Article

A Zero-Waste Campus Framework: Perceptions and Practices of University Campus Community in Malaysia

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Abstract: This paper will explore the university campus community's perspective towards the realization of a zero-waste campus. A qualitative approach is employed to identify the factors influencing the campus community's awareness and participation in solid waste management (SWM). Perceptions, attitudes, beliefs, opinions, and ideas of Universiti Sains Malaysia (USM) campus community members are explored in focus group discussions (FGD) to determine the main factors influencing their zero-waste pro-environmental behaviour (PEB). The in-depth interview (IDI) is used to learn more about the university campus community's perspectives on the themes defined by the FGD. The instruments were developed based on the adaption and adoption of previous studies, especially in reference to Kollmuss and Agyeman's 2002 Model of Pro-Environmental Behaviour and a modified Knowledge-Attitude-Practices model. The findings show that environmental goals, environmental education, personal waste-related experience, environmental policy, environmental self-awareness, reinforcement contingencies, community engagement, social responsibilities, exemplary leadership, and social media influence the campus community's zero-waste PEB. A framework based on an adaptation of Kollmuss and Agyeman's model of pro-environmental behaviour is proposed to promote sustainable pro-environmental behaviour towards a Zero-Waste Campus.

Keywords: pro-environmental behaviour; zero-waste campus; waste minimisation; social media; persuasive technology

1. Introduction

Lifestyle changes, particularly in urban areas, have resulted in a severe municipal solid waste (MSW) problem. The waste generation rate caused by urbanisation is outpacing the rate of urbanisation itself [1]. Human activities such as industry, construction, commerce, the service and domestic sectors, and individual households generate waste continuously [2]. Unsustainable waste management significantly impacts residents in developing countries, particularly the urban poor, more than those in developed countries. Due to rapid population growth and urbanisation, annual waste generation is expected to increase by 73% from 2020 to 3.88 billion tonnes in 2050 [3], making waste collection and landfill procurement harder [1]. According to the Malaysian Investment Development Authority [4], Malaysia's rising population of 32.8 million people in 2021 generates a massive amount of solid waste, estimated to be 38,427 metric tonnes per day (1.17 kg/capita/day), of which 82.5% is disposed of in landfills. Following the most recent data, Malaysia's population increased by 0.3% in the third quarter of 2022 to 32.9 million, according to the Department of Statistics Malaysia [5]. This number will impact the total amount of MSW collected based on the pattern established the previous year. Furthermore, it has been reported that more than 200,000 tonnes of MSW have been produced monthly since the

first movement control order (MCO) from March 2020 to March 2021, with food and the plastic waste being the two top contributors to landfills [6]. Meanwhile, the Solid Waste Corporation (SWCorp) reported that the recycling rate achieved in 2020 is 30.67%, which is lower than the rates achieved in other developed countries such as Singapore (59%), Korea (49%), and Taiwan (60 per cent) [7]. The figures are concerning, and the situation will worsen if nothing is done to address the problems.

The Ministry of Housing and Local Government in Malaysia established the Department of National Solid Waste Management (*Jabatan Pengurusan Sisa Pepejal Negara*—JPSPN) to standardise and enhance waste management [8]. The establishment of JPSPN is one of the catalysts for the government to achieve the National Green Agenda's recycling rate target of 40% by 2025. JPSPN is responsible for solid waste management under Act 672 of 2007, Solid Waste Management and Public Cleansing. This act has been in force since 1 September 2011 [4]. However, these efforts faced challenges such as limited financing, low staff technical capacity, and ambiguity in the policy's guidelines [1]. Furthermore, the act was only adopted by the Federal Territories of Kuala Lumpur and Putrajaya, Pahang, Negeri Sembilan, Melaka, Johor, Kedah, and Perlis. Meanwhile, the respective State Governments handle the waste management of other states in Malaysia, i.e., Perak, Pulau Pinang, Kelantan, Selangor, Sabah, and Sarawak.

In addition to these challenges, the MSW problem is one of the many environmental problems that is affected by human behaviours [9,10]. Environmental quality is highly dependent on patterns of human behaviour, and changing the appropriate behaviour may reduce environmental impacts [11]. Food waste accounts for 32% of total waste in Malaysia, followed by plastic waste at 21%, and plastics at 14% [12]. There are 17,000 tonnes of daily food waste, of which 4005 tonnes, or 24%, are still edible or easily avoidable [13]. These food scraps are discarded and added to the already crowded landfills. Food waste prevention at the consumer level is critical. Thus, changes in human behaviour are believed to improve the waste problem. Promoting behaviour change is more effective if it is systematically planned, implemented, and evaluated [14]. Therefore, environmental education is viewed as a requirement in fostering positive attitudes towards environments [15]. The goal of environmental education is to create a society that is environmentally conscious and has the knowledge, skills, attitudes, motivations, and commitment to work towards solutions for the current problems and prevention for the new ones [16].

Thus, Malaysian universities are considered the ideal setting for promoting PEB, especially to overcome the MSW problems. This paper will explore the Universiti Sains Malaysia (USM) campus community's perspective on MSW issues. The objective of this paper is as follows:

i.   Investigate the main factors that influence the pro-environmental behaviour towards a zero-waste campus;
ii.   Determine the relevant factors in shaping a community's sustainable pro-environmental behaviour towards a zero-waste campus;
iii. Propose a theoretical framework to help promote environmental sustainability via sustainable pro-environmental behaviour towards a zero-waste campus.

The paper is divided into three sections after the introduction: the literature review, the results and findings, and the conclusions. The first section of the literature review examines existing zero-waste strategies at four Malaysian research universities: Universiti Kebangsaan Malaysia (UKM), Universiti Malaya (UM), Universiti Putra Malaysia (UPM), and Universiti Sains Malaysia (USM). The PEB model is explained in the following section, and the third section of the literature review focuses on the KAP model and how it was modified to fit the study. The findings and results will be divided into three categories: methodology and findings from focus group discussions (FGD), methodology and findings from in-depth interviews (IDI), and the proposed framework. Finally, in conclusion, limitations and future recommendations will be made.

2. Literature Review

2.1. Mapping Improvements with Existing Zero-Waste Strategies in Universities in Malaysia

Universities have diverse organisational cultures that value and promote learning. Thus, they can play an essential role in educating new generations of citizens and leaders [17]. Additionally, university campuses can be viewed as small cities for their extensive coverage, population size, and numerous complex activities, which may or may not impact the environment [18]. Thus, solving the MSW problems on the campus grounds could be applicable and adopted by the government at the national level to devise suitable strategies to enhance public awareness and participation in promoting PEB towards a zero-waste goal. On a negative note, Malaysian universities are claimed to contribute to solid waste generation in the country [19]. Therefore, it is important to study why this occurs by examining and comprehending the university campus community's perspective on the matter.

In mapping improvement with zero-waste strategies, it is essential to know what contributes to the university campus's waste products and how zero-waste strategies can be practically implemented. It is stated that food waste contributed the most to the waste accumulation on UKM's campus, followed by papers and plastic each from dormitories, faculties, students' affairs, and offices [20]. Abdul Hamid et al. [21] supported UPM's finding. While Ong et al. [22] showed that food waste made up the most significant MSW component at USM.

