. Introduction

Despite having control over more than 20% of the world's proven crude oil and natural gas reserves, the Gulf Cooperation Council (GCC) member states face significant environmental concerns and are putting their development and sustainability trajectory at risk due to the extensive production and consumption of non-renewable energy resources [1]. The GCC, which comprises six member states, namely Bahrain, Oman, Qatar, Saudi Arabia, the United Arab Emirates (UAE) and Kuwait, is considered to have higher CO_2 emissions per capita when compared to the global average [2]. Despite the GCC countries accounting for only 0.6% of the global population, they contribute 2.4% of the world's greenhouse gas (GHG) emissions [3]. Buildings and transportation are the primary sources of energy-related emissions, representing the largest contributor to the aforementioned GHG emissions. The region's extensive reliance on fossil fuels for the generation of power leads to a rise in its GHG emissions, which in turn has a significant adverse effect on environmental sustainability [4].

Bahrain's GHG emissions increased from 16 (Mt/year) in 1990 to 54 (Mt/year) in 2020, which is approximately a 13% increase per year, as shown in Table 1 [5]. The increase in GHGs is mainly due to transportation and urbanisation. The rapid increase in urbanisation has led to an increase in population density and therefore an increase in the number of registered vehicles in the country. In addition, the absence of parks, pavements and pedestrian-friendly infrastructure leads to a heavy dependence on vehicles, which increases GHG emissions. This escalating problem of high GHG emissions has led the country to set a target of achieving net-zero emissions by the year 2060 [6]. The authorities in the Kingdom have developed many sustainable initiatives to achieve this, including Bahrain's

National Vision 2030, the Government Plan and the newly implemented Green Building Code, in line with the UN's 2030 Agenda of 17 Sustainable Development Goals (SDGs) [7].

Table 1. GCC countries' greenhouse gas (GHG) emissions (in million tons per year) and their patterns over time [5].

Year	UAE	Saudi Arabia	Oman	Kuwait	Bahrain	Qatar
1990	79	240	20	39	16	16
1995	103	286	31	47	20	25
2000	115	345	40	70	26	40
2005	156	425	46	95	32	54
2010	208	565	64	108	41	87
2015	253	726	92	126	49	117
2020	250	713	95	136	54	120

Bahrain's National Vision 2030 was launched in late 2008 to establish a definitive path for the ongoing advancement of the country's economy, centred around the principles of sustainability, competitiveness and fairness. Through fostering robust economic growth, government funding, enhancing human capital, promoting fairness and cultivating a highly competitive market, the nation aims to make significant progress towards achieving the majority of the SDGs. These goals represent the government's current priorities and are closely aligned with the executive actions outlined in the current Government Plan, which comprehensively addresses sustainability through strengthening the foundations of the country and society, fostering financial stability and economic growth and establishing an environment conducive to sustainable development [8]. Bahrain is actively tackling climate change by implementing legislative infrastructure and mitigation policies. Environment Law No. 7 for the year 2022 aligns with SDG 13 (Climate Action), and its main objectives are to safeguard the environment from detrimental activities, combat pollution and preserve natural resources. The law grants the Supreme Council for the Environment the legal authority to undertake studies, evaluate projects and formulate policies in the realm of environmental protection. To reinforce its climate action endeavours, the Supreme Council for the Environment is also currently developing a comprehensive and phased monitoring, reporting and verification (MRV) system to monitor the national GHG inventory, track progress in achieving national emission reductions and assess adaptation measures [9].

GHG emissions resulting from human activities are a significant contributor to climate change [10], with building materials and emissions alone accounting for approximately 40% of global emissions [11]. The existing literature demonstrates the plethora of strategies to decrease GHG emissions, such as reducing overall energy consumption, minimising water usage, conserving electricity and minimising waste generation, but it all begins with raising awareness. The quality of the environment is highly influenced by patterns of human behaviour, and ensuring appropriate behaviour can lead to the implementation of these strategies, thereby resulting in a reduction in environmental impacts [12]. The effectiveness of promoting behaviour change is enhanced when there is a systematic approach to its planning, implementation and evaluation [13]. Consequently, environmental education is considered essential in nurturing positive attitudes towards the environment [14]. The objective of environmental education is to cultivate a society that is environmentally aware and equipped with the necessary knowledge, skills, attitudes, motivations and dedication to address existing environmental challenges and prevent new challenges from arising [15]. Today, incorporating environmental education about global warming across all educational levels, from elementary schools to universities, is widely recognised as the most effective strategy to foster environmental consciousness among nations [16]. Universities bear significant responsibility in fostering environmental education and encouraging pro-environmental behaviours in order to reduce GHG emissions [17,18]. The first essential step in designing programmes to promote such behaviours and climate change mitigation

is to assess the environmental attitudes of university students and identify the underlying drivers of individual behaviour towards the environment [19].

It is imperative for universities to enhance their efforts to effectively address climate change and successfully fulfil the SDGs. Researchers in the field should closely monitor the implemented sustainability initiatives and explore further measures that could be employed. The available literature emphasises a gap in the research regarding the awareness of environmental issues and climate change in Bahrain and the wider GCC region [19]. To the best of our knowledge, this study is the first of its kind to examine pro-environmental behaviours specifically within universities in Bahrain. Therefore, the main objective of the study is to develop a strategic framework with which to promote pro-environmental behaviour towards realising greener campuses. This is achieved by identifying the main factors influencing pro-environmental behaviour and measuring the current pro-environmental behaviours exhibited by students and members of the faculty at the University of Bahrain campus.

This research is organised in four main sections, beginning with a theoretical background represented by a literature review presenting a thorough exploration of the existing literature on pro-environmental behaviour and principles of green campuses using qualitative methods. This is followed by a practical section, which comprises measurements and observations (quantitative methods). The third section discusses the method, results and findings, and, in the final section, the conceptual framework is summarised in the discussion, along with the conclusions. This mixed methodology encompasses an assessment of pro-environmental behaviour and an examination of the current state of the University of Bahrain campus in Isa Town. This assessment is accomplished through a questionnaire and observations. The results and findings will support and establish a strategic framework outlining and promoting pro-environmental solutions that can contribute to the goal of achieving a greener campus. The target audience of this research is stakeholders and decision-makers in higher education within the Ministry of Education in Bahrain.

2. Literature Review

2.1. Pro-Environmental Behaviour

Human behaviour is the cause of many environmental problems, including global warming, urban air pollution, water scarcity, environmental noise and biodiversity loss [12,20,21]. Therefore, modifying relevant behaviours can minimise the impact on the environment and enhance its quality. Pro-environmental behaviour pertains to actions that minimise harm to the environment or, in some cases, actively benefit it [22]. Steg and Vlek suggest that encouraging pro-environmental behaviour revolves around four key issues: identifying the specific behaviours that should be changed, outlining the factors that influence the relevant behaviour, proposing possible interventions that could encourage pro-environmental behaviour and examining the effects of these [22].

In the field of environmental psychology, a significant proportion of studies rely on participants' self-reported measures of behaviour. This approach is commonly employed, due to the practical challenges associated with directly measuring individuals' actual behaviour. Therefore, it is essential to conduct comprehensive research to explore effective methods to obtain reliable and valid self-reported measures of behaviour [22,23]. Researchers have utilised factor analyses [24] and Rasch analyses [25] to investigate the underlying dimensions of environmental behaviour. The findings from factor analyses indicate that individuals display a certain level of variability in their environmental behaviour. This suggests that factors beyond environmental considerations, such as status, comfort, effort and behavioural opportunities, play a significant role in influencing behaviour [24,26]. Steg and Vlek propose considering the factors that affect pro-environmental behaviour more systematically by categorising them into motivational factors (weighing costs and benefits; moral and normative concerns; and effect), contextual factors and habitual factors [22]. Other literature has shown that they can also be grouped into psychological, cognitive and socio-cultural factors [27]. Steg and Vlek propose that behaviour is influenced by hedonic

goals, gain goals and normative goals. These factors guide individuals' attention, influence the information that they perceive, determine the accessibility of knowledge, shape the perception of action alternatives and, ultimately, impact their behavioural choices [22].

