Green Campus Paradigms for Sustainability Attainment in Higher Education Institutions-A Comparative Study

Abstract

Purpose

This study aims to explore the current Green practices implemented in Malaysia higher education institutions towards sustainability attainment by developing a multi-disciplinary comprehensive policy framework to further extend the collaboration among sustainability practitioners in providing integrated data on Green indicators linked to economic, social and environmental dimensions of sustainability in higher education institutions.

Design/methodology/approach

Primary data which comprises of sustainability archival documents from sixteen universities in Malaysia was employed to explore the extent of Green practice for sustainability. In addition, this study also utilized secondary data from existing literature on sustainable development in Malaysia higher education institutional context.

Findings

Findings from the examined sixteen universities and prior sustainability studies in Malaysia universities suggest that higher education institutions in Malaysia are presently implementing Green practices in their university campuses towards attaining sustainability.

Research limitations/implications

Qualitative data is only collected from higher education institutions in Malaysia. Hence, findings from this study cannot be generalized to universities in other countries.

Practical implications

This study provides insights towards infusing Green campus paradigms from technological perspective to facilitate the exchange of information between sustainability practitioners in order to produce innovative solutions for addressing sustainability challenges.

Social implications

This research developed a policy framework that provides trans-disciplinary approach to be adopted by higher education institutions in Malaysia and further beyond towards attaining sustainability. Socially, this study provides Green indicators that act as reference manual and road map towards sustainable development in higher education institutions.

Originality/value

A novel multi-disciplinary comprehensive policy framework is developed grounded on identified Green indicators integrated to provide information on how sustainability practitioners can implement Green practices paradigms across universities. Furthermore, the Green indicators can be employed as metrics to provide data for Green practice measurement and monitoring in higher education institutions.

Keywords: Sustainability attainment; Environmental policy; Green campus paradigms; Green indicators; Higher education institutions; Policy management.

1. Introduction

The world is currently faced with addressing environmental challenge in relation to climate changes and global warming, thus sustainability is rapidly changing from a simple issue into an important agenda (Anthony Jnr *et al*., 2019). Therefore, there is need for higher education

* Corresponding author. E-mail address: bkanjr@gmail.com

institutions (HEI) to implement Green initiatives in supporting sustainability attainment for waste decrease, energy efficiency, water utilization reduction, healthy working surroundings as well as clean indoor air (Sonetti *et al*., 2016). These initiatives can bring about improved quality of life for all, better economic vitality and a reduced environmental footprint (Mat *et al.,* 2011). Higher education institutions are similar to smaller cities in terms of urban characteristics and population size. Besides, several activities take place across the campuses, which possess direct or indirect impacts on the natural environment (Alshuwaikhat and Abubakar, 2008). Hence, it is required for practitioners in higher education institutions to implement Green practices, where these practitioners can assist in providing multidisciplinary Green technical solutions in achieving sustainable development within the university (Zakaria *et al*., 2016).

Sustainability is a concern that has been discussed in many global conferences particularly in the educational domain. Thus, the idea of sustainable development has gained international attention since its inception in the Brundtland tagged "Our Common Future" during the United Nations Conference on Environment and Development in the year 1987 (Brundtland, 1987). To this end, Green practice in higher education institutions is a growing field of consideration and practice yet attaining sustainability in Malaysia universities is still considered an issue (Hooi *et al*., 2011; Anthony Jnr, *et al*., 2019). Malaysia is one of the countries committed to support sustainability in universities by signing the Talloire Declaration (Saadatian *et al*., 2013). Since then the interest for sustainable development has been gradually growing within Malaysia. Although, most universities are still lagging behind in implementing Green practices for attaining sustainability as part of their institutions policy, even though sustainability has been on the agenda of higher education institutions since 1992 Earth Summit in Rio, progress is still slow. Currently, there exist pressures form governmental and non-governmental organization (NGOs) on universities to integrate Green practices into their campus activities based on numerous sustainability declarations.

In line with the endorsements of the Malaysian government towards development of Green university campuses in the country, a few universities in Malaysia have begun to implement various Green practices in a bit to promote sustainability. Thus, higher education institutions in Malaysia are committed in supporting the 40 percent decrease of Carbon dioxide (CO_2) emissions pledged by the government in 1992 Earth Summit in Rio (Ramli *et al*., 2014). Nonetheless, researchers such as Nejati and Nejati (2013) mentioned that in Malaysia university management, stakeholders and practitioners are unaware of Green campus paradigms and this has led to most universities not implementing Green practices. At the moment propaganda on sustainability is been initiated and socially promoted by practitioners in higher education institutions (Taghavi *et al*., 2014). But there is lack of an approach that provides an interdisciplinary collaboration and communication among these sustainability practitioners to provide integrated data collected based on Green indicators which is to be considered in attaining sustainability within Malaysia university campuses (Foo, 2013¸ Junior *et al*., 2018).

Accordingly, this study examines the current Green practices implemented in sixteen universities in Malaysia whilst exploring key Green indicators needed to be considered for sustainability attainment within higher education institutions. The originality of this research lies on the fact that the Green indicators can be utilized as an effective tool for evaluating, monitoring and provide information to support appropriate decision-making on the current Green practices implemented in universities. Thus, based on the review of prior studies and sustainability documents a multi-disciplinary comprehensive policy framework was developed to create equilibrium between different disciplines in facilitating the exchange of information between different sustainability practitioners from different disciplines in resolving environmental-socio-economic challenges. Therefore, the framework will be useful to universities interested to increase practitioners' engagement and participation in "walking the talk" and "leading by example" towards sustainability attainment in their respective campuses. It is hope that the Green indicators presented in this study will provide guidelines for sustainability practitioners policy maker and environmental management committee in upholding Green campus paradigms. The structure of this paper is organized as follows: Section 2 presents the literature review. Section 3 is methodology. Section 4 is the findings and Section 5 is discussion. Section 6 is the implications. The final Section is the conclusion, limitations and future works.

1.1. Problem Statement

1.1.1. Inadequate Approach to Provide Information on Critical Green Indicators

Sustainability in university campuses involves a trans disciplinary approaches of creating balance among science and technology, social sciences, and humanities, especially in existing Green initiatives being implemented, as such there is a need to facilitate the exchange of information between all practitioners from diverse areas in order to produce innovative solutions to address social, environmental and economic challenges (Jegatesen and Koshy, 2013; Anthony *et al*., 2017). Although, there are works of literature citing the importance of sustainable development in university campuses (Darus *et al*., 2009; Mat *et al*., 2011; Johan and Turan, 2016), issues related to inadequate integrated data collected based on Green indicators to be considered towards sustainability attainment in universities has not been adequately resolved (Velazquez *et al*., 2005; Nifa *et al*., 2016; Sonetti *et al*., 2016). Thus, there is need for an approach that provides information on Green indicators to be considered by sustainability practitioners in institutions of higher learning.

1.1.2. Lack of Interdisciplinary Collaboration and Communication among Sustainability Practitioners

Currently sustainability practitioners from different areas of specialization all work together to attain sustainability in universities. But, currently, there is lack of interdisciplinary collaboration and communication among sustainability practitioners in higher education institutions (Velazquez *et al*., 2005; Abdul-Azeez and Ho, 2015; Sonetti *et al*., 2016; Azlin *et al*., 2016). According to Sanusi and Khelghat-Doost (2008) sustainability attainment in higher

education institutions entails a systemic method that highlights intra, trans and inter disciplinary approaches. Similarly, Tilbury *et al.* (2011) stated that inter-disciplinary approach is required to invariably bridge the distinction between applied curiosity-driven and basic problem solving toward sustainability attainment in university campuses. Likewise, Peter *et al.* (2016) cited Velazquez *et al.* (2005) and mentioned that the lack of an interdisciplinary approach is one of the issues that mitigate against universities achieving sustainability. Accordingly, Peter *et al.* (2016) suggested that there is need for an interdisciplinary approach capable of providing higher education institutions with a Green campus paradigm towards achieving social, environmental, and economic sustainability. This statement was also supported by Capdevila *et al*. (2002); Junior (2019) when the researchers declared that there is inadequate coordination and collaboration among practitioners from different domain that works together in attaining sustainability.

1.2. Research Questions

To address the issues detailed in Section 1.1 the following research questions are answered to provide solution to the research problems;

RQ1-What are the existing models or frameworks developed to support higher education institutions attain sustainability?

RQ2- What are the existing declarations and summits towards higher education institutions?

RQ3-Which higher education institutions in Malaysia are currently implementing Green practices for sustainability attainment?

RQ4-What are the critical Green indicators to be considered by institutions of higher learning for sustainability attainment?

2. Literature Review

This section provides answer to the first research question to review existing models or frameworks developed to support higher education institutions in Malaysia attain sustainability. Although, literature on sustainability in institutions of higher learning has increased over the years, only a few related studies have been carried out in the Malaysia context, among these studies Nifa *et al.* (2014, 2015) developed a framework for Universiti Utara Malaysia (UUM) to strengthens the efforts of the university towards attaining sustainable development in UUM campus. Their framework aimed at supporting the implementation of integrated project delivery which is derived from elements identified for performing various functions within the university. The framework components comprise of communication, technologies and sustainable design implementation. Likewise, Mat *et al.* (2011) proposed a model envisioned for Universiti Kebangsaan Malaysia (UKM) towards achieving sustainability. The model comprises of a directional layer and structured layer that institutes the university's mission and vision aimed at conceptualizing sustainability goals. The presented missions and vision provide the foundation and platform strategies in achieving sustainability goals. The vision and mission initiatives shall be adhered to by campus community towards fostering and promoting sustainability agenda. The model components

comprise of mission, vision, sustainability committee (people), education, research (inter and multidisciplinary) and lastly outreach and partnership (domestic and global).

Similarly, Kamal *et al.* (2015) presented a sustainability framework for campus society in Universiti Teknologi MARA (UiTM) to achieve Green campus towards achieving a healthier environment for the campus community, particularly for students in terms of their economic, social and environmental quality of life. The framework comprises of psychological (values and knowledge involving the environment), physical (accessibility of Green facilities), personal (time availability, performance requirement), public perception (social norms), price (cost of going Green) and policies (regulatory and management support) which impacts the university community commitment towards sustainable development. Darus *et al.* (2009) studied the issues related to attaining sustainable development in university campus and stated that Green indicators are significant tool to be utilized in ensuring that sustainability plan of Universiti Kebangsaan Malaysia (UKM) could be assessed in determining if sustainability goals have been achieved. The Green indicators presented by Darus *et al.* (2009) comprises of equity (human wellness, curriculum, ability construction and governance), economy (water management, usage of materials, energy management, and solid waste management), and lastly design (transportation, infrastructure design, landscape and forestry).