The zero-waste hierarchy by Zero Waste International Alliance [23] describes a progression of policies and strategies to support the zero-waste strategies, from the most preferred option to the least preferred option. The hierarchy is designed to be applicable to everyone, from policymakers to industry and the individual. It provides more depth to the 3Rs (Reduce, Reuse, Recycle) concept to encourage policy, activity, and investment at the top of the hierarchy; it also provides a guide for those who wish to develop systems or products promoting zero-waste. It enhances the zero-waste definition by guiding planning and a way to evaluate proposed solutions. Therefore, it is applicable to be referred to in efforts towards creating a zero-waste campus. This study will focus on waste minimisation at source (reduce), waste recycling, and waste separation, which fall in between the most preferred option and least preferred option of the hierarchy. These three options were chosen because they are suitable for a university setting. It is expected that strengthening these three options would accelerate the effort toward a zero-waste campus.

The zero-waste campus initiatives had been introduced in several public universities in Malaysia. These initiatives are the continuation of sustainability programmes [24]. UKM, UPM, UM, and especially USM aim to promote sustainability among their community through education and research activities [25]. In UKM, this programme has been developed with the aims of (1) reducing waste produce; (2) increasing and sustaining involvement in recycling and composting schemes, (3) raising and maintaining awareness of waste issues; (4) promoting the waste hierarchy (reduce, reuse, recycle); (5) providing a diverse range of ways of increasing education and awareness; (6) giving a consistent message; and (7) linking in with regional and national campaigns [26]. Similarly, Sumiami Yusoff [27] said that UM also initiated their zero-waste campaign known as University of Malaya Eco Campus Blueprint. It is a sign of commitment towards campus sustainability performance and improvement where the zero-waste campaign is one of the university's most consistent. This long-term campaign aimed to achieve an integrated waste management model and ultimately a zero-waste campus through several projects such as the Green Bag Scheme, an in-house composting centre, an anaerobic digestion project, a recycling collection system, a composting emission study, and others.

UPM had launched its zero-waste campus programme on 29 June 2019, focusing on the concept of reduce (take less), reuse (use responsibly), recycle (add back) and repair (make better). This initiative is to support the government's efforts and maintaining UPM's status as a green campus. Among the main highlights are zero use of plastic-polystyrene materials and collaborative works for environmental protection [28]. In the year 2000, USM has begun adopting education for sustainable development (ESD) and a "University as

a Living Lab" approach through the concept of *Kampus Sejahtera* (Campus Well-being) and University in a Garden. USM aims at promoting sustainability among the campus community through education and research activities [25]. Since 2002, *Kampus Sejahtera* has been working with the School of Communication to raise awareness of recycling and had managed to divert a large amount of waste from ending up in the landfill. Sadly, the effort is not consistently pursued. Eventually, paper-based waste and plastic are still being sent to landfills [29]. To overcome this problem, USM's Centre for Global Sustainability Studies (CGSS) has been established in 2009 to act as an intermediary to assist the university in mainstreaming sustainability within the campus. The CGSS has planned to collaborate with all related parts of universities, regional and international sustainability organisations, national and regional governments, the private sector, civil society organisations, and NGOs to support sustainable development [25]. The zero-waste concept has been the USM goal to educate and encourage the USM community to emulate recycling that allows all waste to become sources for other uses [30]. *Sekretariat Kampus Sejahtera* (Campus Well-being Secretariat; SKS) is one of the leading USM platforms to instil volunteerism in students and support sustainability-related activities on campus. Waste management is one of the six clusters of SKS. This secretariat will guide the USM students' commitment and responsibility towards campus sustainability through self-initiatives, proactive teamwork, and volunteerism. In the year 2008, 'White Coffin' (Styrofoam food containers) and 'Say No to Plastic' were a hugely successful campaign that has spread to other universities resulting in a follow-up activity called Tapau-mania. This program encourages the campus community to bring their own reusable containers to pack food from cafeterias. It has also influenced the Penang state government to implement a 'No Plastic Bag' policy since January 2011 [31].

2.2. Understanding Pro-Environmental Behaviour

Steg and Vlek [32] state that human behaviour patterns significantly impact environmental quality. Investigating the relationship between human behaviour and the environment is critical in building a zero-waste community. PEB refers to environmental behaviour that benefits the environment or causes the least amount of harm to the environment. The earlier PEB study drew the attention of environmental psychologists, who attempted to explain and comprehend the factors that shape individual PEB [33,34]. According to Sollberger [35], two of the most influential theoretical frameworks for the explanation of PEB at the individual level are the theory of planned behaviour (TPB) [36] and the value belief-norm theory (VNB) [37].

TPB has emerged as one of the most important social psychology theories for elaborating the determinants of individual decision-making, especially in environmental science [38]. Three predictors determine a full behavioural intention in TPB. First, the individual's attitude towards the behaviour must be positive. Second, perceived social norms must support the behaviour, and third, the individual must believe in having actual control over the behaviour. Thus, the TPB explains behaviour based on factors that are unique to the behaviour under investigation. TPB has been shown to predict different PEB in the workplace [39], sustainable behaviour among young adults [40], and green consumer behaviour [41]. In a waste management study, attitudes, social norms, and self-efficacy significantly influenced attitudes toward recycling behaviour [42].

The VBN theory is a modified version of Schwartz's moral norm activation theory of altruism, which Stern et al. [37] adapted to explain PEB [35]. The VBN theory says that values affect PEB through pro-environmental beliefs and activation of personal norms. Environmental beliefs, in turn, include believing that the environment is under threat and that the individual's actions can mitigate the negative impact. This chain reaction was initiated by self-transcendent values such as altruism, egoism, and biospheric value. The VBN theory has been tested in a diverse background of environmental studies, i.e., Chung et al. [43] focussed on religious fundamentalism, Whitley [44] on cafeteria of choices, Yacob et al. [45] on green practice, and Han et al. [46] on eco-friendly behaviour.