A study that investigated UAE university students' perceptions, attitudes and intentions in relation to sustainable living demonstrated the significance of environmental knowledge and its influence on attitudes and intentions. The results underscored the impact of perceived benefits as a critical mechanism through which knowledge influences an individual's intention to actively participate in pro-environmental behaviours [28]. However, another study in Finland suggests that even scientific ecological knowledge is not sufficient to advance pro-environmental attitudes unless it is very strongly related to global concerns [29].

Fishbein and Ajzen's theory of reasoned action (TRA), recognised as a highly influential model in the realm of social-psychological literature, puts forth the notion that behaviour is influenced by three key factors: attitude towards behaviour, subjective norm and behavioural intention [30]. The theory of planned behaviour (TPB) is a subsequent model to the TRA that incorporates the concept of volitional control. The inclusion of this factor significantly enhances the model's applicability by addressing the wide range of behaviours that necessitate specific skills or external resources, such as the availability and accessibility of recycling collection systems [30]. Norm activation theory (NAT) describes the development of moral considerations and their impact on behaviour. In the context of environmental behaviour, which often involves a social dilemma, acting in favour of the environment and community is generally perceived as morally superior to acting out of self-interest. NAT explains that norm activation generates a personal sense of obligation to engage in specific behaviours, establishing a moral dimension in environmental decision-making [30].

Bamberg and Möser's meta-analysis provides further support for the mediation role of pro-environmental intention in the impact of various psychosocial variables on pro-environmental behaviour. The initial set of factors—namely problem awareness, social norms, internal attributions and a feeling of guilt—shape the subsequent factors of personal behaviour control, attitude and moral norm. These, in turn, influence the intention to act, which ultimately influences behaviour. This model showcases the intricate nature of the relationship between knowledge and behaviour. It highlights that knowledge is a crucial factor in shaping behaviour, albeit through a complex and indirect pathway, emphasising the need to stimulate action [31].

The integrated psychosocial model for determinants of pro-environmental behaviour serves as both a replication and an extension of the meta-analysis initially proposed by Hines et al., two decades after its original publication. It also draws upon Ajzen's TPB, which posits that decision-making is driven by a rational evaluation of the outcomes associated with a particular behaviour. Individuals are motivated to avoid punishment and seek rewards; thus, the collective assessment of negative and positive consequences shapes one's attitude towards a specific behavioural option [32]. Numerous studies have also highlighted the significant influence of socioeconomic characteristics in predicting pro-environmental behaviours. These socioeconomic factors encompass gender, age, educational level and income [33]. Albert Bandura proposed that self-efficacy, including experiences, verbal persuasion and emotional arousal, as well as outcome expectancies and environmental factors, are key to behaviour initiation and maintenance [34].

Figure 1 shows Kollmuss and Agyeman's model of pro-environmental behaviour, which is one of the most cited frameworks in pro-environmental studies [35].

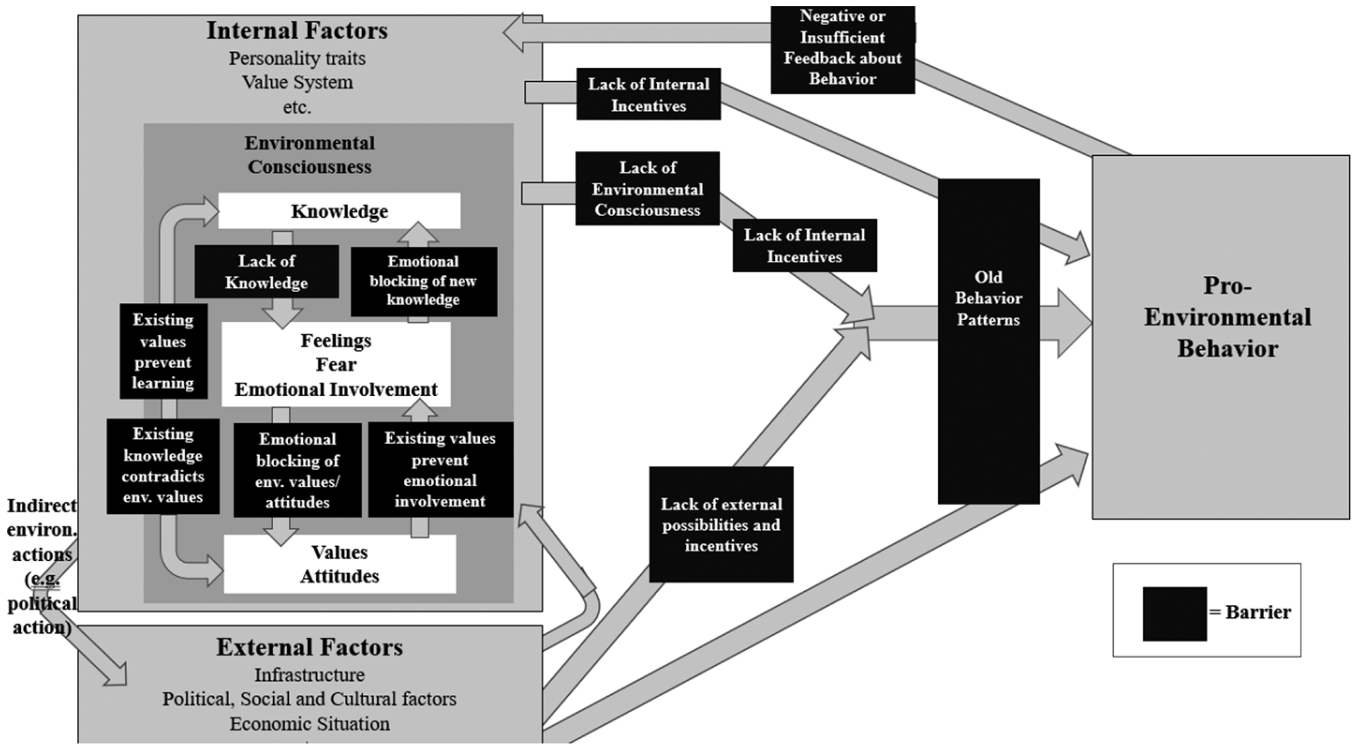

Figure 1. Model of pro-environmental behaviour [35].

The model highlights the significance of knowledge, attitudes, values and emotional involvement as internal factors that synergistically interact with external factors (such as infrastructure, politics and social and economic factors) in shaping the complex concept of "pro-environmental consciousness". This study adopts the aforementioned model as a framework with which to examine the factors and obstacles impacting pro-environmental behaviour at the Isa Town campus. The aim is to gain insights that can facilitate positive changes in these factors and address barriers in promoting pro-environmental behaviours.

Additionally, the Positive Sustainable Built Environments (PSBE) model, as shown in Figure 2, is used to analyse the campus characteristics through the "prime", "permit" and "invite" domains. In this context, "prime" refers to the attributes that prepare occupants to embrace pro-environmental behaviours, such as access to nature and the mental clarity that it provides in priming or preparing individuals to participate in pro-environmental behaviours. "Permit" pertains to the features that enable occupants to conserve resources, such as building features that allow occupants to act upon their environment by turning off a light, adjusting a thermostat or sorting recyclables or waste. "Invite" encompasses the characteristics that explicitly encourage the adoption of pro-environmental behaviours, such as interventions or educational materials, signage or even feedback about resource consumption via an energy dashboard [27]. There are many strategies available, and it is widely acknowledged that intervention programmes that encompass a range of techniques targeting various psychological and sociological factors tend to yield the most long-lasting behavioural results [36,37].

Identifying the factors of environmental behaviour allows targeted interventions or methods that steer behaviour in a certain direction. These techniques can be employed, for example, to shift behaviour from being harmful to the environment to pro-environmental behaviours that support the environment [30]. For attitude-related behaviour, promoting attitude changes can be effective. Removing contextual barriers enables desired behaviours. Steg et al. categorise interventions into informational strategies and structural strategies, to be used depending on the factors influencing environmental behaviour. Informational strategies encompass activities such as information provision, persuasion and support, while structural strategies involve elements like service availability, regulations and finan-

cial measures [22]. The literature demonstrates that green buildings can be utilised as an intervention strategy with which to foster residents' pro-environmental behaviour [38]. Implementing a rewards-focused system that encourages pro-environmental behaviour has the potential to decrease carbon emissions [39]. Research highlights that the integration of sustainability knowledge into existing organisational processes is essential, along with the design of organisational cultures and climates that foster support for sustainability initiatives. Empowering employees and fostering a sustainability-focused atmosphere are crucial in creating a buzz and driving sustainable practices [40]. The translation of pro-environmental behaviour into a sustainable culture is crucial in achieving long-term environmental sustainability [38].