Isa (2016) conducted a study and investigated the level of awareness among Universiti Pendidikan Sultan Idris (UPSI) academic staffs regarding sustainable development initiatives within university campus. The author presented a framework that comprises of the relationship between knowledge, attitude and behavior of academic staffs in relation to their level of awareness on sustainable development initiatives and principles in universities. CGSS (2009) proposed a model for sustainable development attainment in Universiti Sains Malaysia (USM). The model was infused with the principles and practice of sustainable development, sustainability agenda for ability building at systemic, institutional and individual levels towards producing graduates that are conversant with sustainability issues. The model addressed key sustainability issues and infuses societal, environmental and economy goals into the university's mission teaching, research and community engagement.

Hooi *et al.* (2011) designed a Green campus initiative framework for UCSI University. The framework comprises of external, internal forces integrated with perceive value and perceive outcome. However, the framework is designed mainly for management members in the university in achieving Green campus initiatives. It is apparent that a few researchers had proposed frameworks and model to support university campuses attain sustainable development within the Malaysian context. However, Nifa *et al.* (2015) called for a more practical approach that enables the social, economic and environmental dimensions to be incorporated with the existing university campus operations. Moreover, among the eight studies reviewed, none of the researchers proposed a model or framework that comprises of Green indicators which are based in the social, economic and environmental dimension of sustainability.

3. Methodology

This paper employs a comparative approach to investigate the current Green practices implemented by Malaysia higher education institutions by utilizing data from prior studies and sustainability document in providing answers to research questions as stated in Section 1.2.
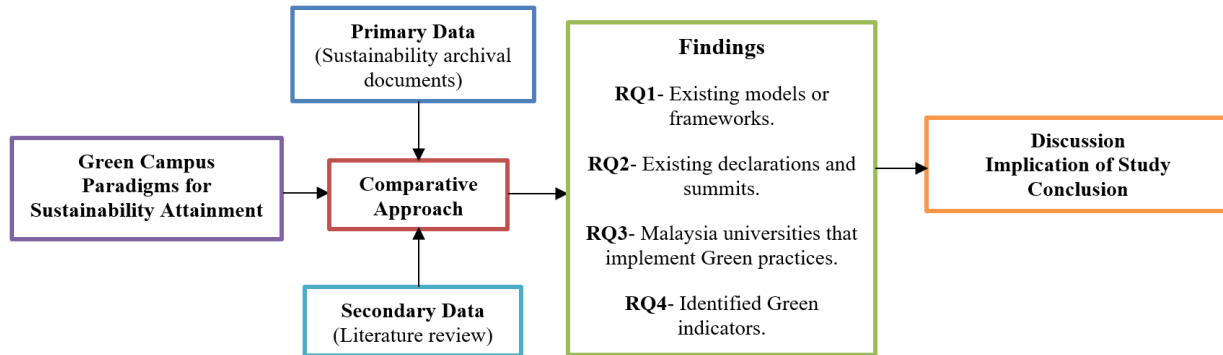

Figure 1 Comparative review approach

Accordingly, Figure 1 show the comparative review method applied in this study aimed at providing answers to research questions based on secondary and primary data. The sustainability documents from sixteen universities in Malaysia were analyzed to provide insight on Green practices implemented, thereby investigating various eco-friendly initiatives being deployed in the selected universities. The sustainability archival documents on Green ICT, Green IT, and sustainability documents from various universities in Malaysia was retrieved, extracted and synthesized to identify the best practice implemented by the universities. Most of the documents were provided by the universities on request and others were retrieved from the university sustainability websites. Furthermore, review of prior studies was carried out in order to identify the critical Green indicators to be considered by universities. The review aims to syntheses, extract, appraise and critique scientific literature related to indicators, and practices for sustainability attainment mainly in Malaysia higher education institutions.

Therefore, this paper explores Green practice paradigms in Malaysia institutions of higher learning to support sustainability attainment. Thus, sixteen studies were selected using purposive sampling since they possess knowledge on sustainability and currently implement Green initiatives in their respective institutions. Regarding data collection technique this study collected data from prior sustainability studies in universities and analyzed sustainability documents utilized in university institutions to provide insights on the current Green practice adopted by sustainability practitioners. However, response rate is not applicable in this study as primary data was not collected from participants using either questionnaire or interview. Therefore, this study reviews the current Green practice implemented in sixteen selected universities across Malaysia based on comparative analysis of their current Green practice being implemented. The syntheses of secondary and primary data provided a general background on sustainability, which was used in the development of the policy framework. The comparative analysis is evidence based on

descriptive approach that was grounded on primary data from sustainability archival document and secondary data from literature review as shown in Figure 1.

4. Findings (Descriptive and Comparative Analysis)

4.1. Declarations and Summits in Higher Education Institutions

Sustainability is a concern that has been raised in several international conferences particularly in the educational domain. This sub-section aims to provide answer to the second research question to identify the declarations and summits that was initiated to foster sustainability attainment in higher education institutions as depicted in Table 1.

Table 1 Declarations/summits for institutions towards attaining sustainability

Year	Location	Declarations	Purpose
1972	Sweden	Stockholm Declaration (United Nations Conference on Human Environment).	This declaration presented a first step towards international human activities on the natural environment. This declaration presented a viewpoint on how institutions of higher learning can address issue of conserving the environment.
1975	Serbia (former Yugoslavia)	The Belgrade Charter (International Workshop on Environmental Education).	Aimed to resolve environmental issues universally by designing a global framework for ecological education stated as the Belgrade Charter. The declaration goal has been largely acknowledged by practitioners in educational field.
1977	Georgia (former USSR)	Tbilisi Declaration, (Intergovernmental Conference on Environmental Education Tbilisi).	The declaration established a framework that provides guidelines for environmental education at national, regional, and global levels. The declaration suggested the implementation of benchmarks to help guide and develop environmental education.
1990	France	Talloires Declaration.	This declaration was mostly aimed at implementing an exceptional scale to reduce pollution and natural resource degradation by creating educational research policy for information exchange.
1991	Canada	Halifax Declaration.	Aimed to shape the present and future growth in relation to sustainable development by proposing eco-friendly practices that can overcome root causes of environmental degradation.
1992	Rio de Janerio, Brazil	Agenda 21 (Promoting Education, Public Awareness and Training, United Nations Conference on Environment and Development).	This declaration was presented by the 1992 Earth Summit and laid more emphasizes that societal population, natural resource consumption, and technologic inventions are the main driving factors of environmental change. This declaration presented guidelines to decrease extravagant and incompetent consumption patterns in encouraging sustainable development.
1993	Japan	Kyoto Declaration on Sustainable Development.	This declaration outlined better communication by presenting how university campuses can understand the why and what of sustainable development in research and teaching operations to reflect best practices among universities.
1993	United Kingdom	Swansea Declaration.	This declaration was committed in improving policy changes in educational research and public roles towards sustainable development in society at large.
1994	Geneva, Switzerland	Copernicus University Charter for Sustainable Development.	Mainly focused to promote institutional commitment, environmental attitudes and ethics in university campus. This declaration also encourages education of university staffs' programs by promoting interdisciplinary distribution of knowledge for continuing campus programs.
1997	Greece	Thessaloniki Declaration, (International Conference on Environment and Society: Education and Public Awareness for Sustainability).	This declaration presented a new vision for the role of education and the societal awareness in attaining sustainability. This declaration aimed to provide a platform for sustainable development to mobilize action at local, national and international levels. The declaration also intended to bring about changes in behavior and lifestyles to share knowledge to prepare community support for sustainability.
1998	Paris France	World Declaration on Higher Education for the Twenty-first Century and Framework for Priority Action for Change and Development in Higher Education	This declaration aimed at increasing awareness on significance sociocultural and economic development towards developing the future for younger generations to come. The declaration also presented outlines on how the younger generations can be equipped with new knowledge, ideals and skills on sustainable development.

2001	Luneburg, Germany	The Luneburg Declaration on Higher Education for Sustainable Development.	Created a requisite enabling role for sustainable development building in institutions of higher learning by generating new knowledge towards training practitioners and lecturers of sustainable development goals.
2002	Johannesburg , South Africa	Unbuntu Declaration.	Called for the establishment of a global learning platform for sustainable development in producing action oriented initiatives for university campuses. The declaration was designed to move from commitment to action in indicating and suggesting Green practice for attaining sustainable development and outreach based on best practice and successful case studies.
2004	Spain, Barcelona.	Declaration of Barcelona, Education in Sustainable Development (EESD), 2004 Conference Scientific Committee.	The declaration acknowledged that education in institutions of higher learning is an important tool that can address challenges faced in the society. The declaration also stated that institutions of higher learning are to be involved if the world wants to achieve sustainable development and social progress.
2005	Austria	Graz Declaration on Committing Universities to Sustainable Development.	Called on university campuses to give priorities to sustainable development in their day-to-day activities. It also called for campuses leaders to use sustainable development as a model for improving social dimension.
2005	Bruxelles, Belgium	Bergen Declaration.	Established and promoted university campuses worldwide to infuse the principles of sustainable development.
2006	Strasbourg, France	Declaration on the Responsibility of Higher Education for a Democratic Culture, Citizenship, Human Rights and Sustainability.	The declaration presented activities that are intended to create awareness and increase the commitment of university campuses towards a sustainable societies and democratic culture.
2006	Boston, USA	American College and University Presidents' Climate Commitment.	Called for university campuses to be proactive in becoming a climate neutral community by incorporating sustainable development into their curriculum and making it part of their educational experience by initiating a "make action plan" policy.
2007	Lucerne, Switzerland	Lucerne Declaration on Geographical Education for Sustainable Development.	Aimed towards promoting education for sustainable development by relating geography in education for sustainable development. The declaration outlined the components for developing geographical curricula education for sustainable development.
2008	Havana, Cuba	Declaration of the Regional Conference on Higher Education in Latin America and the Caribbean (CRES).	Highlighted the importance of sustainable development for societal, economic and environmental issues that ranges from poverty reduction; climate change; energy crisis etc.
2008	Sapporo, Hokkaido Japan	Sapporo Sustainability Declaration.	This declaration outlines the need for university campus to work hand in hand with policy-makers, since university's governance role is becoming increasingly perilous.
2009	France	World Conference on Higher Education United Nations Educational, Scientific and Cultural Organization.	Improved understanding of complex issues and increased interdisciplinary focus in institutions of higher learning towards sustainable development. The declaration also promoted wellbeing of the society, human right and also contributed to education of citizens.
2009	Italy	Turin Declaration on Education and Research for Sustainable and Responsible Development.	Called for newer approach for economic and social development consistent with sustainable development principles. The declaration also presented ethical method for attaining sustainable development by presenting energy policy that focused on the ecosystems.
2009	Tokyo, Japan	Tokyo Declaration of Hope, Asia-Pacific Forum for ESD Educators and Facilitators.	This declaration is very distinctive in setting up action goals for further promoting education for sustainable development for educators, lecturers and facilitators to promote sustainability.