This study is influenced by the Kollmuss and Agyeman [47] Model of Pro-Environmental Behaviour, one of the most cited papers in pro-environmental studies. This model emphasised the importance of knowledge, attitudes, value, and emotional involvement in forming the 'pro-environmental consciousnesses' complex as internal factors which work synergistically with external factors (infrastructure, politics, social, and economic). Figure 1 shows Kollmuss and Agyeman's proposed model. This model omitted habits, social desirability, personality, and character of individuals towards PEB. The model is characterised by arrows indicating the various factors influencing each other. The larger arrow represents the most significant positive influence on PEB, which happens when internal and external factors work synergistically. Some of the most significant barriers are identified and represented by the black boxes in the model. The proposed zero-waste campus framework will be based on an adaptation of this model that incorporates the factors identified during the FGD and IDI.
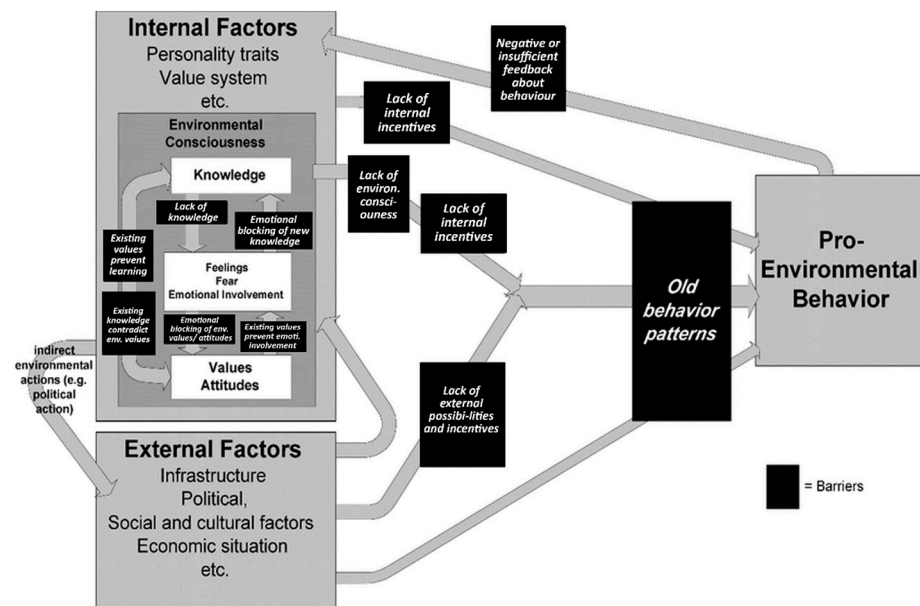

Figure 1. Kollmuss and Agyeman Model of Pro-Environmental Behaviour.

2.3. Assessing Campus Community Perspectives towards the Efforts of a Zero-Waste Campus through Modified KAP Model

The interaction of knowledge, attitudes, and practice is known as KAP Model [48]. This model was developed as a tool to investigate what is known, believed, and done by participants on a specific topic. This model aids in the development of questionnaires that target specific audiences while identifying barriers and constraints. It is also cost-effective and widely used to study human behaviour [49]. The model's development guidelines have been established in various disciplines such as study guidelines by Kaliyaperuma [50], Vandamme [51], and FAO [52] as well recommendations in survey research [53,54]. Typically, KAP questionnaires are tailored to each situation and project, and the content reflects specific knowledge, attitude, and practice values.

There are three essential identification domains in KAP surveys: Knowledge, Attitude, and Practice. In this study, knowledge refers to acquiring, retaining, and applying information combined with experience and skills gained from zero-waste education and experience. Attitude is a degree of favour or disfavour, or feelings of identifying the main factors contributing to the campus's MSW problem. While practices refer to the participant's actions towards improving the MSW problem and creating a zero-waste campus. It is a model feature that aids in understanding how knowledge relates to attitude and practice towards PEB. It also enables this study to be completed within limited financial and time constraints. Values are an affective domain of a human [55], which involve the internalisation of emotion and feeling. In this study, the KAP Model was slightly modified

to recognise the importance of value, as mentioned by Kollmuss and Agyeman [47]. In a recent study, values are an essential factor in determining PEB [56,57]. In this study, value is defined as accepting a zero-waste phenomenon or behaviour concerning worth, excellence, usefulness, or importance, where specific emotions that affect behaviour are identified. Whereas Redclift et al. [58] highlight that values are often negotiated, transitory, and contradictory.

The preceding discussion demonstrated the significance of social and human behaviour in ensuring environmental sustainability [11]. However, technological advancement is one of the main pillars of environmental protection [59] and plays an important role in sustainable environmental development [60]. Information technology advancements have explicitly changed how people work, network, and communicate. In his book, Fogg [61] described how websites, software applications, and mobile devices could be used to influence people's attitudes and behaviours. He defined this as persuasive technology, which uses persuasion and social influence rather than pressure to change attitudes or behaviours of users. According to Zheng et al. [62], technology improves motivation and self-efficacy among adult learners. While Altıok et al. [63] acknowledged that technology-assisted learning significantly improves students' metacognitive level. Malaysia has over 47 million mobile cellular subscriptions, with 141 per 100 inhabitants, according to The World Bank [64]. This statistic may benefit from Sung et al. 's [65] discovery that learners performed significantly better when using mobile devices. Thus, it is critical to investigate the roles of technology, particularly information technology, in instilling zero-waste behaviour among the campus community. According to Malik et al. [66], there is an urgent need to increase technology-related sustainability awareness among students through education. It is believed that combining appropriate human behaviour with proper technology use will result in a better solution to the solid waste issues. The conceptual framework for the modified KAP model approach is shown in Figure 2.
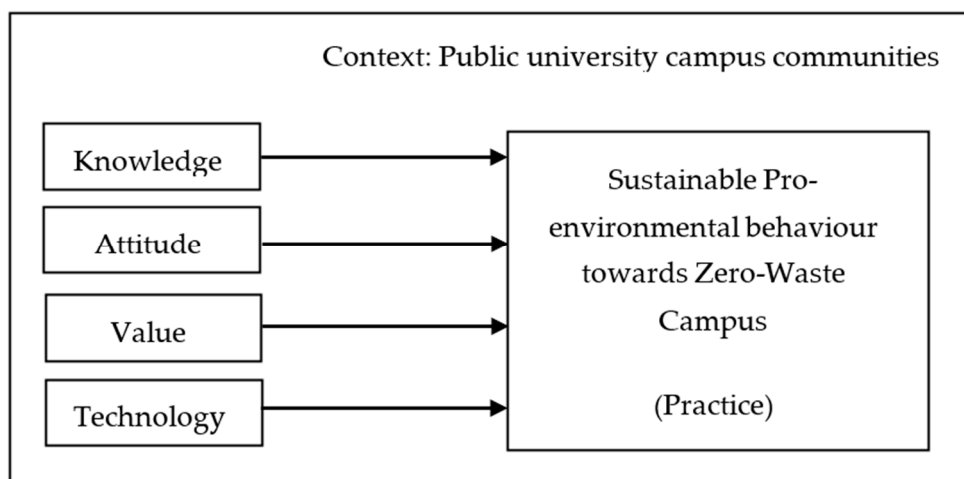

Figure 2. Conceptual framework.

This study seeks to identify the underlying perspective among the USM campus community on waste management to create a sustainable zero-waste campus. Thoughts and ideas from the members of the discussions and interviews representing the USM community provided significant insight into understanding the aspects of influencing communities' PEB. The proposed framework is hoped to be utilized to develop an environment-specific plan by university management, other institutions, or national-level agencies. It may be a learning module, a comprehensive environmental policy, governance guidelines, or a course-based programme, among other things.

3. Results and Discussion

3.1. FGD Results and Findings

The following discussion includes the findings from the FGD. The findings highlight the most mentioned issues.

In response to the prior knowledge on PEB, especially the zero-waste approach, the respondents are aware of and acknowledged zero-waste as they defined it as a goal to achieve, and it involves the process of minimising waste towards no waste at all. Furthermore, reduce, reuse, and recycle (3R), and waste segregation are stated as the mechanism used to achieve the goal.

> *"In my opinion, I feel like zero-waste is no waste at all. In step with, it is to minimise the amount of waste. The goal is to reduce the amount of waste completely."* Participant 4.