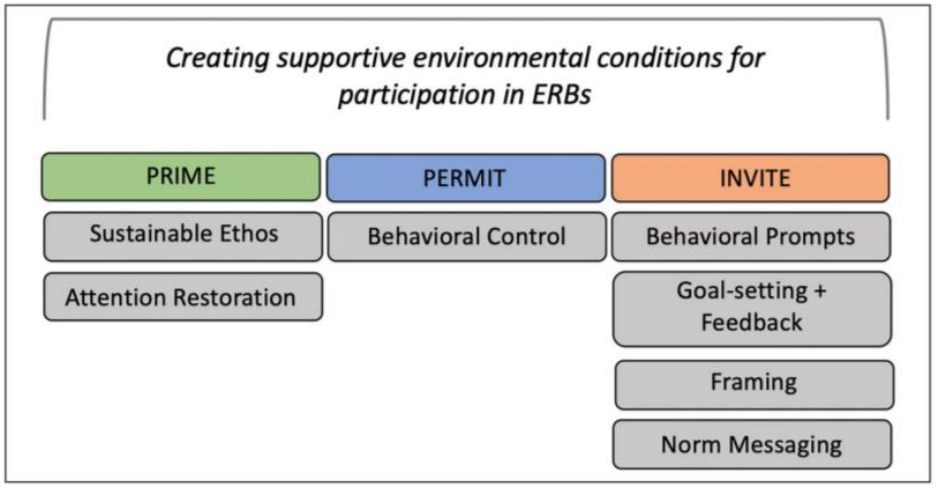

Figure 2. The Positive Sustainable Built Environments (PSBE) model [27]. Reprinted with permission from 2021, Erin. M. Hamilton, License No. [5734790244703].

2.2. Understanding Principles of Green Campuses

Due to their contribution to climate change, universities often have a sense of obligation to address their individual impacts by adopting environmentally friendly practices and "greening" their campuses. A multitude of higher education institutions (HEIs) globally have embraced initiatives such as striving to become "carbon-neutral universities" or transforming into organisations with low emissions and carbon-neutral footprints. In addition to carbon neutrality, universities aim to improve waste management, reduce materials and resource use, improve environmental quality, increase green areas and adopt green transportation [41]. In pursuit of sustainable development, universities also view climate change education and campus greening approaches as integral components of their strategies to contribute towards sustainability [42]. The incorporation of green practices within universities signifies their commitment to the environment and their acknowledgment of social responsibility [43].

Aligned with SDG 13, specifically Target 13.3, universities strive to enhance education, raise awareness and develop human and institutional capacity in areas such as climate change mitigation, the reduction of impacts and early warning systems [41]. In his book titled *The Nine Elements of a Sustainable Campus*, Mitchell Thomashow [44] asserts that sustainability is a necessary response to the urgent environmental crisis that we face on a global scale. Thomashow links the campus to the planet, emphasising that local efforts can have a global impact. He identifies nine elements for a sustainable campus, designed to evoke a 21st-century catalogue of transformational sustainable practices, as illustrated in Figure 3. They entail three dynamic and interconnected categories: infrastructure (energy, materials and food), community (governance, investment and wellness) and learning (curriculum, interpretation and aesthetics) [44].

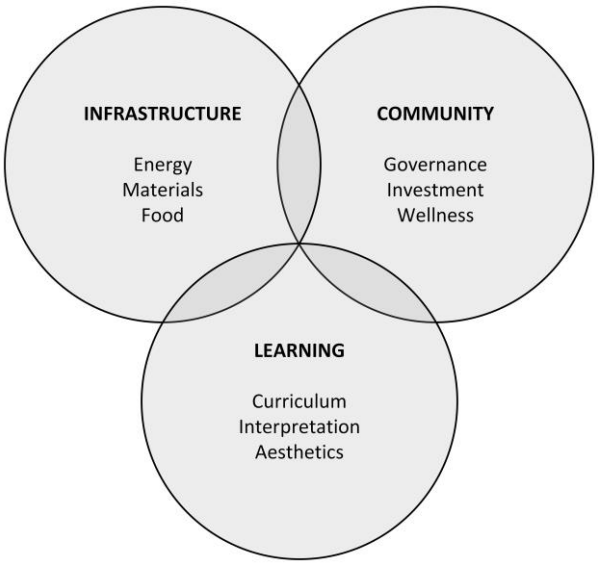

Figure 3. The nine elements of a sustainable campus [44].

Thomashow states that universities, like other institutions, municipalities and countries, bear the responsibility to address these environmental challenges. They possess the ability to make unique contributions through research, teaching, student initiatives, community involvement, campus operations, housing, transportation and food services. By engaging in these practices, universities can play a significant role in reducing GHG emissions, which is of paramount importance in the global environmental agenda [45].

Filho et al. also outline six recommendations through which HEIs can address climate change, mostly in line with Thomashow's principles. These include curriculum reform, education and awareness, research, collaboration, renewable energy and green buildings [41]. The principles discussed thus far tackle a wide spectrum of recommendations towards more sustainable and greener universities; however, the scope of this research is focused on the awareness and collaboration aspects, related to enhancing pro-environmental behaviour.

2.3. Visualising Co-Occurance Bibliometric Networks

After examining the literature on pro-environmental behaviour, green campuses and campus sustainability ranking systems, a search was conducted via VOSviewer, version 1.6.20, to create a co-occurrence bibliometric network. This was used to visualise the relationships between specific keywords. The input data for the bibliometric analysis were obtained from an academic literature database, Scopus. In an effort to gather pertinent literature for the analysis, we formulated a search string that combined terms pertaining to pro-environmental behaviour and green campuses. The search string was as follows: TS = ((“pro-environmental behaviour” OR “pro-environmental behaviour”) AND (“green campus” OR “sustainable campus” OR “green university”) AND (“climate change” OR “global warming”) AND (“sustainability”)). The literature search was conducted on 22 December 2023 and returned 1000 documents, published between the years 2020 and 2023, for term co-occurrence analysis in VOSviewer. The minimum occurrence of keywords was set to four, which resulted in a total of 286 keywords, categorised into 20 clusters.

The final result, depicted in Figure 4, consists of a system of interconnected nodes and links. The size of each node corresponds to the frequency of keywords, while the width of the links represents the strength of the connections between terms. Terms that are closely linked together form clusters, which can be seen as significant thematic areas that have garnered a relatively higher level of attention in the literature. Through the utilisation of this literature mapping approach, the study successfully identified, collected and analysed the existing literature pertaining to pro-environmental behaviour and green campuses. This involved the careful selection and synthesis of specific keywords in order to extract valuable

insights. Consequently, the literature mapping process not only provided a comprehensive understanding of the current knowledge on the subject but also conceptualised a diverse range of future research directions, policy implications and practical recommendations, tailored to different stakeholder groups [41].

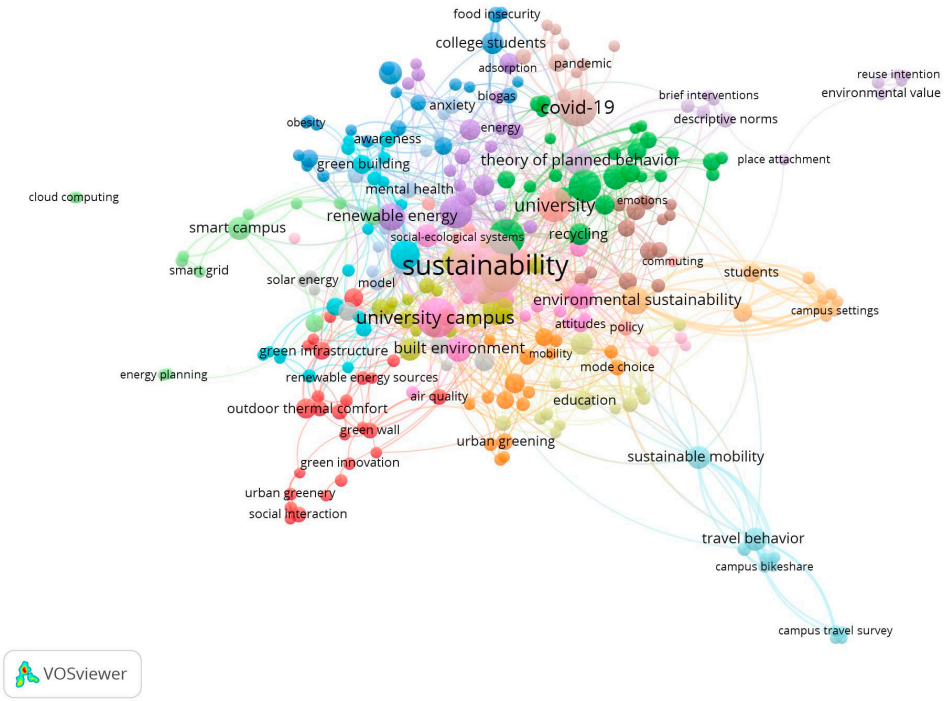

Figure 4. Results from the co-occurrence analysis using VOSviewer.