Table 3 summarizes the declaration for universities from 1972 to 2009. Each of the reviewed twenty-four declarations aimed to achieve sustainable development in higher education institutions to preserve the environment for future generations to come. However, none of the reviewed declaration presented a framework that provides adequate information on the critical Green indicators to be adopted by universities in achieving social, economic and environmental sustainability. Likewise, the declarations are not applicable in providing an interdisciplinary collaboration and communication among sustainability practitioners.

4.2. Descriptive Analysis of Green Campus Paradigms in Malaysia Universities

This sub-section aims to provide answer to the third research question; which Malaysia higher education institutions are currently implementing Green practices for sustainability attainment. At the moment a few universities in Malaysia are inculcating Green practice behavior among their staffs and mostly students. Therefore, this sub-section provides a diversity of Green initiatives implemented in sixteen universities across Malaysia for attaining sustainability. These higher education institutions were selected to be included in this study because they are the leading universities in Malaysia that implements Green practices; they walk the talk and contribute to the attainment of sustainability in their respective universities.

Accordingly, data from this section was collected from literatures on Green practices implemented in Malaysian universities as well as document reviews downloaded from the university website alongside evidence based sustainability report presented in the universities sustainability website. Findings from this sub-section provide knowledge as best practices on how higher education institutions across Malaysia support sustainability through their Green campus paradigms operations, development and application thereby deploying Green initiatives into practice in their respective universities. Furthermore, the universities are selected for this study because they presently implement Green practices and each of the universities have a sustainability center or department in their respective universities that promotes and extend Green campus paradigms. Respectively, Green practices implemented in the selected sixteen universities are summarized in Table 2.

Table 2 Descriptive analysis of universities in Malaysia that implement Green practices

#	University/Location	Implemented Green Practices	Sources
1	Universiti Pendelikon Sultan Idris (UPSI) / Perak	- Provides sustainability curriculum. - Carries out research and development towards sustainability. - Supports Green operations initiatives. - Implements services and outreaches to external societies. - Develops Green buildings.	(Isa, 2016).
2	Universiti Utara Malaysia (UUM) / Kedah	- Creating awareness on sustainability practices. - Design and incorporates Green practices. - Implement energy efficient building features. - Presently drafting a Green implementation blueprint.	(Nifa *et al.*, 2014; Nifa *et al.*, 2015; Nifa *et al., 2016*; Osman *et al.*, 2014).
3	Universiti Sains Malaysia (USM) / Penang and Kelantan	- Established the white coffin programmes to completely stop usage of polystyrene containers within the campuses. - Practice campus wide recycling initiatives. - Plant trees annually within the campus. - Create awareness on dangers of the plastic bags usage on the environment and promotes Green purchasing. - Promotes tobacco smoke free campus. - Created papers mainly from banana leaves. - Deployed the Green office project to reduce energy usage, lessen paper usage, recycle, reuse, and repair policy. - Decreasing water consumption and wastage.	(Sanusi and Khelghat-Doost, 2008; Karpudewan *et al.*, 2009; Amran *et al.*, 2010; Abd-Razak *et al.*, 2011ab; Jegatesen and Koshy, 2013; Kadir *et al.*, 2012; Foo, 2013; Nejati and Nejati, 2013; Rahim *et al.*, 2014; Abib *et al.*, 2017).

4	Universiti Teknologi Malaysia (UTM) / Johor Bharu and Selangor	• Encourages the university community to move around the campus on bicycles, which are provided for use free of charge. • Provide planned buses to decrease the campus's carbon emission. • Prohibit usage of polystyrene related containers in all canteens within the campus. • Supervision of campus solid waste and food waste. • Recycling programs such as recycling day which is every Monday in the university. • Energy and water consumption management. • Increasing energy saving awareness and developing energy preservation life style. • Engaging formal recycling collector. • Provide incentives to boost the recyclable of items within the campus. • Implement Green meeting that encourages call for meeting using email, and the usage of the university online meeting system to avoid printing. • Promotes biodegradable packaging on campus and paper usage reduction under the campus Green office initiative.	(Sapri and Muhammad, 2010; Ahmad *et al*., 2012; Ishak *et al*., 2012; Ting *et al.,* 2012; Ramli *et al*., 2014; Bakhshi *et al*., 2015; Abdul-Azeez and Ho, 2015; Peter *et al*., 2016; Zakaria *et al*., 2016; Zen *et al*., 2016).
5	Universiti Kebangsaan Malaysia (UKM) / Bangi Selangor	• Encourage and enhance collaboration with other associations towards implementing sustainable development. • Progresses the wellness and production of the community. • Improves the natural environments health of the campus. • Encourages research related to environmental conservation. • Develop tool to improve the continuous sustainable development. • Manages and maintain the water consumption. • Provides efficient and eco-friendly energy. • Implements proficient solid waste administration. • Develop Green building design and conserved landscape • Enhanced public commutating and transportation around the campus. • Creates awareness for sustainable and better quality of life within campus.	(Darus *et al*., 2009; Abd-Razak *et al*., 2011ab; Hooi *et al*., 2011; Mat *et al*., 2011; Hooi *et al*. 2012; Zain *et al*., 2012; Saadatian *et al*., 2013; Azlin *et al*., 2016; Kwami *et al*., 2014; Reza, 2016).
6	Universiti Teknologi MARA (UiTM)/ Selangor, Pahang and Perak	• Practices recycling and waste management activities. • Deploys energy efficient practices and proper water management. • Induced CO_2 emissions reduction management practices. • Eco-friendly transport policies, increases campus community awareness and deploys campus environmental management initiatives.	(Saleh *et al.* 2011; Hashim *et al*., 2013; Rusman *et al*., 2013; Kamal *et al*., 2015).
7	Universiti Malaya (UM) / Selangor	• Carries out effective recycling operation. • Install efficient fluorescent lighting lamps that utilize less energy. • Presently conserving energy use in the campus buildings with the help of reflective colors' in the building to reduce heating absorption. • Provides private shuttles for municipal commuting to encourage the campus community to utilize public transportation.	(Saadatian *et al*., 2009; Abd-Razak *et al*., 2011ab; Osman et al., 2014; Ismail *et al*., 2016b).
8	Universiti Putra Malaysia (UPM) / Serdang, Selangor	• Provides recycling bins available at the different locations within the campus. • Provides ecological friendly public transportation or shuttle services. • Cycling lanes are developed in parts of the university. • Sustainable water heaters and coolers are provided in the students hostels. • The university occasionally organized workshops, seminars, and lectures on sustainability. • Collaborates with external associations towards sustainability.	(Shari and Jaafar, 2006; Saadatian *et al*., 2009 Abd-Razak *et al*., 2011a; Abd-Razak et al. 2011b; Osman et al., 2014; Zanariah and Norsidah, 2014).
9	Universiti Malaysia Pahang (UMP) / Gambang, Pahang	• Change of normal light bulbs and T8 tubes to LED light bulbs and T5 tubes. • Fitting of motion sensors in lavatories and deploying energy efficient offices. • Installing intelligent metering systems to monitor and record energy usage in real-time with all data saved and observed using an online based system. • Replacement of normal campus street lighting to LED lights.	(mygreen.ump.edu.my, 2016; Johan and Turan, 2016).

		• Fixing twelve units of internal smart meter in some buildings and laboratories. • Deployed initiatives to decrease plastic and paper use on campus. • Effective recycling strategies for university generated wastes. • Implementing toxic, organic and inorganic waste treatment handled. • Eco-friendly sewerage treatment and disposal. • Constructing bicycle lane on campus. • Utilizing video conferencing across the university campuses. • Providing public commuting services through commercial buses.	
10	International Islamic University Malaysia (IIUM) / Selangor	• Turning off monitor when not in use for more than 20 minutes. • Switching off computers when not in use for more than 2 hours. • Deploys computer power control setting and also utilize power strip or surge protector for monitors, printers and other accessories. • Printing only when needed initiatives and printing double sided to save paper.	(Ahmad *et al*., 2013; Ismail *et al*., 2016a).
11	Universiti Malaysia Sabah (UMS) / Sabah	• Print only when necessary on double sided-printing policy program. • The use of tumbler as a replacement for plastic bottles. • Using reusable and recyclable bags to substitute plastic bags. • Running a poultry, organic and inorganic waste composting facility treatment as well as toxic waste storage and handled. • Installing LED and T5 lamp across the campus offices and faculties. • Installing smart building facilities. • Production of renewable energy source inside the university campus. • Deploying solar energy powered bus stop. • Integrating Green building development and renovation policy. • Promoting bicycle usage on campus. • Encouraging strategies to decline private vehicles usage on campus. • Providing on-campus commuting service. • Deploying rainwater harvesting systems. • Generated financial benefit from harvesting rainwater systems.	(Ayog *et al*., 2015; UMS, 2016)
12	UCSI University / Kuala Lumpur, Malaysia	• Implement CO_2 emission measurement in caring for the environment. • Reduced paper usage. • Deploy effective water management. • Implemented efficient energy measurement. • Encourages lesser fuel consumption for transportation in reducing CO_2 emission.	(Hooi *et al*., 2011; Hooi *et al*., 2012).
13	Monash University Malaysia/ Subang Jaya, Malaysia	• Reduces excessive usage on air conditioning. • Implements water harvesting programs and reduce water bottle usage. • Encouraging students and staff to switch off lighting when not in use. • Initiate sustainability internship run in the university • Establish Green steps program at the university as a leadership initiative.	(Greensteps.edu, 2016; Monash.edu, 2016)
14	University Malaysia Perlis (UniMAP) /Perlis	• Annually organizing the Earth-day campaign to create awareness on environmental protection. • Organizes recycling initiatives and waste management policy. • Practiced Green purchase by buying goods and services that are eco-friendly and have Green labels. • Presently uses renewable materials that are bio-degradable with high rates of biodegradation. • Deploys energy management saving by taking into account the quantity of energy utilized or natural materials needed. • Deploys Green building design and promotes bicycle riding which is more eco- friendly compared to using fuel based transportation. • Protects natural land and promotes efficient water management. • Prevents food wastage and supports the health and lifestyle of the campus society. • Utilizes recycled and uses only less toxic or non-toxic materials. • Concerned about materials that have adverse effect on the eco-system.	(Elmuradov *et al*., 2015; UNIMAP, 2016).

15	Taylor University Subang Jaya, Malaysia	• Proficient energy management towards energy savings strategies by reducing current demand and Green purchasing initiatives. • Installing effective lighting and air conditional. • Better water conservation for water harvesting and recycling. • Development of Green facilities and building. • Better indoor environment quality for campus community. • Materials and natural resources towards conservation of materials. • Green transport across the campus and food system Green program. • Solid waste reduction management and recycling initiatives. • Landscape, watershed and habitat management. • Community outreach programs and promotes sustainability in academics.	(Taylor University, 2016).
16	Sunway University/ Subang Jaya, Malaysia	• Provides a hub for expanding practical knowledge of practitioners and decision makers towards sustainable development. • Advance linkages with leading universities to extend sustainability research and policy development. • Infused the world's best academic curriculum and management modules on sustainable development • Changed the attitude of society in the university campus towards sustainable development in their daily lives.	(Universitysunway, 2016; Sunway, 2016; NST, 2017; Thestar, 2017).