> *"Zero-waste is the goal we are trying to achieve, so 3R is the mechanism we use. The ways that we want to use. The main goal is zero waste. We try to achieve the goal, but how to do it? The way is 3R."* Participant 14.

However, there are doubts and scepticism if it is possible to be achieved.

> *"It is impossible not to have waste, right? Because we are always using it, right?"* Participant 25.

Further, the reasons and obstacles of the waste problem on the campus were addressed during the discussions. Few crosses were noted between the reasons and obstacles. It is brought to the attention that the campus implementation in practising PEB such as not using straws is not firmly stressed and implemented, for there is always an option to ask for the straws.

> *"For example, at the Desa Siswa in here, they said there is no straw, but there is still an option for the straws. So, it is hard to change the attitude. When we said no straws, it supposed to be no straw at all. There is no option there. Rules, if there is no implementation-the way to implement it must be right."* Participant 27.

The lack of facilities to practice the intended PEB, especially the 3R bins, was repeatedly mentioned by several respondents. Due to that, recyclable items will always end up in the trash bins. According to them, such facilities should be provided by university management.

> *"I think they (university management) need to provide the facilities first so that we can use the facility. Specially to provide the bins for the plastic, glass, paper. When we have that facility, we can enforce the students or staffs to use the bins."* Participant 7.

Furthermore, it is claimed that the university management's lack of campaigns contributes to the waste problem on campus.

> *"To mention student awareness on the zero-waste at this campus, I do not think the students were exposed to the zero-waste campaign."* Participant 15.

Additionally, a policy is needed to ensure the community are practicing PEB. However, policy and cost were cited as obstacles for university management to provide the facilities as making policy itself is not easy as it involved many things such as legislation. Thus, it is costly to provide the facilities and maintain the waste management itself.

> *"Because we, as the subordinate, will follow the order of the superiors. So, if there is a policy, we have already done it."* Participant 18.

> *"There is no policy yet. Because to make a policy is not easy, and it involves many things, such as legislation."* Participant 14.

Lack of awareness, weak enforcement, and "attitudes" are also cited as contributing factors to the campus waste problem. It is claimed that students and staff do not act in an environmentally friendly manner. The university management's enforcement is ineffective, mainly when it is inconsistent. At the same time, another reason and obstacle of the waste

problem on campus is caused by the human attitudes from different backgrounds of life and their nature of taking matter for granted. Three main suggestions had been mentioned on how to improve the waste problem on the campus. One of them was working on a zero-waste campaign and programme. It is suggested that it be increased, properly planned, and consistently carried out.

> *"Need to increase the number of campaigns for zero-waste and 3R awareness."* Participant 16.

> *"Need proper campaign from the top campaign to the door management, students, you know- everything."* Participant 8.

> *"I used to see there are zero-waste campaigns in USM. However, it is not continuously. It stops after a few weeks. We need to make sure the campaign is continuous."* Participant 5.

On another note, university management was suggested to impose enforcement on the campus community to encourage PEB. The policy needs to be strictly enforced. The respondents mentioned a few possible punishments that could be applied, included deducting points for the staff's continuous professional development (MyCPD), students' continuous student development (MyCSD), or even being monetarily fined. At the same time, rather than punishing, it was suggested that pro-environmental acts be rewarded to encourage the community to practice the behaviour.

> *"I want to suggest that if we do the enforcement, the policy must be approved."* Participant 11.

> *"Punishment is good to stop people from doing something."* Participant 3.

> *"Give rewards instead of fines."* Participant 1.

Furthermore, the facilities such as 3R bins need to be provided for the community to access them. Meanwhile, respondents' current zero-waste practices implied that they have been doing waste recycling, waste separation, waste reduction (3R), and supporting the no single-use plastic movement. They are reducing their use of paper, processed foods, and their overall shopping habits. These actions demonstrate that they are attempting to reduce waste at the source. They demonstrate their support by using alternative items such as their own food/drink containers and shopping bags.

> *"For me, it would be not buying any plastic bottle and saying no to the single-use plastic."* Participant 6.

> *"When we go out, I will make sure we will bring our own shopping bag."* Participant 9.

Apart from the university administration's need to provide facilities such as recycling bins, these practices are suggested to be widely applied in creating a zero-waste campus. In the meantime, ongoing campaigns are critical in instilling zero-waste behaviour in the campus community. Next, personal encouragements are seen as values that motivate people to participate actively and effectively in waste management. Self-personal awareness in the community will encourage others and themselves to participate in the zero-waste effort. It is subjective, but it is an important component in instilling PEB in a person. The community is believed to benefit from rewards such as points and monetary incentives to keep the practices going. Meanwhile, community support and trends will encourage people to join the movement.

> *"The main thing is awareness."* Participant 8.

> *"Reward is very important. Student needs money."* Participant 1.

> *"As a student, I do not want to do this alone. So, I think what I should do and what other students should do is invite friends to do it together. Yes, both support and trends."* Participant 29.

Technology is described as a tool, social agents for information dissemination, and a medium for allowing interactions to instil zero-waste behaviours. Through persuasion and social influence, technology is helping to change users' attitudes and behaviours. Because the respondents are familiar with using mobile applications, the mobile applications' roles

are discussed to support the responses on the role of technology. It is a veiled reference to the role of information technology in promoting zero-waste behaviour.

"Information on the zero-waste issue needs to be disseminated from time to time through the mass media such as television, radio, or social media platforms such as Facebook, WhatsApp, Instagram. Nowadays, most people are using them. Maybe continuance of dissemination may touch their mind." Participant 12.

It is essential to link the FGD results to the PEB theories to bring a zero-waste campus vision into reality. However, it needs to take into attention that certain points of discussion may not justify a whole community's perspectives as they are the point of view of individuals. The KAPV approach was used to study the relationship between the campus community's knowledge, attitudes, practices, and values towards a zero-waste campus's efforts and how technology, especially information technology, play a role in bridging the efforts towards achieving the goal. A study by Syed Hasan, Harun, and Lim [67] stated that the relationship between environmental knowledge and attitude among the students showed a positive correlation towards PEB. The FGD respondents showed adequate knowledge of the environmental information and understanding. Although some respondents expressed inaccurate information and facts, they were aware of the importance of the environment and engaged in PEB in their daily lives. It demonstrated that information accuracy is neither necessary nor sufficient for making decisions, and that it can be irrelevant. Instead, subjective beliefs that link behaviour of interest to positive or negative outcomes, to the normative expectations of important reference individuals or groups, and to control factors that can facilitate or inhibit the behaviour's performance are what determine intentions and actions [68]. Therefore, it is believed that the focus should be on the knowledge that encourages intentional behaviour rather than general or domain-specific knowledge, such as accurate zero-waste knowledge. Several respondents expressed their concern about practising PEB but were unsuccessful in turning their concern into action.

"I am trying to reduce the amount of paper used, but I did not manage to." Participant 4.

"I did not use straws. Unless the shop is providing it, I will use it." Participant 5.

Ahmad, Noor, and Ismail [69] found that students' attitude or concern about the environment could not be used to predict or explain the practice. However, some respondents are environmentally conscious and practice the zero-waste lifestyle.