The co-occurrence analysis demonstrated the plethora of topics related to pro-environmental behaviour and green campuses, under the larger branch of sustainability, as shown in Figure 5. The green cluster describes topics related to pro-environmental behaviour, such as TPB, recycling and place attachment. The orange cluster focuses on the different factors that affect behaviour, such as the situational setting—and, in this case, the campus physical environment—attitudes and policies, which are linked to the blue cluster, which describes travel behaviour, mobility and transport and a general awareness of environmental issues. The red cluster is more focused towards possible solutions and interventions that could promote pro-environmental behaviour on campuses, such as green infrastructure, enhancing outdoor thermal comfort and air quality, introducing urban greenery, green walls, green innovation, recycling methods and social interaction. All of these topics are interconnected and work towards enhancing the overall sustainability of the built environment.

2.4. Campus Sustainability Ranking Systems

The rise of global ranking systems for campus sustainability is playing a growing role in driving competition among HEIs to achieve sustainable campuses. Thakur [45] stated that the field of higher education is experiencing a period of global rivalry, largely due to the influence of university ranking systems. While there are numerous well-established global university ranking systems, there is only one global ranking system specifically dedicated to campus sustainability: the GreenMetric World University Ranking [46]. This ranking focuses on infrastructure, energy and climate change, waste, water, transportation and education and research. Additionally, the Times Higher Education Impact Rankings stand apart as an exclusive global performance table evaluating universities' adherence to the United Nations' SDGs. The University of Bahrain ranks in the 201–300 range in the 2021 Times Higher Education Impact Rankings, addressing SDGs 5, 8, 16 and 17, as seen in Figure 5 [47]. With regard to the GreenMetric 2023 Rankings, it holds position 384

globally, as illustrated in Figure 6, and ranks first in the country (Figure 7) [48,49]. Despite the University of Bahrain being mentioned in the rankings, the specific campus that is being referred to is ambiguous, due to its two locations: Sakhir and Isa Town. This research primarily focuses on the Isa Town campus.

Figure 5. The Times Higher Education impact rankings 2021 [47].

Rank 2023	University	Country	Total Score	Setting & Infrastructure	Energy & Climate Change	Waste	Water	Transportation	Education & Research
384	University of Bahrain	Bahrain	6885	1275	950	1050	900	910	1800

Figure 6. GreenMetric overall rankings 2023 [48].

Ranking	University	Country	Total Score	Setting and Infrastructure	Energy and Climate Change	Waste	Water	Transportation	Education
1	University of Bahrain	Bahrain	6885	1275	950	1050	900	910	1800
2	Applied Science University	Bahrain	6625	900	1425	1200	700	1325	1075
3	Gulf University	Bahrain	4565	830	1175	525	250	510	1275

Figure 7. GreenMetric rankings by country 2023: Bahrain [49].

3. Method

3.1. Observations to Examine the Current Situation of the Campus

Given the crucial role that universities play in addressing climate change mitigation and achieving the SDGs, it is imperative to assess the existing physical state of the campus to determine whether or not it offers occupants opportunities to actively participate in pro-environmental behaviour. This was achieved in this case using observations, through the systematic documentation of its indoor and outdoor spaces, followed by an analysis using the PSBE model. The method was chosen based on its strong alignment with the defined objectives and its inherent logical and critical characteristics. As a result, it emerged as the most appropriate approach with which to thoroughly examine and evaluate the current situation of the campus. The research team conducted campus visits in December 2023, during which they took approximately 100 photographs. The photographs captured different opportunities for pro-environmental behaviours, such as light switches, recycling bins and informational posters promoting environmental awareness. As this study is primarily concerned with the role of the situational context in impacting pro-environmental behaviours (PEBs), the major independent variables of concern are the "prime", "permit" and "invite" domains of the PSBE model. To assess the different spaces within each building, the PSBE model was employed as a scoring guide, with identifiable characteristics based on Hamilton's work, as illustrated in Table 2.

Table 2. PSBE model—building characteristic scoring guide [27], adapted by authors. Reprinted with permission from 2021, Erin. M. Hamilton, License No. [5734790244703].

PSBE Domain	0—None	1—Low	2—Medium	3—High
PERMIT	No action available	Only one way to engage in PEB	Two PEBs available	Three or more PEBs available
Energy Water Materials Travel	Light switches—multiple switches for areas of the room; manual override for motion-activated lights; dimmers; multiple levels of lighting and adjustability; adjustable thermal comfort conditions (thermostat or window units); window-shading devices; operable windows Manual taps turn on/off; dual-flush toilets; adjustable water settings on washers/instruments Rubbish/recycling/compost bins; multi-sort recycling versus single-sort; water bottle filling stations; places to gather donated items for reuse Bike racks; pedestrian paths; bus stops; perceivable proximity to amenities			
INVITE	No attempt to shape behaviour	Only one strategy implemented	Two strategies implemented	Three or more strategies implemented
Energy Water Materials Travel	Energy dashboard (provides feedback in form of declarative information); prompts to turn off lights Posted signage to turn off water while washing hands (prompts); information about dual-flush toilets Number of bottles saved from landfill on water bottle fillers; posted signage: "Using hand dryer saves X trees per use" (effectiveness information connects behaviour to environmental outcome) Covered bike racks outside; posted bus schedules (procedural information); ride-share signage (procedural information and social norms); bike station (situational convenience, procedural information)			
PRIME	None	Low	Medium	High
Sustainable Ethos and Information Attentional Capacity	Natural materials; mixture of materials; natural motifs; natural features (indoor plants, water features, etc.); recycled or repurposed materials/finishes; providing declarative information about the sustainability of a feature Windows/views to outdoors; views of nature; places for reflection (walking paths, etc.); natural light			

Specifically, the "permit" and "invite" aspects were evaluated for seven spaces in each building, considering behaviour categories such as energy, water, materials and travel. However, when assessing the "prime" domain, a holistic approach was taken, rather than evaluating it based on behaviour categories. The "prime" domain focuses on creating conditions that encourage individuals to engage in pro-environmental behaviours, and its characteristics are not regarded as specifically priming behaviour in a single behaviour category. Each space was evaluated using a rating scale ranging from 0 to 3 for each of the three PSBE domains. In the "permit" and "invite" domains, the numerical values on the scale represented a quantitative assessment of the number of features identified within each behaviour category. In contrast, the score assigned to the "prime" domain reflected a qualitative assessment (none, low, medium, high) of the observable characteristics depicted in the images. The scoring sheet, as illustrated in Figure 8, provides a visual representation of this evaluation process. A scoring sheet was completed for each building, with certain buildings like the library, mosque and course-specific laboratories being excluded due to their specific functionalities. Interestingly, it was discovered that all the buildings within the University of Bahrain had similar scores, indicating comparable performance across the board. The buildings at Bahrain Polytechnic also received identical scores, suggesting consistency in their characteristics and features. Due to the presence of duplicates among the buildings associated with Bahrain Polytechnic and the University of Bahrain, the individual scoring sheets for each building became insignificant. As a result, the overall assessment of the campus's existing state could be effectively captured by utilising just two scoring sheets.