4.3. Description of Critical Green Indicators

This section relates to the last research question which aims to identify the critical Green indicators to be considered by higher education institutions as seen in Table 3.

Table 3 Green indicators for Green practices implementation

Green Indicators	Description
Pollution reduction and prevention	A Green campus design should be responsible to provide protection to the natural environment and ecosystem. Hence, eco-friendly design standards should be based on the incorporation of architectural component, engineering practices and technology usage that will not lead to pollution of the environment. It also involves the combination of environmental consideration, aesthetic values, political social and morale consideration when designing building within campuses (Darus *et al*., 2009). Although, every university campus directly or indirectly contributes to land, water and air pollution. Organic and inorganic waste from campus operations should be ethically disposed as these wastes are the main contributors to river pollution, which affects the eco-system (Amran *et al*., 2010).
Social protection and safety	Within the university campus there is need for landscape constructions that provide sunshade cover for better condition for student's joggers', walkers and also cyclists. Besides, the campus walk way should provide variety of topographies for creating sense of protection and safety for social activities (Foo, 2013). The campus community should be safe from crime, and pedestrian-friendly towards a sense of security. Thus, sustainability practitioners should incorporate spatial procedures that support social assimilation among its community for public well-being and a sense of belonging by infusing Green elements to offer healthy environment in supporting the safety of campus community (Kasim and Ujang, 2014; Leal Filho *et al.,* 2019).
Food waste management	Campus waste disposal unit can turn food leftovers into compost, which decreases the quantity of waste sent to landfills. However, findings from Kadir *et al.* (2012) highlight that the awareness on composting initiatives relating to food waste among university staff members is still very low. Effective food waste disposal is a Green initiative aimed at decreasing CO_2 emission indirectly in creating ecological campus environment. Besides, this indicator aims to diminish the solid and food waste generated in within campus cafeterias by implementing resource recovery and recycling which moderate CO_2 emission generated (Ramli *et al.,* 2014).
Technological infrastructure deployment	This indicator highlights university focuses on the reuse of systems and technologies towards modernization and continuing restoration for energy efficiency and economic profit. Since it is a known fact that future technology will substitute the older technology, there is need for sustainability practitioners to deploy technologies and systems today that will be able to adapt to future technologies advancements (Ravesteyn *et al.,* 2014). Thus, technological infrastructures should also be installed bearing in mind their future application (Mat *et al*., 2011). Technological infrastructures or equipment and Information and Communications Technology (ICT) can also lead to energy conservation when university campuses install energy proficiency light bulbs and sensors to switch off unused lighting autonomously (Ting *et al.,* 2012; Ismail *et al.,* 2016b).

Energy management and conservation	Energy is needed for ventilation, air conditioning, heating and other operations in university campus hence sustainability practitioners should promote the use of natural lighting in the office, since natural light boosts positive mood, healthier, productive workers, increases general wellbeing, and lastly saves electricity (Kadir *et al*., 2012; Bantanur *et al*., 2015). Sustainability practitioners can implement initiatives that include installation of electric sub-meters at campus administrative, educational, residential, hostel and research buildings. In addition, campus-wide conservation energy awareness campaigns should be carried out. T8 bulbs should be replaced with T5 light fittings, use LEDs, white light with low watt light bulbs and all air-conditioning within the campus can be set to be in same temperature of about 24º centigrade after which the remotes are to be confiscated so that all air-conditioning unit in each office are to be controlled by a single remote (Darus *et al.,* 2009).
CO_2 emission management	There is need for data towards the quantification of CO_2 emission. Hence, this indicator is important in planning and analysis for implementing Green initiatives that facilitate efficient monitoring of progress achieved towards CO_2 emission decrease from energy source and thereby attaining effective management of CO_2 emitted through resources that utilizes energy within university campuses (Abdul-Azeez and Ho, 2015). Moreover, policies that aim to achieving low carbon emission in university campus should be put forward through university campuses governance strategy that considers the university's carbon footprint (Darus *et al.,* 2009)
Eco system conservation and less loss of biodiversity	Conservation of forest reserved within university campus should be encouraged. Rehabilitation and maintenance initiatives of forest should be given due concern towards stabilized the ecosystem (Darus *et al*., 2009). This indicator addresses sustainable landscape, lawn minimization, pest management, pesticide control, and native plants protecting against invasive plants (Saadation *et al*., 2009). As suggested by Ulkhaq *et al*. (2016) quite a few bio-pores, a narrow hole bored into the ground (about ten centimeters across and hundred centimeters in deep) which when filled with organic matters, can be carried out in strategic locations within the university campus to increase the biodiversity by boosting root and worm activities, to proliferate the porosity of the soil.
Transportation management	Physical development across university campus has resulted to the dependence on vehicles as a mode of commuting which has resulted to traffic congestion, air quality reduction, and a gradual loss of campus sustainability. Ramli *et al*. (2014); Kamal *et al*. (2015) affirmed the need to promote cycling and walking, hence universities should provide pavements, road crossings and public spaces for the campus society to encourage walking habit with shorter distance as this will lessen the number of vehicles in the campus. Therefore, creating a positive impact to the natural environment since motor vehicles are major cause of air pollution in campuses where the smokes (fumes) from these vehicles consists of 72 percent of carbon monoxide (CO), 70 percent of nitrogen oxides (NO), 28 percent of volatile organic compounds (VOCs), 31 percent of particulate matter (PM), CO_2 emission and noise pollution generated from the vehicles can be reduced (Darus *et al*., 2009; Rusman *et al*., 2013). Kadir *et al*. (2012) also suggested public transportation and car-pooling as a medium for university campuses to achieve clean environment. But, Ismail *et al*. (2016b) recommended telecommuting as a sustainable option that can be utilized to decrease transportation crowding within campus. Since telecommuting possess the ability to mitigate and reduce campus vehicle emissions.
Waste management	This indicator signifies the need for managing wastes generated within university campuses operations by implementing waste recycling which is the recovery of unwanted materials through reuse, either for other purposes or their original purpose (Zain *et al*., 2012). Hence, sustainability practitioners Green practice initiatives should include solid waste management governance policy. However, effective waste management mostly entails a complete understanding of waste streams composition as well as the activities that determine the waste generation. Furthermore, ethical waste management can help sustainability practitioners in university campuses ascertain pertinent opportunities toward recycling and reducing organic waste (discarded vegetable, food waste, garbage and plant matter), inorganic waste treatment (discarded paper, rubbish, metal, trash, plastic, glass, bottles etc.) (Kristanto *et al*., 2014; Sonetti *et al*., 2016). Waste management also includes taking waste off campus to a strategic dump site, for partial reuse or full recycling of the waste (Sonetti *et al*., 2016).
Rain water harvesting and management	Rainwater harvesting aims to resolve the issue of unlimited access to freshwater supply by supplementing existing water sources derived from rain fall. This indicator involves collecting rainwater using a catchment attached to campus roof buildings. Rainwater harvesting has been a form of Green practice due to its contribution to sustainable water provision (Ayog *et al.,* 2015; Ulkhaq *et al*., 2016). Likewise, other water management initiatives involve the installation of wastewater collecting and treatment plant to recycle used water within the university campus (CGSS, 2009).
People's contribution	The campus community (student, lectures, staffs, practitioners and stakeholders) have a role to play in supporting the university campus achieve sustainability (Dagiliūtė *et al*., 2018). Hence, the people must change the way they make decision relating to the natural environment. But, campus community's decision on implementing Green practices entails change in attitude towards the natural environment (Osman *et al*., 2014).
Green building facilities	Campus building development affects the entire university in terms of social, economic and environmental, thus should be centered on the institution's mission. Hence, when constructing building the physical characteristics such as land allocation, locations of academic, residential building and provision of commercial facilities should be considered (Abdul-Razak *et al*., 2011b). Sustainable development in campus calls for university design and planning committee to support Green buildings that reduce water and energy consumptions while having nominal carbon footprint (Nifa *et al*., 2015; Isa, 2016). Therefore campus buildings should be able to utilize less energy to accomplish more of the occupants (students, staffs and practitioners) needs. Accordingly, sustainability practitioners should carry out retro commissioning quality check on older campus buildings to ensure these building are efficiently operational. Also, there is need to carryout comprehensive testing of campus buildings facilities in identifying and improving deficits if needed for achieving energy saving, increases occupant comfort and moderate water consumption (Mat *et al*., 2011). Administrative offices within the campus can be designed in a way that one room could