"I am trying my best to go zero-waste. I am now transitioning from the bottled shampoo to the shampoo bar for my current zero-waste practice. I bring my own cutleries. If I have the intention to pack the food, I will bring my food container. I will bring my own water bottle. Moreover, if I want to buy something like bubble milk tea, I will bring my own bottle to the shop." Participant 19.

This demonstrates how difficult it is to comprehend the relationship between environmental attitudes and practices. Thus, different approaches are required to accommodate various individuals' unique attributes. Although attitudes are good predictors of behaviour and are relatively easy to change, they can only explain specific behaviours. According to Gatersleben, Murtagh, and Abrahamse [70], individual factors such as values, which are more resilient, may influence a broader range of behaviour. They defined values as concepts or beliefs about desirable end states or behaviours that transcend specific situations and guide the selection or evaluation of behaviour and are ranked in order of relative importance. In the FGDs, general ideas on what might entice respondents to contribute productively to create a zero-waste campus were discussed. Personal encouragements are valued as motivators for people to participate actively and effectively in waste management. It is found that personal awareness, supports, trends, and reinforcement motivate the respondents to be proactively involved in pro-environmental activities.

Technology is used for almost everything in the modern era. Today, technology plays an essential role in influencing people's communication, learning, and thinking. Even though the question was on technology in general, most participants focused on

how information could promote zero-waste PEB. However, a few mentioned the role of technology in treating the waste that had been created instead of focusing on how to use technology to stop someone from creating the waste in the first place. Therefore, technology will be further discussed during the interview focusing on how technology, specifically information technology, can be utilised to promote zero-waste PEB.

The discussion may not portray the view of the whole campus community. However, the representative, diverse views may help us understand the campus community perspective. The FGDs were carried out to identify the main factors that influence the university campus community's PEB towards the effort of a zero-waste campus. From the analysis of the qualitative data from the FGDs, nine main themes have emerged. These are the main factors that will be thoroughly studied later using IDIs and surveys. Figure 3 shows the main factors influencing USM's community campus's PEB toward a zero-waste campus effort.
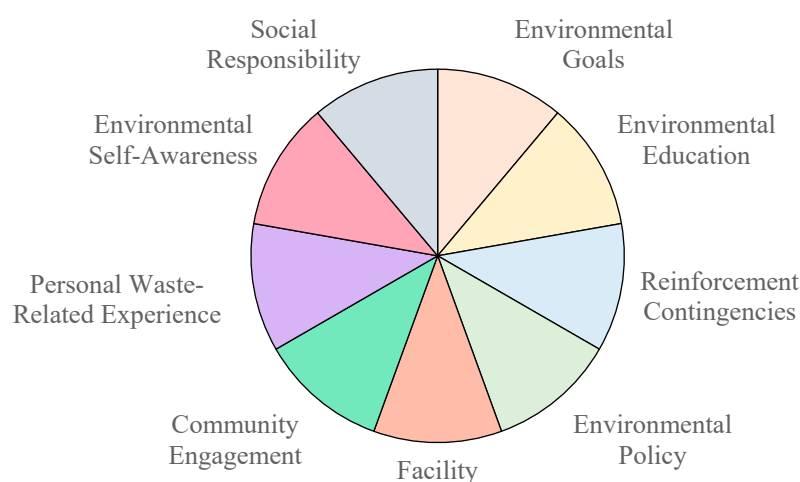

Figure 3. Main factors influencing USM's community campus' pro-environmental behaviour.

i.   Environmental Goal

The goal is defined as the cognitive representation of the desired endpoint that impacts evaluations, emotions, and behaviours [71]. Lunenburg [72] emphasises the significance of the goal-performance relationship. According to him, goals motivate people to develop strategies that will enable them to perform at the required goal levels. Achieving the goal can lead to satisfaction and increased motivation while failing to achieve the goal can lead to frustration and decreased motivation. It is important to have a goal towards the efforts of a zero-waste campus. According to Locke and Latham [73], goal setting's success depends on mediators and moderators that determine its efficacy and applicability. Therefore, developing an action plan with goal-setting criteria to motivate [74] the campus community toward a goal is an important part of zero-waste campus goal setting.

ii.   Environmental Education

Environmental education is a process that allows individuals to explore environmental issues, engage in problem-solving, and take steps to protect the environment to gain a better understanding of the issues and make more informed decisions [75]. Environmental education includes not only nature but also society, culture, economy, and policy [76]. Therefore, knowledge gain from the learning process will encourage intentional PEB among the campus community.

iii.   Personal Waste-Related Experience

Personal experience is the act of gaining knowledge or skill through doing, seeing, or feeling something. Individuals' perceptions can differ due to differences in their experiences and/or their social construction of these experiences [77]. According to Haselhuhn et al. [78],

individuals often gain more information when they learn from experience, and affective information can be conveyed through personal experience in ways that other modes of communication fail to. Therefore, it is not solely about one's prior personal experience to make the individual environmentally conscious. It is believed that engaging in pro-environmental activities to raise environmental awareness can create the community personal experience.

iv. Environmental Policy

The policy is a system of laws, regulatory measures, courses of action, and funding priorities concerning specific topics enacted by a governmental entity or its representatives [79]. While the environmental policy is defined as any deliberate action taken to manage human activities to prevent, reduce, or mitigate harmful effects on nature and ensuring that human-made changes to the environment do not have negative consequences for humans or the environment [80]. A university's environmental policy could promote sound environmental management and practices towards a zero-waste campus goal.

v. Facility

There is mix view of the facility. The necessity for facilities to turn waste into something usable and 3R bins was mentioned. Even though facilities such as 3R bins are provided, not many use them as they are supposed to, and the bins still encourage people to create waste. The best is to have a facility that supports reducing waste at the source. However, everything that is environmentally friendly, including waste treatment, deserves careful consideration.

vi. Reinforcement Contingencies

Contingencies of reinforcement are comprised of antecedents, responses or behaviours, and consequences. Antecedents are defined as events that occur immediately before a behaviour, while consequences occur immediately after a behaviour [81]. Findings from the FGDs showed that both positive and negative reinforcement could promote community campus' PEB. Positive reinforcement is a process that increases the likelihood of a specific response by introducing a stimulus after the behaviour is completed. Negative reinforcement increases the likelihood of a specific response by removing an unfavourable consequence [82].

vii. Community Engagement

Community engagement is the process of working collaboratively with groups of people who are affiliated by geographic proximity, a common interest, or similar circumstances to address certain issues. One of the pillars of environmental sustainability education is community engagement. The community learns to appreciate the experiences that affect the environment and others as they interact with the environment through community engagement [83].

viii. Social Responsibility

Social responsibility is an ethical theory in which individuals are responsible for performing their civic duty, and the actions of an individual must benefit the whole of society [84]. Being socially responsible demonstrates both social awareness and self-management skills. Campus communities are responsible to fulfil their civic duty in supporting the effort a zero-waste campus.

ix. Self-Awareness

Self-awareness is one's ability to not only be conscious and alert in an environment but also the ability to understand their purpose within it [85]. While environmental awareness involves incorporating knowledge of current issues affecting nature locally and globally, determining which actions can make a difference in the surroundings, and being self-aware of personal environmental philosophies [86]. Therefore, campus community self-awareness towards the environment should be cultivated in ensuring environmental sustainability.