	Energy		Water		Materials/Waste		Travel		PRIME
	PERMIT	INVITE	PERMIT	INVITE	PERMIT	INVITE	PERMIT	INVITE	
Public Spaces									
Building Exterior/Surroundings									
Main Enrance/Lobby Interior									
Semi-Public/Private Spaces									
Hallways									
Bathrooms									
Classrooms									
Office									
Kitchen									

Figure 8. Building characteristics scoring sheet—scores from each domain per space were recorded, and one scoring sheet was completed for each building [27]. Reprinted with permission from 2021, Erin. M. Hamilton, License No. [5734790244703].

In general, the buildings affiliated with Bahrain Polytechnic achieved higher scores compared to the buildings of the University of Bahrain. This difference can be attributed to the presence of additional elements in the Polytechnic's buildings that were not found in the University of Bahrain's buildings. These additional features included dual-flush toilets and multi-sort recycling bins, related to the "permit" domain of the PSBE model, and posters promoting digital movement and discouraging paper waste through printing, related to the "invite" domain (Figure 9). These extra items contributed to the higher overall score attained by the Polytechnic's buildings.

Figure 9. Water fountains to allow occupants to perform pro-environmental behaviours through saving water and filling up their water bottles; multi-sort recycling bins and poster discouraging paper waste at Bahrain Polytechnic (photos by authors).

Both Bahrain Polytechnic and the University of Bahrain's buildings offered additional opportunities that promoted pro-environmental behaviour. These opportunities primarily fell within the "permit" domain and encompassed features such as light switches, adjustable thermostats to regulate the thermal conditions, shading devices, operable windows, manual water taps, rubbish bins and water stations (Figure 9). Furthermore, several features were associated with the "prime" domain, including natural elements like indoor plants, views of the outdoors and nature, ample natural light and designated spaces for reflection (Figure 10). These features collectively contributed to creating an environment that encouraged sustainable practices and fostered a connection with the natural world.

Figure 10. Restorative natural views and natural light, priming occupants for pro-environmental behaviour through restorativeness (photos by authors).

Based on the observations and photographs captured during visits to the Isa Town campus, it is evident that there are several opportunities to promote pro-environmental behaviour across all three domains of Hamilton's PSBE model. The presence of restorative views and natural lighting primes and prepares occupants to engage in pro-environmental behaviours. Furthermore, various elements within the campus permit the performance of such behaviours, including the availability of water fountains to conserve water, light switches to save energy and multi-waste bins for recycling. However, there are certain areas that need improvement. The travel category appears to be weak, with a limited number of bus stops and a lack of bike racks. Additionally, the "invite" domain is inadequate, as there is only one poster discouraging printing and paper waste throughout the entire campus. Moreover, there is a noticeable imbalance in the distribution of building characteristics and features that could enhance pro-environmental behaviour between the Bahrain Polytechnic and the University of Bahrain buildings. This disparity should be addressed in order to achieve a greener campus that actively promotes sustainability.

3.2. Questionnaire to Assess User Awareness, Pro-Environmental Behaviour and Related Factors

A questionnaire was distributed at the shared Isa Town campus in December 2023, to assess users' pro-environmental behaviours and the perception and awareness of environmental concerns, and to outline the factors influencing pro-environmental behaviour. The method was chosen due to its ability to yield a comprehensive wealth of information, encompassing demographic characteristics, behavioural habits and attitudes, across a substantial sample size and within a relatively short timeframe. The Isa Town campus is shared by two universities, so the questionnaire was distributed online via Google Forms to students and faculty members from both universities. A total of 261 questionnaires were collected, but 37 were excluded due to incomplete responses. Ultimately, 224 valid responses were included in the subsequent statistical analysis.

Table 3 presents the demographics in more detail. Out of the 224 participants, 32.6 identified as male and 67.4 as female. In terms of age, 61.6% of the participants belonged to the 18–25 age group, 30.8% belonged to the 26–45 age group, 7.1% belonged to the 46–64 age group and only 0.5% belonged to the over 65 age group. With regard to the different occupations, the majority—68.8%—were University of Bahrain students, 6.2% were Bahrain Polytechnic students, 21% were University of Bahrain faculty members and 4% were faculty members at Bahrain Polytechnic. In terms of their family background, only 7.6% had between one and two family members, 40.6% had between three and four members and 51.8% had more than five members in their family household.

Table 3. Demographics.

Variable	Category	n	%
Gender	Male	73	32.6
	Female	151	67.4
Age Group	18–25	138	61.6
	26–45	69	30.8
	46–64	16	7.1
	65+	1	0.5
Occupation	UOB Student	154	68.8
	Bahrain Polytechnic Student	14	6.2
	UOB Staff	47	21
	Bahrain Polytechnic Staff	9	4
Family Members	1–2	17	7.6
	3–4	91	40.6
	5+	116	51.8

To evaluate the level of awareness among users, an assessment using a five-point Likert scale was conducted among students and faculty members regarding their general knowledge of environmental issues (see Table 4). The findings revealed that the majority (54%) reported a rating of 4 out of 5, with a mean of 3.9 and SD of 0.8, indicating a sufficient understanding of the topic. Only a small proportion of participants (22.3%) believed that the recycling facilities at the Isa Town campus were adequate, while the majority (72.8%) claimed to have no knowledge of any environmental initiatives happening on campus. Furthermore, nearly half of the participants (47.8%) recognised the significant impact of pro-environmental behaviours on addressing environmental challenges, scoring a mean of 4.8 with an SD of 0.87 on a five-point Likert scale.

Table 4. Assessing awareness, pro-environmental behaviour and related factors encouraging and preventing pro-environmental behaviours.

No.	Question	Possible Response	n	%	Mean	SD
Pro-Environmental Behaviour						
1	How often do you actively recycle your plastic?	4—Always	105	46.9	3.04	1.06
		3—Sometimes	49	21.9		
		2—Rarely	44	19.6		
		1—Never	26	11.6		
2	How often do you turn off lights and appliances when not in use?	5—Always	186	83	4.77	0.58
		4—Often	29	12.9		
		3—Sometimes	6	2.7		
		2—Rarely	2	0.9		
		1—Never	1	0.5		
3	What transportation method do you use when coming to campus?	Walking	6	2.7	-	-
		Car	188	83.9		
		Bicycle	2	0.9		
		Bus	27	12.1		
		Taxi	1	0.4		
4	How often do you practise water-conservation methods?	5—Always	191	85.2	4.79	0.58
		4—Often	27	12.1		
		3—Sometimes	2	0.9		
		2—Rarely	2	0.9		
		1—Never	2	0.0		

Table 4. *Cont.*

No.	Question	Possible Response	n	%	Mean	SD
5	How often do you minimise paper usage and opt for digital alternatives?	5—Always 4—Often 3—Sometimes 2—Rarely 1—Never	127 36 25 21 14	57 16.1 11.2 9.4 6.3	4.07	1.27
	User Awareness					
6	Which of the following best describes your knowledge of environmental issues?	1 (limited) 2 3 4 5 (extensive)	2 7 50 115 50	0.9 3.1 22.3 51.4 22.3	3.90	0.80
7	Do you believe that there are sufficient recycling facilities at the Isa Town campus?	1—Yes 0—No 0.5—Not sure	50 109 65	22.3 48.7 29	0.37	0.40
8	Do you know about any environmental initiatives in Isa Town campus?	Yes No	61 163	27.2 72.8	0.27	0.45
9	Do you believe that behaviours that benefit the environment can make a significant difference in addressing environmental challenges?	1 (No, definitely not) 2 3 4 5 (Yes, definitely)	5 3 22 87 107	2.2 1.3 9.8 38.8 47.8	4.80	0.87
	Factors Encouraging and Preventing Pro-Environmental Behaviours					
10	What motivates you to participate in behaviours that benefit the environment?	Environmental concern Desire to save money Influence of friends and family Personal health and well-being Personal values and beliefs	188 168 122 140 114	83.9 75 54.5 62.5 50.8	-	-
11	What barriers prevent you from participating in behaviours that benefit the environment in Isa Town campus?	Lack of knowledge Lack of opportunities Lack of time Lack of motivation Social norms and influence	128 191 147 100 56	57.1 85.3 65.6 44.6 24.8	-	-
12	Which measures would encourage you to engage in more environmentally friendly behaviours on campus?	Educational resources Incentives Encouraging environment Stricter policies Green interventions	157 164 168 136 100	70.1 73.2 75 60.7 44.6	-	-

To assess pro-environmental behaviour, participants were asked questions related to the domains from the PBSE model: energy, water, materials and travel. The findings revealed that the majority of the participants actively engaged in pro-environmental practices. Specifically, 46.9% reported participation in recycling, 83% demonstrated a commitment to energy conservation by conserving electricity, 85.2% showed a dedication to water conservation and 57% reported a decrease in paper usage. Nevertheless, a significant proportion of the participants did not opt for environmentally friendly transportation when commuting to campus. A total of 83.9% relied on their cars, only 12.1% utilised the bus and a mere 2.7% chose to walk. The means and SDs are outlined in Table 4.