	be divided into other rooms, thus reducing the consumption of energy. As suggested by Aljerf and Choukaife (2016) other development may include integration of solar panel systems in the buildings.
Administration management involvement	At the moment institutions of higher learning in Malaysia are pursuing sustainability (see Table 2). Although, the scope of Green practice implementation differs in respect to management culture (Hashim *et al*., 2013; Osman *et al*., 2014). The campus management committee is responsible to set the Green governance polices, processes and procedures for implementing, reviewing and maintaining university campus policy towards achieving sustainability. Hence, management involvement toward sustainable development is a continuous process for stakeholders to improve and audits the present Green initiatives being implemented within the university campus by documentation and benchmarking (Mat *et al*., 2011). Hence, it is obvious that management support and commitment towards resources allocation, both in terms of funding and personnel is very significant and serves as the preliminary strategy for an operational Green practice implementation (Ting *et al*., 2012). Thus, management should provide adequate support and also participate by implementing Green practices, since management participation shows a good example to staffs in the university that they are serious about addressing environmental issues. Lastly, management should establish pertinent policies, based on the institutions' vision and mission.
Budget allocation	This indicator is important in facilitating sustainable development. But, findings from researchers such as Kadir *et al.* (2012) suggested that budget allocated towards supporting Green practices in university campuses is limited, this fact was also supported by Ismail *et al*. (2016a) who mentioned that economic crisis faced by higher education institutions has made it a challenge to prioritize budget to support environmental protection. Hence, Kadir *et al.* (2012) mentioned that due to budget constraints most university campus departments do not installed energy saving lights. The need for considerable cost savings currently disrupts maintenance budget which in turn affects sustainable development (Ismail *et al*., 2016a). Thus, more funds should be directly for Green initiatives in implementing Green policies within higher education institutions.
Information management	Campus communities are faced with the provision of adequate information on how they can implement Green practices as such lack of precise knowledge leads to energy wastage and also prohibit energy conservation practice within the university (Ting *et al*., 2012). Information on environmental protection and issues related to climatic changes can be raised in university campuses through various channels, such as sustainability campaigns, distribution of Green stickers with important messages, monthly Green implementation newsletters, Green knowledge competitions, campus Green week, and other pertinent methods that could lead to creating awareness on sustainability within the campus community (Ting *et al*., 2012). Hence, sustainable practitioners should provide information or Green best practice that could help in improving existing Green practice being implemented in the university (Nifa *et al*., 2015). Information concerning implementation of Green governance policies, procedures and environmental management initiatives should be provided by sustainability committee or sustainability department (Saleh *et al.,* 2011). Knowledge about environmental protection and conservations can affect the attitude of campus community toward the eco-system which in turn influences their behavior.
Green procurement	Green procurement is the practice of purchasing of environmentally friendly services and products by sustainability practitioners when they outsource equipment needed in the university (Bantanur *et al*., 2015). Thus, in attaining Green procurement initiatives, sustainability departments need work with the ICT department and maintenance department to ensure they purchase only product that has Green label and are eco-friendly. Sustainability practitioners can also purchase recycled reusable and durable material such as rechargeable batteries, papers, etc. (Kadir *et al*., 2012; Ragazzi, and Ghidini, 2017).
Partnership and collaborations	Achieving sustainable development in higher education institutions requires partnership with governmental private and non-governmental organizations. Universities can collaborate with external associations' for research and development in commercializing Green initiatives and programs. The collaboration can either be with domestic, national or globally based associations (Mat *et al.,* 2011). A particular university can also collaborate with other university in attaining sustainability. Hence, relevant Green practice implementation training materials can be adopted from other universities that have appropriate experience (Ting *et al*., 2012). Thus, collaboration among universities is very crucial in encouraging and promoting sustainability for a viable future (Isa, 2016).
Sustainability Education	Education in institution of higher learning provides campus community with an understanding of the critical environmental problems currently faced by the world. It presents an agenda on the problems, possible solutions and the role that the campus society have in reducing negative environmental effects (Kasim and Ujang, 2014). Thus, for Green campus paradigms to be in line with sustainable development there is need to educate future generations towards the concept of sustainability (Osman *et al*., 2014; Akib *et al*., 2017). Moreover, Green practice education provides a prospect to train the campus community on how they can be socially responsible towards environmental protection (Hamón *et al*., 2017). Therefore, provided education creates awareness among campus community on current development relating to sustainability gains of Green practice implementation (Ting *et al.,* 2012; Reza, 2016). Hooi *et al.* (2012) added that education towards sustainable development in universities develops the skills and knowledge of campus society in making decisions collectively, individually locally, and internationally towards presently improving the quality of life without altering the future.
Green Lifestyle	One of the Green indicators is the lifestyle of university community. Hence, there is need for sustainable practitioners to encourage photocopying and printing on both sides of the paper. Also, paperless initiative as a strategy to lessen waste should be supported as a life style across the campus, by utilizing web based system. Furthermore, text style in word documents should be formatted as single spacing other than double spacing to lessen paper consumption (Kadir *et al*., 2012). Thus, such initiatives can help reduce paper, since paper is one of the most utilized materials and paper industry is the 5th largest industrial energy consumer (Zen *et al*., 2016). Furthermore, plastic bags usage in campuses should be limited since plastic use results to environmental issues which are hazardous to aquatic life particularly when they end up in sea and are mistaken eaten by animals as food and these plastics bags (polythene) are not naturally biodegradable (Akib *et al*., 2017).

Agriculture	According to Sonetti *et al*. (2016) the agricultural part of the university involves area on campus covered in vegetation in form of forest plantation. Agriculture is important in various areas of life as also in the university. Hence, there is need to reduce landscaping by avoiding lawns, planting more trees and moderate cutting of trees. This is useful for flood management, drought prevention and productions of Oxygen (O_2) from the trees and vegetation which helps to reduce CO_2 used for photosynthesis. Thus, there is need to reduce the usage of pesticide on the environment (Jegatesen and Koshy, 2013). In addition, instead of using chemicals and artificial fertilizers a Green initiative of creating fertilizers from the leaves can be employed. Likewise, manures can be gotten from livestock's waste within the university.
Health	This indicator represents the university campus focus on the wellness of the campus community (administrative technicians, teaching staff and students) that support all activities undertaken in terms of the fitness and quality of life, paying particular attention to food, education and research (Sonetti *et al*., 2016). Accordingly, healthy practices can be applied in the offices and all departments by having appropriate indoor living plants in offices. This is supported by finding from Kadir *et al*. (2012) where the authors identified that plants in office reduces stress, improves office appearance, promotes indoor air quality, diminishes air pollution and also encourage wholesome living for a cleaner environment (Jegatesen and Koshy, 2013).

Table 3 depicts the identified Green indicators to guide, as well as serving as an effective tool for monitoring and evaluating existing Green practices being adopted in universities. Besides, the identified Green indicators provide information that educates and supports sustainability practitioners in addressing sustainability issues.

4.4.Developed Policy Framework

The concept of Green campus paradigms was introduced in this study as one of the approach for attaining sustainability in fostering environmental economic, social and development. As seen in Section 4.1 several declarations such as Stockholm Declaration, Tbilisi Declaration, Talloires Declaration etc. formally ascertains the role of institutions of higher learning in progressing sustainability at the global level. Also, findings presented on the Green campus paradigms implemented in Malaysian institutions of higher learning corroborates with the standards set by these declarations such as Agenda 21 which highlights societal consumption, technological development, and population growth which are the main forces of environmental change. Additionally universities in Malaysia are currently taking steps towards decreasing inefficient and wasteful consumption lifestyle while promoting sustainability. Respectively, out of 20 public universities, 41 private universities and university colleges and lastly 485 private colleges in Malaysia only a few higher education institutions are currently implementing Green practices as seen by the description of the university provided in Table 2.

Findings from Table 2 suggest that Malaysia higher education institutions are implementing Green practice in reducing their carbon footprint and upholding sustainable development by focusing on using eco-friendly materials in their daily operational activities within their campuses. Although, it is evident that Green initiatives had been undertaken by Malaysia higher education institutions where some universities have contributed towards energy saving, waste management CO_2 reduction, water management and other related areas. However, there are still issues that impede sustainable development in higher education institutions as presented in Section 1.1. However, in supporting sustainable development attainment in universities there is need for a framework for managing the social, environmental and economic aspects of sustainable development. The framework can act as a master plan to guide and enhance university campus development. Therefore, this sub-section presents the developed comprehensive multi-disciplinary

policy framework which comprises of Green indicators derived from Table 3 as shown in Figure 2.
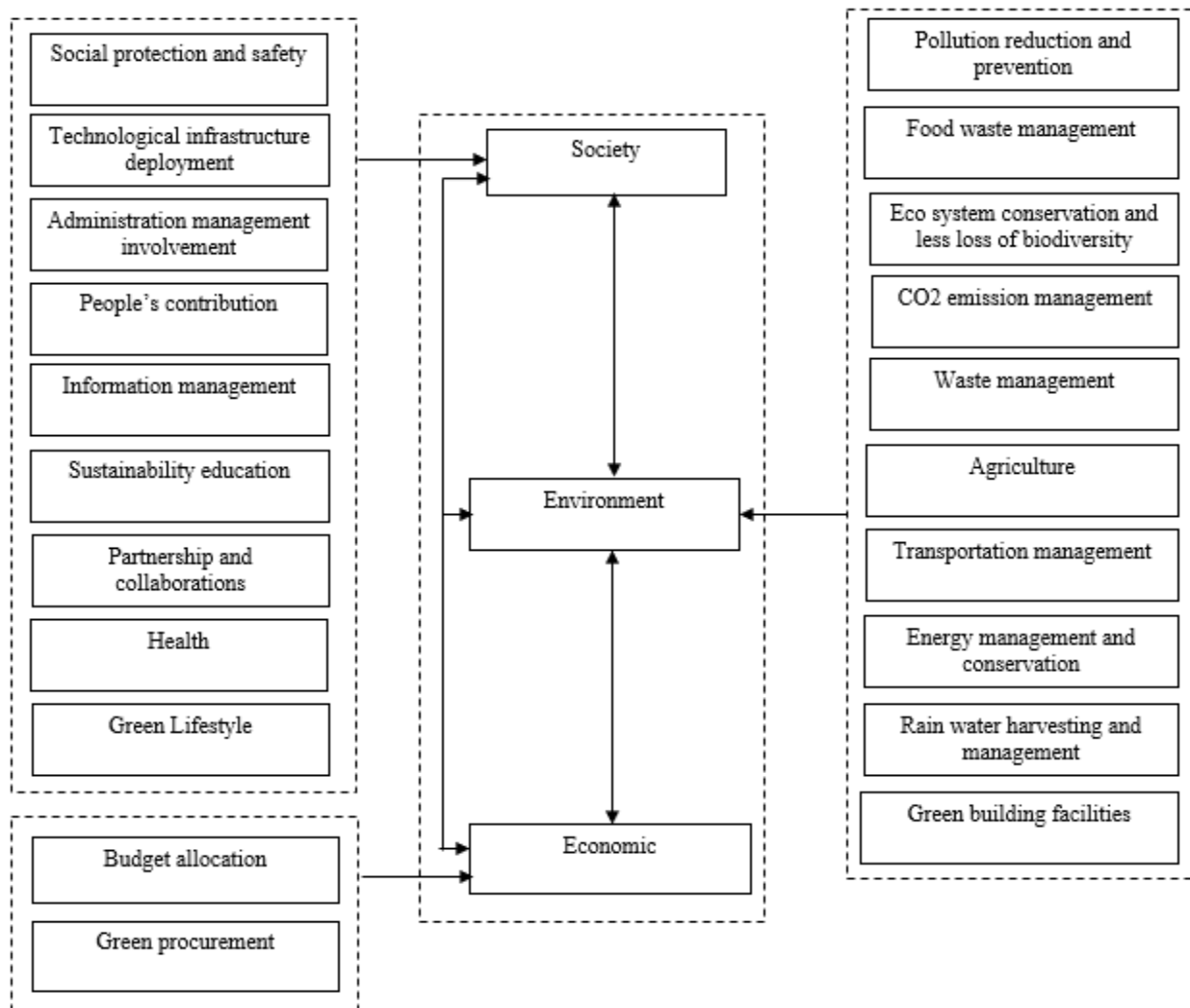

Figure 2 Developed multi-disciplinary policy framework

Institutions of higher learning comprise of complex system which includes several indicators that are to be considered (as seen in Table 3) as an integral approach in attaining sustainable development. Although, the Green indicators cannot be designed as isolated elements they have to be created in the framework or a plan, therefore this study integrated the identified Green indicators discussed in Table 3 into a comprehensive policy framework (see Figure 2) that provides hands-on practical experiences to sustainability practitioners in walking the talk and leading by example. The policy framework comprises of the identified Green indicators linked to the dimensions of sustainability. The policy framework provides an interdisciplinary collaboration and communication among sustainability practitioners by providing information on the critical Green indicators to be considered for Green campus paradigm toward sustainable development.