3.2. IDI Results and Findings

The IDIs results show the same patterns discussed during the FGD sessions with a more profound understanding, except that the role of facility was found irrelevant.

"In my opinion, being a university for more than 20 years, USM has no issue with facilities. The university has provided enough facilities for waste disposal and everything. Still, I think there is more to what kind of idea or innovation you can come out with to practice zero-waste. If you say facilities, we are still creating a place to dump the waste. We are trying to come out with zero-waste. When it comes to zero-waste, we need an alternate recycling method. For example, food waste; all the restaurants, hostels, cafeterias, and everything how they deal with food waste." Participant B.

Furthermore, there are two additional points have been highlighted. They are exemplary leadership and social technology. Exemplary leadership has its role in influencing university campus community zero-waste PEB. Meanwhile, the role of technology, specifically information technology, has been narrowed down to social technology. The following few sentences are quoted from the many participants during the interviews.

"To educate by observation. For example, the students will follow the first act of their superiors." Participant D.

"Maybe the lecturers could involve themselves with the waste management activity." Participant F.

"The schools are very straightforward between the students and the teachers. However, on university campus, there is a huge community. We need to identify each role and which role can deliver faster." Participant B.

"Watching a movie, a documentary about the environment and reading the news or about the impact of climate change and getting your awareness from the social media. Just increase my knowledge of it."

"Before, there were many campaigns to save the environment on television. Nowadays, it seems to be lesser. We need to always advertise environmental care. Social media such as Instagram can be created and used to share detailed information on environmental care. Dissemination of information that is suitable for the function of the social media application." Participant D.

"Giving awareness and stuff. You can sell things through social media. So can sell environmental things through there. And you can do live streaming and show like tutorials. It also helps to educate people to help the environment. I think engaging with the people and giving the information and knowledge." Participant H.

"Personally, to develop self-awareness for this pro-environmental behaviour, one must always be knowledgeable about their surroundings from television news and social media such as TikTok, Instagram, Facebook, etc. So they know what is going on outside the country or outside of the place." Participant L.

i.   Exemplary Leadership

Leadership is referring to the role of leaders in public entity in supporting the principle of good public governance [87]. According to Kouzes and Posner [88], there are five practices of exemplary leadership which are model the way, inspired shared vision, challenge the process, enable others to act and encourage the heart. Exemplary leadership in promoting environmentally friendly waste management in universities is believed to be able to influence the community to follow and make the vision a reality.

ii.   Social Technology

According to Suby [89], social technology is any communication-enabled technology that facilitates social interactions, such as the internet or a mobile phone. Social media is an internet-based form of communication that influences how the learners communicate and

interact [90]. Table 1 shows a classification of social media adapted from Goulding, Calvert, and Ihejirika [91] and is modified to fit the most recent example.

Table 1. Classification of Social Media.

Social Media Tools	Description	Example
Media sharing sites	Allow users to upload, organise and share multimedia materials with people and/or selected communities.	YouTube, Vimeo, Instagram, Flickr
Blogs/Microblogs	Allow authors to post their writings or information on the web, hoping someone will read them.	Blogger, Twitter, Plurk, Tumblr, Weibo
Social Bookmarking sites	Allow users to collaboratively use tags to annotate and categorise the web content they found interesting	Pinboard, Pinterest, Digg, Foursquare
Virtual/Online Communities	Allow individuals to share specific information and interests through interactive tools on a website.	Gizmodo, Quora
Social Networking Sites	Allow individuals to build social relationships and interests among friends and acquaintances.	Facebook, LinkedIn, TikTok
Virtual Worlds	Provide computer-simulated environments where people can interact in a virtual world.	Second Life, World of Warcraft, IMVU

Source: Adapted and modified from Goulding, Calvert, and Ihejirika.

Social media as persuasive technology can promote PEB towards environmental sustainability [92]. Persuasive technology can be defined as an interactive computer system, which is used to try to change human behaviour [93]. Figure 4 shows the revised graphical presentation for the relevant factors influencing USM's community campus' PEB toward a zero-waste campus effort based on the findings from the IDIs.
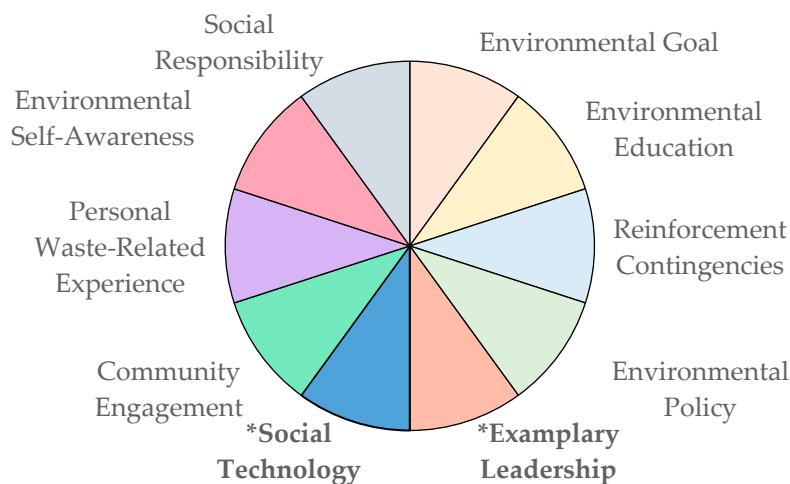

Figure 4. Relevant factors influencing USM's community campus' pro-environmental behaviour. * Bold text: Additional factors.

3.3. Proposed Framework

Based on the findings from the FGDs and IDIs, and adaptions from the KAP model, VBN model, TPB theory, and Kollmuss and Agyeman 2002's Model of Pro-Environmental Behaviour [47], a framework to help promote environmental sustainability via PEB towards a zero-waste campus has been proposed. Figure 5 shows the proposed framework.
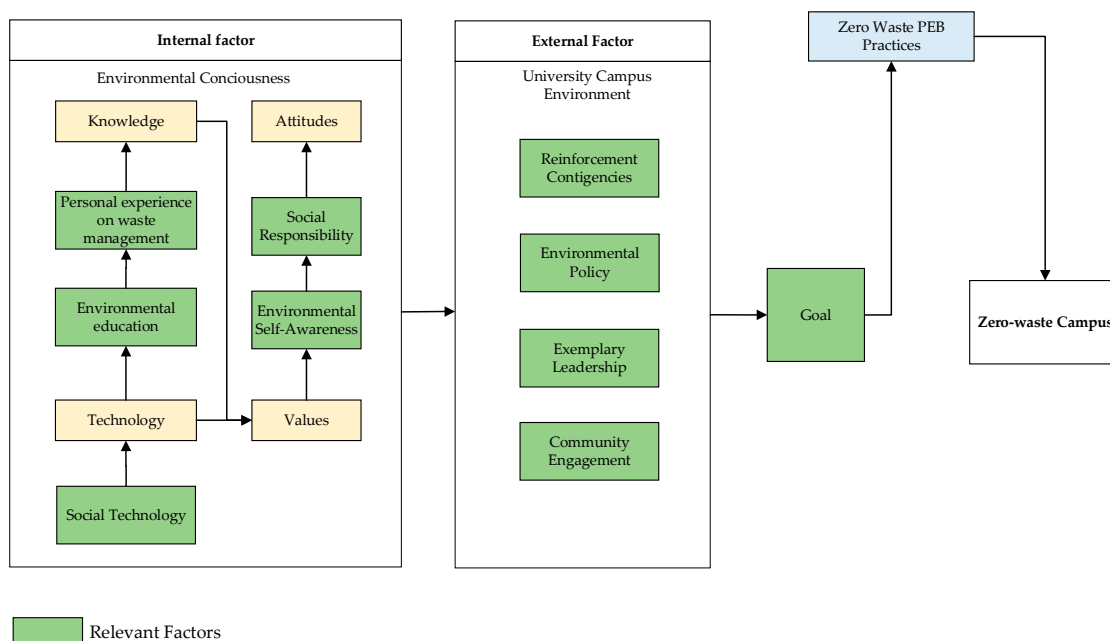
Figure 5. Zero-Waste Campus Framework.