The vast majority of respondents (83.9%) cited their deep concern for the environment and the issue of climate change as their primary driving force behind their involvement in pro-environmental activities. Saving money on energy bills emerged as the second most influential factor, with a significant 75% of participants expressing this motivation. The

remaining factors, namely the influence of family and friends (54.5%), personal health and well-being (62.5%) and personal values and beliefs (50.8%), showed a relatively balanced distribution among the participants. In terms of barriers preventing pro-environmental behaviours, a lack of environmentally friendly options or opportunities on campus (85.3%) emerged as the top barrier. A lack of time to engage in pro-environmental behaviours (65.6%) and a lack of knowledge about pro-environmental practices (57.1%) were also significant barriers. Only 24.8% stated that social norms and peer influences negatively impacted their pro-environmental behaviours. Participants also reported that the provision of educational resources and incentives for pro-environmental actions would encourage them to participate in more pro-environmental behaviours.

4. Discussion

4.1. Factors Affecting Pro-Environmental Behaviours

To determine the associations between age, gender, family background and occupation, and their effects on pro-environmental behaviours such as recycling, turning off lights and appliances, using greener transportation, water-conservation methods and minimising paper use, a data analysis was conducted using the Statistical Package for Social Sciences (SPSS version 29.0 for Windows) and the Statistical Package from Excel 2016 (Microsoft Corporation).

Given the continuous nature of the dependent variable and the presence of multiple independent variables, a multinominal logistic regression analysis was conducted with a 95% confidence level. The results of the value inflation factors (VIF) show no evidence of multicollinearity in the dataset. The omnibus tests of the model coefficients are as follows: recycling plastic (chi-square = 39.6, df = 12, $p < 0.001$); turning off lights (chi-square = 45.4, df = 16, $p < 0.001$); transportation (chi-square = 43.8, df = 16, $p < 0.001$); water conservation (chi-square = 45.4, df = 16, $p < 0.001$); and minimising paper use (chi-square = 28.8, df = 16, $p < 0.001$). These indicate that the models are statistically significant. Table 5 outlines the associations between socioeconomic factors and specific pro-environmental behaviours.

Table 5. Independent associations between socioeconomic factors and pro-environmental behaviour.

		Coefficient	Std. Error	Wald	*p* Value
Recycling Plastic (reference category is always—once a day)					
Never	Age	−0.375	0.523	0.513	0.474
	Occupation	0.044	0.356	0.015	0.902
	Family Members	0.438	0.370	1.401	0.237
	Gender	1.090	0.592	3.398	0.065
Rarely—once a year	Age	−1.217	0.561	4.711	0.030
	Occupation	0.168	0.343	0.239	0.625
	Family Members	1.110	0.357	9.680	0.002
	Gender	0.135	0.428	0.099	0.752
Sometimes—once a month	Age	−0.871	0.445	3.832	0.050
	Occupation	0.412	0.276	2.228	0.136
	Family Members	0.913	0.322	8.042	0.005
	Gender	−0.008	0.391	0.000	0.984
Turning Off Lights (reference category is always—once a day)					
Never	Age	19.59	3182	0.000	0.995
	Occupation	−18.42	2892	0.000	0.096
	Family Members	17.51	0.000	1.402	0.089
	Gender	1.512	0.000	3.245	0.095

Table 5. *Cont.*

		Coefficient	Std. Error	Wald	*p* Value
Rarely—once a year	Age	−16.039	2951	0.000	0.996
	Occupation	−14.924	2327	0.000	0.995
	Family Members	0.398	0.837	0.225	0.635
	Gender	−18.961	3457	0.000	0.996
Sometimes—once a month	Age	−1.774	0.929	3.643	0.056
	Occupation	0.952	0.434	4.821	0.028
	Family Members	−0.792	0.436	3.305	0.069
	Gender	0.078	0.643	0.015	0.904
Often—once a week	Age	0.041	0.303	0.018	0.893
	Occupation	0.177	0.201	0.780	0.377
	Family Members	−0.163	0.235	0.479	0.489
	Gender	−0.554	0.297	3.494	0.062
Transportation (reference category is car)					
Walking	Age	−0.561	0.695	0.651	0.420
	Occupation	0.388	0.380	1.042	0.307
	Family Members	−1.354	0.463	8.544	0.003
	Gender	−1.097	0.638	2.956	0.086
Bicycle	Age	1.370	1.003	1.868	0.172
	Occupation	−0.383	0.755	0.258	0.612
	Family Members	−1.198	0.802	2.233	0.135
	Gender	17.417	0.000	0.000	0.153
Bus	Age	1.001	0.324	8.536	0.003
	Occupation	−0.884	0.270	9.540	0.002
	Family Members	−0.903	0.246	10.69	0.001
	Gender	0.435	0.349	0.144	0.704
Taxi	Age	0.880	1.105	0.634	0.426
	Occupation	−0.120	0.861	0.019	0.889
	Family Members	−0.609	1.270	0.230	0.632
	Gender	−17.571	3698	0.000	0.996
Water Conservation (reference category is always—once a day)					
Never	Age	1.316	0.894	2.165	0.141
	Occupation	0.329	0.729	0.204	0.652
	Family Members	0.787	1.007	0.611	0.434
	Gender	−0.890	1.062	0.703	0.402
Rarely—once a year	Age	−15.69	2697	0.000	0.995
	Occupation	−14.19	2096	0.000	0.995
	Family Members	0.131	0.815	0.026	0.872
	Gender	−1.158	1.045	1.228	0.268
Sometimes—once a month	Age	−15.19	2044	0.000	0.994
	Occupation	−12.54	1597	0.000	0.994
	Family Members	−1.194	0.658	3.295	0.069
	Gender	16.53	0.000	0.000	0.068
Often—once a week	Age	0.359	0.335	1.149	0.284
	Occupation	−0.356	0.241	2.173	0.140
	Family Members	0.544	0.273	3.967	0.046
	Gender	−0.768	0.311	6.077	0.014
Minimising Paper Use (reference category is always—once a day)					
Never	Age	0.017	0.674	0.001	0.980
	Occupation	−0.594	0.537	1.224	0.269
	Family Members	0.336	0.474	0.504	0.478
	Gender	0.690	0.699	0.975	0.324

Table 5. *Cont.*

		Coefficient	Std. Error	Wald	*p* Value
Rarely—once a year	Age	−3.750	1.442	6.766	0.009
	Occupation	0.781	0.567	1.896	0.168
	Family Members	0.838	0.474	3.123	0.077
	Gender	0.446	0.591	0.568	0.451
Sometimes—once a month	Age	−1.591	0.799	3.963	0.047
	Occupation	0.409	0.440	0.866	0.352
	Family Members	1.139	0.473	5.792	0.016
	Gender	0.344	0.536	0.411	0.521
Often—once a week	Age	−0.699	0.475	2.165	0.141
	Occupation	0.266	0.296	0.807	0.369
	Family Members	0.327	0.320	1.042	0.307
	Gender	0.507	0.440	1.331	0.249

Age and family background are shown as statistically significant, indicating that they have an influence on plastic recycling. Occupation and gender are shown to have an impact on turning off lights. Family background, occupation and age are also statistically significant in influencing the use of transport. Family background and gender also have an influence on water-conservation methods. Age and family background have a significant influence on minimising paper usage. This confirms the literature that demonstrates that socioeconomic factors such as gender and age have a significant influence in predicting pro-environmental behaviours.