4.5.Comparative Analysis of Selected Universities

Findings from a few higher education institutions across Malaysia (see Table 2) indicate that university campuses are incorporating the principles of Agenda 21 as one of the important sustainable development documents in their governance planning procedures (Ryan *et al*., 2010; Madeira *et al*., 2011). Also, results from Table 4 shows a comparative analysis of the selected universities in Malaysia in relation to their current practice implementation of Green indicators.

Table 4 Comparative analysis of selected universities in Malaysia

Indicators	UPSI	UUM	USM	UTM	UKM	UiTM	UM	UPM	UMP	IIUM	UMS	UCSI	Monash	UniMAP	Taylor	Sunway
Social protection and safety	3	2	2	2	3	2	4	4	3	2	2	2	2	3	2	2
Technological infrastructure deployment	3	4	3	4	4	2	3	3	4	3	3	3	2	3	3	2
Administration management involvement	3	2	3	4	3	2	3	3	3	3	3	2	2	2	2	5
People's contribution	2	2	2	3	3	2	3	3	3	2	3	2	2	2	2	5
Information management	2	2	3	3	2	2	2	3	4	2	3	2	2	2	2	5
Sustainability Education	3	4	3	4	4	3	3	4	3	2	3	2	2	2	2	5
Partnership and collaborations	2	2	2	2	3	2	3	2	3	2	3	2	2	2	2	4
Health	2	2	3	3	2	2	3	2	2	2	2	3	2	2	2	2
Green Lifestyle	2	2	2	3	2	2	3	4	3	2	2	2	2	2	2	2
Pollution reduction and prevention	2	2	2	3	3	2	3	4	4	2	3	3	3	4	3	4
Food waste management	2	2	2	4	3	2	2	2	4	2	2	2	2	2	2	2
Eco system conservation and less loss of biodiversity	2	2	2	4	2	2	2	5	4	3	4	2	2	3	4	4
CO2 emission management	2	2	2	3	2	4	2	3	2	2	2	2	3	3	2	3
Waste management	2	2	2	4	2	3	2	4	4	2	4	3	3	3	2	2
Agriculture	2	2	2	2	2	2	2	5	3	3	4	2	2	2	3	2
Transportation management	3	2	3	3	5	4	5	5	3	3	4	2	3	2	4	3
Energy management and conservation	3	5	3	5	5	3	3	5	5	3	3	4	3	4	5	3
Rain water harvesting and management	2	2	5	2	5	2	3	4	4	2	5	3	5	2	2	1
Green building facilities	5	4	3	3	5	4	4	5	5	3	3	2	2	4	4	3
Budget allocation	2	2	3	3	3	2	4	4	4	2	3	3	2	4	3	5
Green procurement	2	2	5	3	3	2	4	4	4	3	3	2	2	4	4	3
Total Score (105)	**51**	**51**	**57**	**67**	**66**	**51**	**63**	**78**	**74**	**50**	**64**	**50**	**50**	**57**	**57**	**67**

The universities are measured based on a 5-point Likert scale ranging from "2" as not considered, "3" as neutral and "5" as fully considered to examine the correlation of research

question 2 and 4. The rating for each university is based on the information provided by the institution in their sustainability of Green center web portal. The results of the analysis suggest that UPM is the most sustainable university with a score of 78 out of 105 this result is consistent with findings published by (UI Green Metric, 2019), followed by UMP with 74, and then UTM, Sunway university, etc. Moreover, findings from Table 4 show the correlation of the Green indicators mapped to the current sustainability state of the selected universities based on their current social, environmental, and economy status. Moreover, findings from Table 4 reveal that all Green indicators are being adopted by the reviewed universities however differs in magnitude of implementation based on different rating presented in Table 4.

5. Discussion

In recent years, sustainable development has become an important part of many corporate social responsibility agendas. Thus, there is need for a paradigm shift towards building a low carbon sustainable society to deal with climate change (Velazquez *et al*., 2005). This statement was also supported by Kamal *et al.* (2015) when the authors suggested that there is urgent need for every level of society to review their actions and aim to be better stewards of our natural resources for developing low-carbon economies. The expanding university campus in Malaysia is reflected in the numbers of universities established in the country. The rapid expansion of the campuses is in line with the aim of the Malaysian Ministry of Education to place Malaysia on the map as one of the top spots for educations. Therefore, sustainability in higher education institutions calls for universities to promote Green practices that reduce energy and water consumptions while having negligible carbon footprint.

The target of Green practice initiatives also aims to have better lighting, temperature control, improved ventilation and indoor air quality which contribute to healthy environments. However, to support sustainability practitioners implement Green practices a comprehensive measure should be put in place to change campus community and managerial mind-sets of stakeholders, decision makers and more specifically campus administrators towards ensuring that they support Green practices (Nifa *et al*., 2016). Hence, the Malaysia Educational Blueprint for Higher Education 2015–2025 (MEBHE) was announced in early April 2015 to transform Malaysia's institutions of higher learning sector. This blueprint suggested a productive collaboration between industry and academicians, as well as to progress the efficiency and efficiency of institutions of higher learning towards enhancing the overall sustainability of the current system (Zen *et al*., 2016).

Therefore, Malaysia higher education institutions are implementing Green practices to attain sustainable development and reduce Green House Gases (GHGs) emission by 40 percent per GDP by 2020. To this end Malaysia, like the other countries, jointly supported and engaged in efforts to achieve sustainable development. University seen as an institution with the potential for triggering the sustainability of a country has unique features that enable it to assist a country in

solving many challenges within the context of sustainable development. University either directly or indirectly performs various operations and activities that have the potential to impact the environment either positively or negatively. This is because a campus is inhabited by a large population and covers a wide area (Isa, 2016). Moreover, it is observed that many governmental departments and agencies have been following this policy directive in implementation. Besides, findings from Reza (2016) indicated that considerable efforts had been put forth by the government to include sustainable development agendas in Malaysia higher education institutions. Besides, Findings from Reza (2016) also revealed that although many aspects of sustainable development are being implemented in universities across Malaysia now, no institute or center exists having all these domains under the same umbrella.

While, the dimensions of sustainable development have been addressed separately in universities, the integration and coordination of the three dimensions (social, economic and environment) are not sufficiently deployed. Therefore, this study developed a policy framework based on the findings from existing Green practices implementation presented in Table 2 and Green indicators derived from the literatures and sustainability document review shown in Table 3. The developed comprehensive multi-disciplinary policy framework is different from existing approaches previously presented because it is based on existing Green best practices currently been implemented in higher education institutions. The framework provides a multi-disciplinary approach that can be applied in more than one research domain in addressing the economic, social, and environmental sustainability.

6. Implication of Study

6.1. Research Implications

Higher education institutions involves several activities each with implications to the eco-system that directly or indirectly impact the environment but over the years, universities operations have been generally overlooked in terms of environmental and social responsibility (Larrán *et al*., 2016). Only the economic related operations have been fully addresses, hence to resolve the environmental and social dimensions, university activities require the provision of information for monitoring of significant environmental and social impacts (Ceulemans *et al*., 2015). This study provided theoretical implication for Green campus paradigms towards attainment of sustainability in higher education institutions to include policies defined across social, economic and environment sustainability.

Accordingly, the social dimensions aim to develop a healthier society with openness in diminishing barrier, as well as to initiate a fair society, through respect, integrity and ethical norms so as to enhance public oneness for harmonious living. The economic dimension aims to realize cost efficiency by implementing Green infrastructure and facilities, promoting economic viability, optimization of university campus assets in realizing efficacy in operational management of natural resources and equipment as well as to safeguard the successful implementation of Green

governance policies. Lastly, the environmental focuses on implementing low carbon initiatives within the university campus and aims to improve ecological friendly initiatives through the decrease of water and energy consumption in diminishing pollution.

Furthermore, this research developed a comprehensive multi-disciplinary policy framework based on the identified Green indicators for attainment sustainability in higher education institutions. The developed framework includes indicators and action plans to provide guide to sustainability practitioners from different disciplines in implementing Green practices for sustainable development. The policy framework also embodies Green initiatives for decrease of natural resources usage, competent human resources requirement, educating the campus society and incentives provision. Moreover, the policy framework provides an action plans that ensure that university's objectives are implemented with appropriate capital and human resources in a shorter period. Lastly, the policy framework is developed based on the current Green practices implemented across university campuses, prevalent issues and realistic opportunities towards sustainable development attainment in institutions of higher learning.

6.2.Practical Implications

Over the years sustainable development has affected the current paradigms, structures as well as effective practices in institutions of higher education. The practical implication of this study relating to sustainable development in higher education institutions can be regarded as a transformative and integrative approach which requires a Green campus paradigm that infuses an interdisciplinary approach in creating a balance of interaction between the campus community and the natural environment. Practically, this study designs a policy framework that comprises of Green indicators aimed at promoting eco-friendly practices while having nominal carbon footprint and creating students that possess Green attitude towards the natural environment.

The policy framework also suggest how sustainable practitioners in higher education institutions can implement energy efficient Green buildings facilities that have better lighting, efficient temperature control, enhanced ventilation and better indoor air quality which contribute to healthy environments by reducing hazardous air pollutants that cause respiratory illness. This study provides a policy framework that addresses all gaps between existing practices and the best practices of Green practice implementation towards social, environmental, and economy sustainability. Furthermore, this study provides an agenda for managing energy conservation efficiency in enhancing resource conservation, waste management and recycling, water management and water usage conservation which can be enhanced through the collection and harvesting of rain water to support sustainable water consumption in higher education institutions. Hence, this study provides an integrative and transformative comprehensive multi-disciplinary policy framework that addresses all gaps between existing practices and best practices of Green practice implementation (see Table 2).

7. Conclusions, Limitations and Future works

Higher education institutions comprise of university campuses where a university can be considered as smaller cities inhabiting a large portion of land mass with traffics and growing populations with various activities mostly related to research and education. Hence, due to the activities carried out in campuses that have direct and indirect impact to the society, Green practice implementation is suggested for protecting and conserving the health and well-being of society and natural environment in achieving sustainable development within university campus. At the moment Green initiatives are being undertaken in a few university campuses in Malaysia (see Table 2) towards achieving sustainability. However, these universities are faced with issues (See Section 1.1). Thus, it is important for sustainability practitioners to take full responsibility for addressing issues related to sustainable development in their universities. But, issues related to sustainable development are becoming multidimensional and interconnected and hence requires a systematic and integrated method for governing environmental issues.