The proposed framework emphasises factors that can assist in achieving the desired behaviour, whereas Kollmuss and Agyeman's Model of Pro-Environmental Behaviour highlighted barriers. There are five factors under environmental consciousness. Technology through social technology, specifically social media, can disseminate information fast and to a broad audience. Social media is an excellent platform for sharing, and every campus community member can learn from each other's personal experiences on waste management. Environmental education and personal experience on waste management will contribute to environmental knowledge. Knowledge and the impact of technology will instil values in the campus community and promote environmental awareness, leading to the development of an attitude based on a sense of social responsibility. The attitude will help to shape campus community participation in sustainable waste management towards a zero-waste campus. The external factor is firmly bound to the university environment and the individuals as a community. Reinforcement contingencies, environmental policy, community engagement, and exemplary leadership are all factors that go beyond an individual's control. Exemplary leadership, especially at the university administration level, may influence the university's environmental policy, creating appropriate reinforcement contingencies, both positive and negative, to influence the campus community to follow the policy. Exemplary leadership will also have a positive impact on community engagement. The university campus community will be inclined to work together to achieve the goal. Internal factors will have an impact on external factors. These factors will contribute to the achievement of the goal, resulting in a community practicing zero-waste PEB and achieving a zero-waste campus.

4. Material and Method

The research design for this study considers the data collected to be consistent with the research objectives [94]. A qualitative method involving FGD and IDI is used in this study. The flow of the study is illustrated in Figure 6. The FGD is used to investigate the main factors influencing the community's sustainable pro-environmental behaviour towards a zero-waste campus, whereas the IDI is used to determine the relevant factors in shaping the community's sustainable pro-environmental behaviour towards a zero-waste campus.
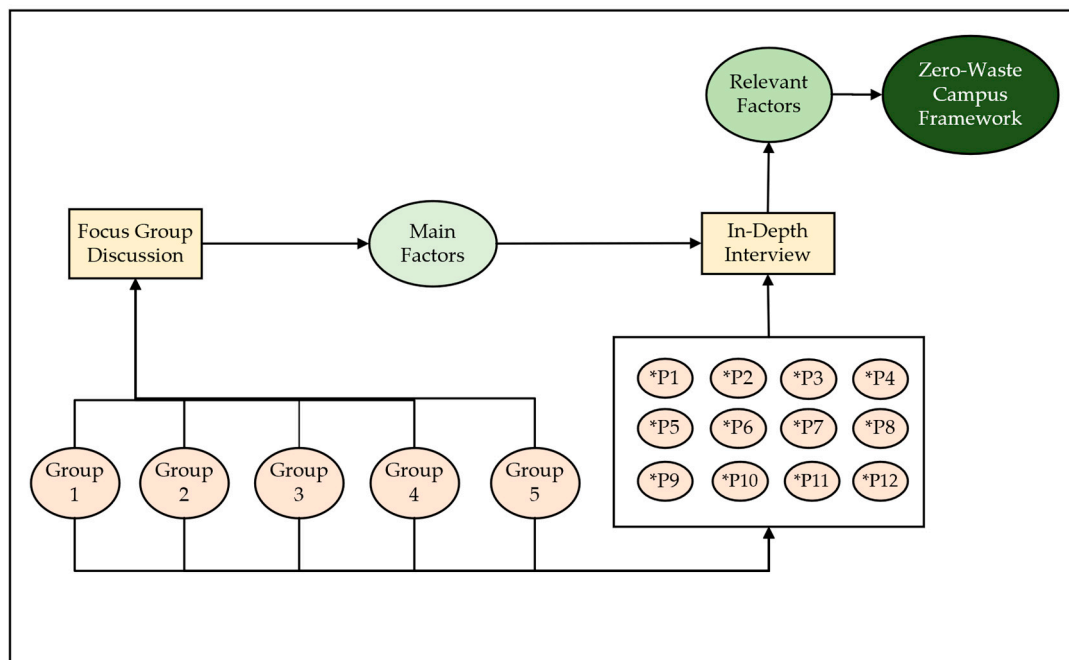
Figure 6. Study methodology. * P: Participant.

4.1. Focus Group Discussion Data Collection Method

FGD has been used to gather qualitative data in exploring one's knowledge, experiences [95], beliefs, perceptions, and attitudes [96] on specific topics. In this study, FGD serves a specific purpose [97] to explore the underlying perspective among the USM campus community on waste management in the effort to create a Zero-Waste Campus. The data have been recorded and manually transcribed into NVivo-12 software (Pro, QSR International, Burlington, MA, USA). The thematic analysis involved methodically reading through the verbatim transcripts, and segmenting and coding the text into categories that highlight what the group discussed [98]. The data were then assessed, compared, and interpreted, and any similarities and differences noted. The categories were combined and assigned to major themes.

FGD participants recruited using a purposeful sampling strategy were willing to talk freely and openly about the study's need [99], which was their perspective on waste management in the effort to create a Zero-Waste Campus. This sampling method is non-probable and cannot be generalised to the entire population. However, information from this phase can explain the dynamics of the factors that shape the behaviour studied. Convenience sampling [100] was incorporated in selecting the participants. The participants selected were those who are close to hand, who were ready and readily available based on the purposive group composition.

Participants of this study are members of USM campus community. In this study, the university campus community refers to a group of people who form a social niche by interacting with one another on campus. The main criteria for participants in this study are adults (over 18) who are physically located on campus and registered as either students or university staff as representatives of the university campus community made up of heterogeneous participants from various roles. Academic, administrative, and service/technical personnel comprise the staff. Students are both undergraduates and postgraduates. This approach capitalises on people's shared experiences and maximises exploration of the individual's different perspectives within a group setting [95,97]. Therefore, people that exhibit PEB, such as involvement in pro-environmental activities including being an environmental activist or attending pro-environmental events, are carefully chosen, as indicated by Ones et al. [101], to ensure the participant has prior knowledge and experiences with PEB. This, in turn, will result in significant data collection.