Figures 11 and 12 highlight the barriers and motivators of pro-environmental behaviour at the Isa Town campus. Participants between the ages of 18 and 25 reported a lack of time as the top barrier preventing them from actively engaging in pro-environmental behaviours, and personal values and beliefs as the top motivator. On the other hand, participants aged 25 to 45 reported a lack of motivation or interest as a significant barrier, and having a concern for the environment and climate change as the top motivator. The results also differed for those aged 46 to 64. Their main barrier was similar to those aged 26 to 46, which was a lack of motivation or interest; however, the top motivator was the desire to save money on energy bills.

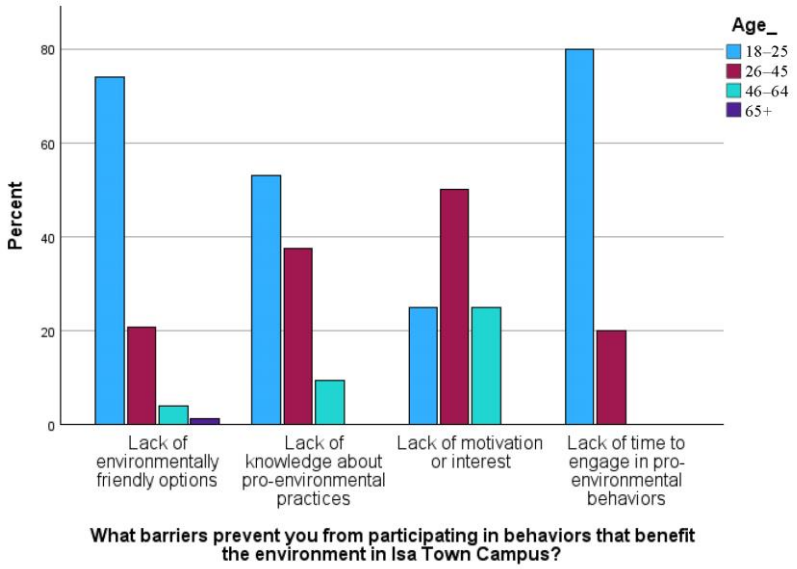

Figure 11. Barriers to pro-environmental behaviours at Isa Town campus.

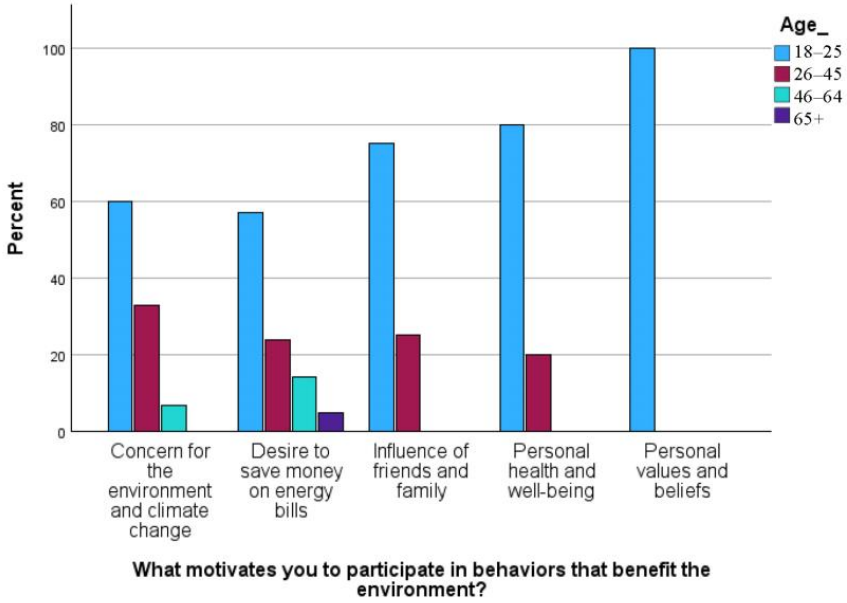

Figure 12. Motivators of pro-environmental behaviour at Isa Town campus.

4.2. Proposed Framework for a Greener Campus

Based on the insights gathered from the campus observations, questionnaires, Kollmuss and Agyeman's model of pro-environmental behaviour, the VOSviewer analysis findings, *The Nine Elements of a Sustainable Campus* and Hamilton's PBSE model, a framework was formulated to promote a greener Isa Town campus. Figure 13 shows the proposed framework.

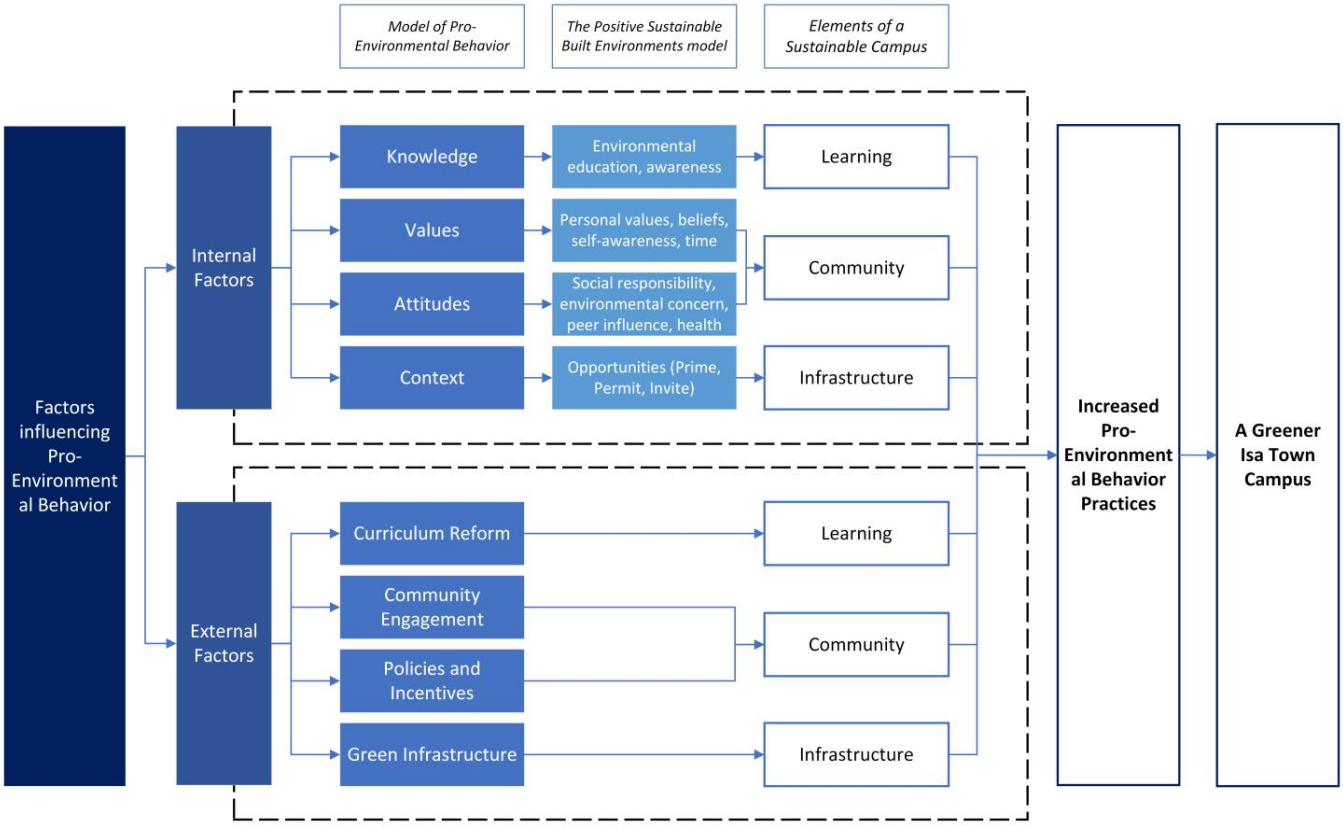

Figure 13. Proposed framework for a greener Isa Town campus.

The framework emphasises both internal and external factors that contribute to the promotion of pro-environmental practices within the campus. Enhancing environmental education and awareness, fostering a community that values social responsibility and environmental ethics and establishing a sustainable built environment that encourages and facilitates pro-environmental behaviour are key elements in achieving a more environmentally sustainable campus. While individual behaviour on campus is crucial, the responsibility for greening the campus extends to the university at a higher level. External factors, such as curriculum reform, community engagement, the reinforcement of policies and incentives and the implementation of green infrastructure, also play a significant role in the campus greening process, surpassing the control of individuals. The collective efforts of the university campus community should be oriented towards the shared objective of achieving a greener Isa Town campus. Internal factors will exert an influence on external factors, effectively nurturing a community that embraces pro-environmental practices and driving the achievement of a greener Isa Town campus.