Therefore, this study utilized data from existing literature and sustainability document in presenting existing declarations and summits initiated across 1972-2009 that have been carryout to support higher education institutions towards sustainability attainment. Next, this study explored on institutions of higher learning in Malaysia that are currently implementing Green practices for sustainability attainment. Moreover, existing models or frameworks developed to support Malaysia higher education institutions in attain sustainable development was reviewed. Lastly, this study identified the critical Green indicators to be considered by higher education institutions for sustainability attainment after which a comprehensive multi-disciplinary policy framework was developed based on the identified Green indicators aligned with social, economic and environmental dimensions. Also, the policy framework provides an interdisciplinary collaboration and communication among sustainability practitioners in university campuses towards providing information on critical Green indicators needed in attaining sustainability.

Accordingly, through the implementation of the comprehensive multi-disciplinary policy framework, sustainability practitioners can establish a baseline to reduce carbon emission rate within university campus by lessening electricity utilization that has taken place over the years as a basis to help mitigate environmental issues and related climate change. The limitations of the study are aligned to the fact that firstly, no empirical data was collected. In this study, data was collected from sustainability archival documents and prior studies on sustainable development in Malaysia higher education institutions. Secondly, findings from this study are from Malaysia universities as such cannot be generalized to other countries. Lastly, no hypotheses were developed in the study. Future work will refine the developed policy framework and also propose hypotheses for empirical testing. Moreover, quantitative method using survey questionnaire will be employed to evaluate the identified Green indicators presented in the designed multidisciplinary policy framework. The data will be collected from sustainability practitioners from universities presented in Table 2 and the collected data will be analyzed using Structural Equation Modeling (SEM) approach.

References

Abd-Razak, M. Z., Abdullah, N. A. G., Nor, M. F. I. M., Usman, I. M. and Che-Ani, A. I. (2011a), *"*Toward a sustainable campus: Comparison of the physical development planning of research university campuses in Malaysia", *Journal of Sustainable Development*, Vol. 4 No. 4, pp.210.

Abd-Razak, M. Z., Mustafa, N. K. F., Che-Ani, A. I., Abdullah, N. A. G. and Mohd-Nor, M. F. I. (2011b), "Campus sustainability: Student"s perception on campus physical development planning in Malaysia", *Procedia Engineering*, Vol. 20 No. 1, pp.230-237.

Abdul-Azeez, I. A. and Ho, C. S. (2015), "Realizing Low Carbon Emission in the University Campus towards Energy Sustainability", *Open Journal of Energy Efficiency*, Vol. 4 No. 2, pp.15-27.

Ahmad, A. S., Hassan, M. Y., Abdullah, H., Rahman, H. A., Majid, M. S. and Bandi, M. (2012), "Energy efficiency measurements in a Malaysian public university", *International Conference on Power and Energy,* pp.582-587.

Ahmad, T., Badariah, T., Bello, A. and Nordin, M. S. (2013), "Exploring Malaysian university students" awareness of green computing", *GSTF International Journal on Education*, Vol. 1 No. 2, pp.92-102.

Akib, N. A. M., Sibly, S., Hassan, M. S., Noor, R. M., Koshy, K. C. and Ibrahim, K. (2017), "Increasing Student Participation and Engagement in Sustainability Projects in Universiti Sains Malaysia (USM) Through Kampus Sejahtera and WSU101: Sustainability Course for Undergraduates", *Handbook of Theory and Practice of Sustainable Development in Higher Education*, pp.277-286.

Aljerf, L. and Choukaife, A. E. (2016), "Sustainable Development in Damascus University: A Survey of Internal Stakeholder Views", *J Environ Stud*, Vol. 2 No. 2, pp.1-12.

Alshuwaikhat, H. M. and Abubakar, I. (2008), "An integrated approach to achieving campus sustainability: assessment of the current campus environmental management practices", *Journal of Cleaner Production*, Vol. 16 No.16, pp.1777-1785.

Amran, A., Nabiha, A. K. S., Abdul-Razak, D and Haron, H. (2010), "Development of MBA with specialisation in sustainable development: The experience of Universiti Sains Malaysia", *International Journal of Sustainability in Higher Education*, Vol. 11 No. 3, pp. 260-273.

Anthony Jnr, B., Abdul Majid, M. and Romli, A. (2019), "Emerging case oriented agents for sustaining educational institutions going green towards environmental responsibility", *Journal of Systems and Information Technology*. Vol. 21 No. 2, pp. 186-214.

Anthony Jnr, B., Abdul Majid, M., & Romli, A. (2019). Green information technology adoption towards a sustainability policy agenda for government-based institutions: An administrative perspective. *Journal of Science and Technology Policy Management*. Vol. 10 No. 2, pp. 274-300.

Anthony, B., Majid, M. A. and Romli, A. (2017), "An agent based Green assessment system architecture for sustainable practice implementation among IT practitioners in university campuses", *8th International Conference on Information Technology (ICIT)*, pp. 17-25.

Ayog, J. L., Bolong, N. and Makinda, J. (2015), "Feasibility Study of Rainwater Harvesting in Universiti Malaysia Sabah"s Residential Colleges in Support Of the Eco-Campus Initiative", *2nd Regional Conference on Campus Sustainability: Capacity Building in Enhancing Campus Sustainability*, Kota Kinabalu, Malaysia, pp. 206-216.

Azlin, A. Z. B., Er, A. C., Rahman, N. B. A. and Alam, A. F. (2016), "Consumers" roles and practices towards sustainable UKM campus", *International Journal of Advanced and Applied Sciences*, Vol. 3, No. 2, pp.30-34.

Bakhshi, M., Othman, N. and Wahab, M. H. B. (2015), "Green Campus in Promoting Green Open Spaces in University Technology Malaysia Kuala Lumpur Campus", *International Joint Conference SENVAR-iNTA-AVAN*, pp.1-14.

Bantanur, S., Mukherjee, M. and Shankar, R. (2015), "Sustainability perceptions in a technological institution of higher education in India", *Current Science*, Vol. 109 No. 12, pp. 2198-2203.

Brundtland, G. H. (1987) "World commission on environment and development", *Environmental policy and law*, Vol. 14, No.1, pp. 26-30.

Capdevila, I., Bruno, J. and Jofre, L. (2002), "Curriculum greening and environmental research co-ordination at the Technical University of Catalonia, Barcelona", *Journal of Cleaner Production*, Vol. 10 No.1, pp.25–31.

Ceulemans, K., Lozano, R. and Alonso-Almeida, M. D. M. (2015), "Sustainability reporting in higher education: Interconnecting the reporting process and organizational change management for sustainability", *Sustainability*, Vol. 7 No. 7, pp.8881-8903.

CGSS. (2009), Centre for Global Sustainability Studies. http://cgss.usm.my/ (Accessed 22 December 2016).

Dagiliūtė, R., Liobikienė, G. and Minelgaitė, A. (2018), "Sustainability at universities: students' perceptions from green and non-green universities", *Journal of cleaner production*, Vol. *181*, No.1, pp. pp. 473-482.

Darus, Z. M., Rashid, A. K. A., Hashim, N. A., Omar, Z., Saruwono, M. and Mohammad, N. (2009), "Development of sustainable campus: Universiti Kebangsaan Malaysia planning and strategy", *WSEAS Transaction on environment and development*, Vol. 5 No. 3, pp.273-282.

Elmuradov D.B., Jusoh M.S., Mohd. Zain Z., Za"aba S. K. and Baadhem, A. M. (2017), "Theoretical Development of Sustainability Management System and Sustainability Performance: An Investigation of Malaysian Higher Education Institutions", *Australian Journal of Basic and Applied Sciences*, Vol. 9 No. 13, pp.209-217.

Foo, K. Y. (2013), "A vision on the role of environmental higher education contributing to the sustainable development in Malaysia", *Journal of Cleaner Production*, Vol. 61 No.1, pp.6-12.

Greensteps.edu. (2016), Green Steps. http://www.greensteps.edu.au/malaysia (Accessed 20 December 2016).

Hamón, L. S., Aldaz, C. B., Pomeda, J. R., Fernández, F. S. and De Navarrete, F. C. F. (2017), "From Ecocity to Ecocampus: Sustainability Policies in University Campuses", *International Journal of Sustainable Development and Planning*, Vol. 12 No. 3, pp.541-551.

Hashim, R., Haron, S., Mohamad, S. and Hassan, F. (2013), "Assessment of campus bus service efficacy: an application towards green environment", *Procedia-Social and Behavioral Sciences*, Vol. 105 No.1, pp.294-303.

Hooi, K. K., Hassan, F. and Mat, M. C. (2012), "An exploratory study of readiness and development of green university framework in Malaysia", *Procedia-Social and Behavioral Science,* Vol. 50 No.1, pp.525-536.

Hooi, K. K., Hassan, P. and Jami, N. A. (2011), "Sustainable education: an assessment of carbon footprint at UCSI University and proposed green campus initiative framework", *3rd International Conference on Information and Financial Engineering*, pp. 342-347

Isa, N. K. M. (2016), "Sustainable campus and academic staffs awareness and behaviour in Malaysia"s institutions of higher learning: A case study of UPSI", *Malaysian Journal of Society and Space,* Vol. 12 No. 6, pp.89-99.

Ishak, M. H., Iman, A. H. M., Sapri, M. (2012), "Theoretical postulation of energy consumption behaviour assessment in Malaysian higher education institutions", *Procedia-Social and Behavioral Sciences*, Vol. 65 No.1, pp.891-896.

Ismail, F. D., Hamsa, A. A. K. and Mohamed, M. Z. (2016a), "Factors influencing the stated preference of university employees towards telecommuting in International Islamic University Malaysia", *Transportation Research Procedia*, Vol. 17 No.1, pp.478-487.

Ismail, M. A., Al-Obaidi, K. M. and Sulaiman, R. (2016b), "Energy Efficiency Policy For Existing Typical Campus Buildings In The University of Malaya", *Planning Malaysia Journal*, Vol. 14 No. 5, pp.129 – 144.

Jegatesen, G. and Koshy, K. (2013), "Systemic Transformation of Higher Education Institutions for a Sustainable Future: the Role of Indicators", pp.1-22.

Johan, K. and Turan, F. M. (2016) ,"The development of Sustainability Graduate Community (SGC) as a learning pathway for sustainability education-a framework for engineering programmes in Malaysia Technical Universities Network (MTUN)", *IOP Conference Series: Materials Science and Engineering*, Vol. 160 No.1, 1-7.

Junior, B. A. (2019), "A retrospective study on green ICT deployment for ecological protection pedagogy: insights from field survey", *World Review of Science, Technology and Sustainable Development*, Vol. 15 No. 1, pp. 17-45.

Junior, B. A., Majid, M. A. and Romli, A. (2018), "Green information technology for sustainability elicitation in government-based organisations: an exploratory case study", *International Journal of Sustainable Society*, Vol. 10 No. 1, pp. 20-41.

Kadir, S. M. A., Ridzuan, M. R., Nor, N. M., Fizri, F. F.A and Sibly, S. (2012), "Implementing Sustainability on the Campus: Towards A Better Understanding of Sustainability Initiatives", *LUK2012*, pp. 1191-1198.