According to Carlsen and Glenton [102], the standard group is usually a minimum of four and a maximum of twelve participants per group. Krueger and Casey [103] and Eliot and Associates [104] suggested that the number of participants is between four and twelve. However, if the number is fewer than six and the participants have a low level of involvement with the issues, some may try to dominate the discussion, according to Liamputtong [105]. Furthermore, Smithson [106] stated that if the number is greater than eight, it may be difficult for a researcher to manage. Therefore, the number of participants for each FGD in this study was set to eight. While the study's group number was based on the saturation principle [107], where over 80% of all themes could be found in two to three FGDs, and 90% can be found in three to six FGDs [108]. Thus, five physical FGD sessions were held in this study from the 18th to 20th December 2019. A researcher and an appointed co-moderator moderated the sessions. Table 2 shows the profile of the participants. There were 29 participants made of ten staff and 19 students. A total of 40 staff and students were invited to participate in the discussions. Unfortunately, some of them did not attend the meetings. Participants in the meetings came from various departments and schools. The majority of postgraduate students come from a variety of professional backgrounds and are pursuing their studies. Meanwhile, Kampus Sejahtera and Gorange committees provided most undergraduate participants.

Table 2. Focus Group Discussion's Respondent Profile.

Position	Frequency		Total
	Male	Female	
Lecturer	2	2	
Administration Staff	3	2	
Retailer	1	0	10
General Workers	0	0	
Postgraduate Students	4	2	
Undergraduate Students	5	8	19
Total	14	15	29

A semi-structured set of questions had been prepared to steer the group discussion. However, flexibility was allowed so that members of the focus groups could explore the broader aspects of any topic they considered necessary [109]. The FGD semi-structured questions were developed by adopting and adapting past literature and credible academic sources of the subject matter. The instrument was approved by The Human Research Ethics Committee of USM (JEPeM). According to Leedy and Ormrod [110], some instruments fail to measure the intended aspects of the study due to reliability and validity issues. Therefore, on 13 December 2019, a pilot test was conducted to obtain feedback from representatives of the target group on how the questions were received [111]. Eight postgraduate students from USM's School of Computer Sciences, School of Mathematics, and School of Educational Studies volunteered for the session. The session was moderated by two people, one of whom was the researcher. All the notes were physically written down on sticky notepaper. This method was later improved by using a digital platform called Padlet to keep and organise all feedback from the sessions. Initially, eight questions were proposed for the FGD. The structure of the questions was then revised. Confusing sentences were rephrased and divided into separate questions after consulting with the internal expert group, which consists of three senior lecturers working on the same project. The questions that have been revised based on pilot test feedback are listed as Table 3. Questions one to three explored the respondent's knowledge of zero-waste and its relationship to the 3R concept. These questions were adapted from the ZWIA [23] definition of the zero-waste concept. Questions four, five, six, and nine are the part of the questions exploring the participants' attitudes, practices, and values on waste management. These questions were based on FGD and IDI questions used by Yukalang et al. [112]. Question eight explored

suitable practices for implementing a zero-waste lifestyle among the campus community based on their perspectives. It was based on the UM Zero-waste Campaign literature review [27]. Question number ten explored the use of technology in instilling zero-waste behaviour. This question was adopted and adapted from Yukalang et al. 's interview question [112]. Meanwhile, the last question focused on information technology, such as mobile applications' roles. This question was adapted from Uzunboylu et al. (2009)'s questionnaire item on mobile learning's usefulness in creating environmental awareness [113]. The five FGDs took less than 75 min each, as suggested by Krueger and Casey [103] and Dawson [114], including the extended discussion when interesting points emerged [105].

Table 3. Focus Group Discussion Questions.

No	Questions
1	Are you aware of zero-waste?
2	What do you understand by the term zero-waste?
3	Do you think zero-waste is the same concept as in reduce, reuse, and recycle (3R)?
4	What are the reasons for waste problem in the campus?
5	What are the obstacles for waste problem in the campus?
6	Do you have any suggestions on how to improve the waste problem in the campus?
7	What are your current practices of zero-waste?
8	How can zero-waste lifestyle be implemented to create zero-waste Campus?
9	What improvements could be made to encourage you to play a more active and effective role in waste management?
10	What is the role of technology in instilling zero-waste behaviour?
11	How do you see the role of mobile application in delivering the content to promote zero-waste behaviour?

4.2. In-Depth Interview Data Collection Method

The information gathered from FGDs was then refined further with IDIs. Selected FGD participants were interviewed to gain in-depth insights into the major themes that emerged from the FGD analysis. This study identified 12 active FGD participants who agreed to participate in the interview, which is sufficient for a homogeneous group of interviews to reach saturation [115]. The inclusion and exclusion criteria are the same for FGDs because IDIs participants are identified from the FGDs participants. Due to the COVID-19 pandemic, the IDIs were conducted online from January to March 2021. The researcher conducted all interviews. Table 4 shows the participant profiles for IDIs.

Table 4. In-Depth Interview's Respondent Profile.

Position	Frequency		Total
	Male	**Female**	
Lecturer	1	0	
Administration Staff	2	0	
Retailer	0	0	3
General Workers	0	0	
Postgraduate Students	2	2	
Undergraduate Students	2	3	9
Total	7	5	12

The IDIs allow for further discussion and delving into the subject matter. The IDIs were conducted using a set of semi-structured questions (See Table 5) based on the main themes that emerged from the FGDs and points that the participants frequently mentioned, especially on social media roles. The researcher and the internal expert group reviewed and discussed these questions.

Table 5. In-Depth Interviews Questions.

No	Questions
1	How important is goal in influencing campus community pro-environmental behaviour?
2	How to educate the campus community to practice pro-environmental behaviour?
3	Why personal experience is important in building pro-environmental behaviour?
4	What are campus community's social responsibility in efforts towards Zero-Waste Campus?
5	What facilities are needed to create Zero-Waste Campus?
6	In your opinion, reward or penalty is more important in encouraging pro-environmental behaviour?
7	How to develop one's self-awareness to practice pro-environmental behaviour?
8	What are the roles of technology in the environment?
9	How does information technology persuade people to engage in pro-environmental behaviours?
10	How does social media help the environment?

5. Conclusions

This study has identified the underlying perspective among the USM campus community on waste management to create a sustainable zero-waste campus. The framework proposed several interconnected factors for establishing a zero-waste campus. One or more factors may accommodate the diverse needs of the campus community and society. Indeed, more will have a more significant impact and strengthen the relationships. The discovery will assist us in gaining a better understanding of the community, as every individual is unique and has preferences that will motivate them to engage in pro-environmental behaviour to make a zero-waste campus a reality. One suggestion on how the proposed framework can be used to develop an environment-specific plan is to make the plan mandatory for the university campus community to undergo or participate at least once when they register as staff or students. As a result, the plan can be implemented to everyone's benefit.

Because of its contribution to the national and societal well-being, this study's translational nature could be further applied to different universities to enhance the understanding and underlying perspectives of different communities within the same higher institution education domain. Furthermore, the findings can be used by other developing countries with similar social and economic diversity.

The current study's limitation is that the focus participants of the FGDs and IDIs are only from the USM communities rather than a combination of other universities. A future suggestion would be to include a broader range of university participants in the FGD and IDI sessions. This qualitative data collection and analysis is the first step in the framework's development. The proposed framework will be tested and verified further using the survey results. The information gathered will be used to create a comprehensive and practical module proposing zero-waste campus ideas.

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