4.3. Sustainable Interventions towards a Greener Isa Town Campus

Expanding on the proposed framework, the implementation of sustainable interventions in both the community and infrastructure areas of a sustainable campus presents opportunities to promote pro-environmental behaviours and facilitate the transition towards a greener Isa Town campus. These interventions are classified according to the three domains of the PSBE model and are strategically placed across the campus, as depicted in Figure 14.

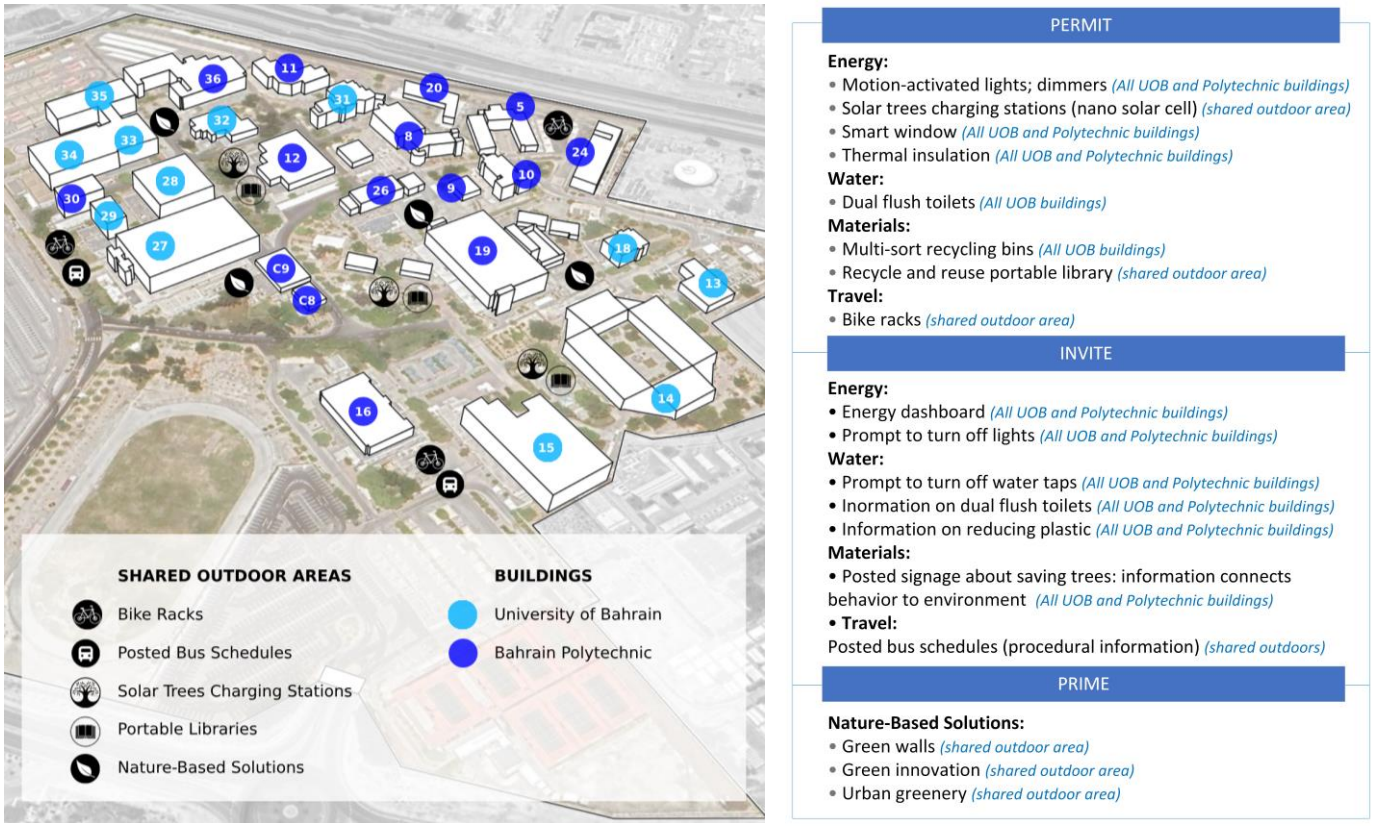

Figure 14. Sustainable interventions towards a greener Isa Town campus.

To reduce energy usage, we propose the installation of motion-activated lights and sensors; Solarban solar control low-e glass, to control solar gains and minimise cooling costs; a 10-mm-thick ThermablokSP aerogel insulation blanket, to reduce energy losses by increasing the insulation factor by up to 67%; and solar tree charging stations, using

nanosolar utility panels [50]. Installing dual-flush toilets in all buildings will reduce water usage, and placing multi-sort recycling bins and portable library kiosks with recycled books in and between buildings will encourage the community to recycle and reuse. This addresses the findings from the questionnaire with regard to the need to increase the opportunities for pro-environmental behaviours. Placing bike racks in strategic locations throughout the campus could encourage cycling among students and faculty, as there are currently none available on campus.

In terms of the "invite" domain of the PSBE model, displaying different prompts to turn off lights and taps and providing information about dual-flush toilets, reducing plastic and saving trees can connect behaviour to environmental outcomes, increasing pro-environmental behaviour [27]. Additionally, the installation of an energy dashboard that offers real-time feedback to users can serve as a catalyst in promoting sustainable behaviour. Displaying bus schedules could also encourage individuals to utilise the bus as a means of transportation. To enhance the green infrastructure as related to the external factors, we propose the introduction of nature-based solutions [51], including green walls [38], cool roofs [52] and green spaces throughout the campus, to support environmentally responsible behaviour [27]. The implementation of these interventions will foster pro-environmental behaviours, resulting in a greener, more sustainable campus environment.

5. Conclusions

This study evaluated the current pro-environmental behaviours of students and faculty members and identified key factors that influence pro-environmental behaviour at the Isa Town campus. The findings of the study, including the literature review and findings from the observational studies and questionnaire, facilitated the development of a framework aimed at promoting pro-environmental behaviour for a more environmentally sustainable campus. Furthermore, sustainable interventions have been identified and strategically distributed across the campus to enhance its sustainability and encourage pro-environmental behaviour, considering the uneven distribution of these elements among buildings. Given its potential contributions to national and societal well-being, the translational nature of this study could be extended to other universities to deepen the understanding and perspectives of diverse communities within the higher education domain. The outcomes of this study offer significant insights to stakeholders and decision-makers in higher education, particularly within the Ministry of Education in Bahrain. These insights can inform and guide the implementation of green initiatives at a policy level. Additionally, the findings from this research provide decision-makers with valuable insights and a clear roadmap for the transformation of the Isa Town campus into an environmentally sustainable institution.

The study was constrained by the absence of empirical data to directly measure the emissions and energy consumption of various campus buildings, due to the unavailability of appropriate instruments. Future research could focus on addressing this limitation to identify buildings that require targeted interventions based on their usage and function. Furthermore, the utilisation of interactive models and dynamic simulation tools could be incorporated to effectively illustrate the diverse impacts of various intervention measures on the campus.

It is also crucial to acknowledge that the literature review conducted through the use of VOSviewer had a limited scope, specifically examining keywords from papers published between 2020 and 2023. Therefore, future research should encompass a wider range of sources in order to comprehensively investigate the factors that influence pro-environmental behaviours in higher education environments.

Follow-up research involving in-depth interviews with stakeholders could also provide valuable insights into their plans regarding green initiatives on campus, including allocated budgets for implementation and the feasibility of phased implementation. This approach could explore how these stakeholders can effectively integrate the identified interventions into their existing plans and strategies.

Another limitation worth noting is the sample size, which was influenced by a lack of awareness regarding pro-environmental behaviour and environmental issues. This limitation underscores the importance of addressing this issue through curricula change, in order to enhance the awareness and understanding among individuals towards a greener campus. Further research could address bottom-up approaches and participatory measures.

Despite these limitations, the study's findings and proposed interventions hold great significance, particularly in light of the urgent need for human responses to the complex and evolving global climate challenges.

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