Kamal, M. M. M., Hanapi, N. M. and Raus, M. I. M. (2015), "The Case Study of 30 years UiTM Pahang"s Development as a Sustainable University Campus", *KONAKA 2015,* pp.148-154.

Karpudewan, M., Hj Ismail, Z. and Mohamed, N. (2009), "The integration of green chemistry experiments with sustainable development concepts in pre-service teachers" curriculum: Experiences from Malaysia", *International Journal of Sustainability in Higher Education*, Vol. 10 No. 2, pp.118-135.

Kasim, Z. and Ujang, N. (2014), "Perception towards sustainability polytechnic campus in Malaysia", *ALAM CIPTA, International Journal on Sustainable Tropical Design Research & Practice*, Vol. 7 No. 1, pp.15-26.

Kristanto, G. A., Priadi, C., Orientilize, M., Udhiarto, A. and Bahsan, E. (2014), "Towards green and sustainable society: A case of engineering faculty, Universitas Indonesia", *ICUE,* pp.1-6.

Kwami, H. I., Che-Ani, A. I., Tawil, N. M., Tahir, M. M. and Basri, H. (2014), "Approach to Campus Sustainability at Universiti Kebangsaan Malaysia (UKM): A Review", *E3S Web of Conferences*, pp. 1-7.

Larrán, M., Herrera, J. and Andrades, F. J. (2016), "Measuring the linkage between strategies on sustainability and institutional forces: an empirical study of Spanish universities", *Journal of Environmental Planning and Management*, Vol. 59 No.6, pp.967-992.

Leal Filho, W., Will, M., Salvia, A. L., Adomßent, M., Grahl, A., and Spira, F. (2019), "The Role of Green and Sustainability Offices in Fostering Sustainability Efforts at Higher Education Institutions", *Journal of Cleaner Production*, Vol. 232 No.1, pp. 1394-1401.

Madeira, A. C., Carravilla, M. A., Oliveira, J. F. and Costa, C. A. (2011), "A methodology for sustainability evaluation and reporting in higher education institutions", *Higher Education Policy*, Vol. 24 No. 4, pp.459-479.

Mat, S. O. H. I. F., Sopian, K., Mokhtar, M., Ali, B., Hashim, H. S., Rashid, A. K. A. and Zain, M. F. M. (2011), "Managing Sustainability in Universiti Kebangsaan Malaysia", *Environmental Problems and Development*, pp.33-38.

Monash.edu. (2016), Taking the lead on sustainability in Malaysia http://www.monash.edu/news/articles/taking-the-lead-on-sustainability-in-malaysia (Accessed 20 December 2016).

MYGREEN. (2014), Green UMP www.mygreen.ump.edu.my (Accessed 20 December 2016).

Nejati, M. and Nejati, M. (2013), "Assessment of sustainable university factors from the perspective of university students", *Journal of Cleaner Production*, Vol. 48 No.1, pp.101-107.

Nifa, F. A. A., Nawi, M. N. M. and Rahim, S. A. (2014), "An IPD framework for sustainable design in UUM campus development", *International Symposium on Technology Management and Emerging Technologies,* pp. 291-295.

Nifa, F. A. A., Nawi, M. N. M., Nadzri, W. and Osman, S. A. R. (2015), "Towards Development of Sustainable Design in Malaysian University Campus: A Preliminary Framework for Universiti Utara Malaysia", *Jurnal Teknologi*, Vol. 77 No. 5, pp.43–49.

Nifa, F. A. A., Rahim, S. A., Rani, W. N. M. W. M. and Ismail, M. N. (2016), "Collaborative procurement for developing a sustainable campus", *AIP Conference Proceedings*, pp. 1-6.

NST. (2016), Sunway sets hub sustainable development http://www.nst.com.my/news/2017/03/197965/sunway-sets-hub-sustainable-development (Accessed 20 December 2016).

Osman, A., Md, I. F., Othman, S. N. and Jaganathan, M. (2014) ,"Attitude towards recycling among business undergraduate students in Malaysia", *American-Eurasian Journal of Sustainable Agriculture*, Vol. 8 No. 13, pp.6-12.

Peter, C. J., Libunao, W. H. and Latif, A. A. (2016), "Extent of Education for Sustainable Development (Esd) Integration in Malaysian Community Colleges." *Journal of Technical Education and Training*, Vol. 8 No. 1, pp.1-13.

Ragazzi, M. and Ghidini, F. (2017), "Environmental sustainability of universities: critical analysis of a green ranking", *Energy Procedia*, Vol. 119 No.1, pp. 111-120.

Rahim, A. A., Fizri, F. F. A., Koshy, K. C., Chacko, K., Othman, M., Nor, M., Md, N. and Sibly, S. (2014), "Sustainability-led Institution: Case of Universiti Sains Malaysia, Penang", *Development of learning materials and methodological support on Sustainable Production and Consumption*, pp.1-12.

Ramli, N. A., Zen, I. S., Bandi, M. and Tajuddin, H. A. (2014), "Reduction in Carbon Dioxide Emissions and Global Climate in Campus: From Policy into Action", pp. 1-23.

Ravesteyn, P., Plessius, H. and Mens, J. (2014), "Smart Green Campus: How IT can Support Sustainability in Higher Education", *Proceedings of ECMLG2014*, pp. 296-303.

Reza, M. I. H. (2016), "Sustainability in Higher Education: Perspectives of Malaysian Higher Education System", *SAGE Open*, Vol. 6 No. 3, pp. 1-9.

Rusman, M. S., Toyong, N. M. P., Yusuff, K. M. and Kamaruzaman, M. F. (2013), "Role of bicycle as a sustainable transportation in Universiti Teknologi MARA", *IEEE Business Engineering and Industrial Applications Colloquium,* pp. 780-783.

Ryan, A., Tilbury, D., Blaze Corcoran, P., Abe, O. and Nomura, K. (2010), "Sustainability in higher education in the Asia-Pacific: developments, challenges, and prospects", *International Journal of Sustainability in Higher Education*, Vol. 11 No. 2, pp.106-119.

Saadatian, O., Sopian, K. B. and Salleh, E. (2013), "Adaptation of sustainability community indicators for Malaysian campuses as small cities", *Sustainable Cities and Society*, Vol.6 No.1, pp.40-50.

Saadation, O., Salleh, E., Mohd Tahir, O. and Dola, K. (2009), "Observations of sustainability practices in Malaysian research universities: highlighting particular strengths", *Pertanika Journal of Social Sciences & Humanities*, Vol. 17 No. 2, pp.225-244.

Saleh, A. A., Kamarulzaman, N., Hashim, H. and Hashim, S. Z. (2011), "An approach to facilities management (FM) practices in higher learning institutions to attain a sustainable campus (case study: university technology Mara-UiTM)", *Procedia Engineering*, Vol. 20 No.1, pp. 269-278.

Sanusi, A. Z. and Khelghat-Doost, H. (2008), "Regional Centre of Expertise as transformational platform for sustainability: A case study of Universiti Sains Malaysia, Penang", *International Journal of sustainability in higher education*, Vol. 9 No. 4, pp.487-497.

Sapri, M. and Muhammad, S. (2010), "Monitoring energy performance in higher education buildings for sustainable campus", *Malaysian Journal of Real Estate*, Vol. 5 No. 1, pp.1-25.

Shari, Z., Jaafar, F. Z., Salleh, E. and Haw, L. C. (2006), "Integration and implementation of sustainability in Malaysian architectural education" *The 40th Annual Conference of the Architectural Science Association*, pp. 22-24.

Sonetti, G., Lombardi, P. and Chelleri, L. (2016), "True Green and Sustainable University Campuses? Toward a Clusters Approach", *Sustainability*, Vol. 8 No. 1, pp.2-23.

Sunway. (2016), Social Responsibility https://www.sunway.com.my/social-responsibility/ (Accessed 20 December 2016).

Taghavi, M., Bakhtiyari, K., Taghavi, H., Olyaee Attar, V., & Hussain, A. (2014). Planning for sustainable development in the emerging information societies. *Journal of Science & Technology Policy Management*, 5(3), 178-211.

Taylor University. (2016), Sustainability https://university.taylors.edu.my/sustainability (Accessed 20 December 2016).

TheStar. (2016), Low Carbon City http://www.thestar.com.my/metro/smebiz/news/2017/01/04/developer-wins-lowcarbon-city-award-for-sunway-city/ (Accessed 20 December 2016).

Tilbury, D. (2011), "Higher education for sustainability: A global overview of commitment and progress", *Higher education in the world*, Vol. 4 No. 1, pp.18-28.

Ting, S. L., Hakim Bin Mohammed, A. and Wai Choong, W. (2012), "Proposed implementation strategies for energy sustainability on a Malaysian university campus", *Business Strategy Series*, Vol. 13 No. 5, pp.208-214.

UI Green Metric. (2019), "UI GreenMetric Overall Ranking 2016", http://greenmetric.ui.ac.id/detailnegara2018/?negara=Malaysia

Ulkhaq, M. M., Prayogo, P. I., Firmansyah, M. and Agustina, D. (2016), "Assessing campus sustainability: a report from Diponegoro University, Indonesia", *International Journal of Information and Education Technology*, Vol. 6 No. 8, pp.6-16.

UMS. (2016), Ecocampus http://www.ums.edu.my/ecocampusv2 (Accessed 20 December 2016).

UNIMAP. (2016), Sustainable campus in UniMap https://www.unimap.edu.my/index.php/en/unimap-campus-life/unimap-sustainable-campus (Accessed 20 December 2016).

University Sunway. (2016), https://university.sunway.edu.my/Jeffrey-D.-Sachs-Center-on-Sustainable-Development (Accessed 20 December 2016).

Velazquez, L., Munguia, N. and Sanchez, M. (2005), "Deterring sustainability in higher education institutions: An appraisal of the factors which influence sustainability in higher education institutions", *International Journal of Sustainability in Higher Education*, Vol. 6 No. 4, pp.383-391.

Zain, S. M., Basri, N. E. A., Mahmood, N. A., Basri, H., Zakaria, N., Elfithri, R. and Shahudin, Z. (2012), "Recycling practice to promote sustainable behavior at University Campus", *Asian Social Science*, Vol. 8 No.16, pp. 163-173.

Zakaria, R. A. G., Hamid, A. R. A., Mansur, S. A., Resang, A., Zen, I. S. and Khalid, M. S. (2016), "UTM sustainable living laboratory campus, Are the implementations effective?" *Regional Conference in Engineering Education*, pp.1-6.

Zen, I. S., Subramaniam, D., Sulaiman, H., Saleh, A. L., Omar, W. and Salim, M. R. (2016), "Institutionalize waste minimization governance towards campus sustainability: A case study of Green Office initiatives in Universiti Teknologi Malaysia", *Journal of Cleaner Production*, Vol. 135 No.1, pp. 1407-1422.