A MODEL OF SUSTAINABLE CAMPUS OPERATIONS FOR MALAYSIAN PUBLIC UNIVERSITIES

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A thesis submitted in fulfillment of the requirement for the award of the Doctor of Philosophy

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For my beloved mom and dad….

_Siti Sara binti Hj. Lateh (1949 – 2012, al-fatihah)_

_&_

_Razman bin Dahalan_
ACKNOWLEDGEMENT

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My heartfelt gratitude is given to my beloved family and friends who always support me with their love, patience, encouragement and constant prayers. And last but not least, I would also like to thank a man in my life, you know who you are, that is always around when needed, as well as giving support in many aspects. His role in ensuring my success today is undoubtful.
ABSTRACT

Currently, various initiatives have been undertaken by several universities around the world to ensure that their campus operates sustainably. Unfortunately, it seems that the efforts are still divergent and not systematically applied within the universities. Several models are available to be used as references for developing and implementing sustainability within campus. However, for local universities in particular, it is extremely important to understand the current situation whether there is a dearth of adequate conditions for the establishment and compliance of all phases of the models. As the issues of sustainability in Malaysia are still new, sustainability in universities should be performed in rather small steps according to the needs and situation of the university itself. Therefore, this study focuses on identifying the relevant Sustainable Campus Operation (SCO) initiatives to be implemented at the Malaysian public universities, and also determining the critical factors of governance that influence the successful implementation of the SCO initiatives. The investigation involves a quantitative approach using structured questionnaire survey, which was designed based on the items obtained from websites of sustainable universities around the world and also from literature review. The questionnaire survey forms were distributed to sixty-eight selected respondents at the Development Office or Sustainable Department of all local public universities. Based on the structural relationship model, it was found that the factor’s group of “Accountability to improve performance of SCO (AccF)” has the highest impact and more significant in implementing the thirteen relevant SCO initiatives as compared to the factor’s group of “Governance support to implement SCO (GovF)”. The established SCO model is the first that integrates all operations at the university, and highlights the importance for considering the governance support and accountability in analyzing and making decision of any potential initiatives towards campus sustainability. Hence, it can assist those involved in the planning of campus infrastructure and development to determine the most critical factors in implementing the SCO initiatives towards sustainability in Malaysian public universities.
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>AccF</td>
<td>Accountability to improve performance of SCO initiatives and Climate Initiative</td>
</tr>
<tr>
<td>AVE</td>
<td>Average Variance Extracted</td>
</tr>
<tr>
<td>BEMS</td>
<td>Building Energy Management System</td>
</tr>
<tr>
<td>C&amp;D</td>
<td>Construction and Demolition</td>
</tr>
<tr>
<td>CAFM</td>
<td>Computer Aided Facilities Management</td>
</tr>
<tr>
<td>CB-SEM</td>
<td>Covariance-based SEM</td>
</tr>
<tr>
<td>CCM</td>
<td>Common Carbon Metric</td>
</tr>
<tr>
<td>CGSS</td>
<td>Centre for Global Sustainability Studies</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon Dioxide</td>
</tr>
<tr>
<td>CR</td>
<td>Composite Reliability</td>
</tr>
<tr>
<td>CSAF</td>
<td>Campus Sustainability Assessment Framework</td>
</tr>
<tr>
<td>CSFs</td>
<td>Critical Success Factors</td>
</tr>
<tr>
<td>CSR</td>
<td>Corporate Social Responsibility</td>
</tr>
<tr>
<td>EMS</td>
<td>Environmental Management System</td>
</tr>
<tr>
<td>EPA</td>
<td>Environmental Protection Agency</td>
</tr>
<tr>
<td>ESD</td>
<td>Education for Sustainable Development</td>
</tr>
<tr>
<td>$f^2$</td>
<td>Effect size</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse Gas</td>
</tr>
<tr>
<td>GovF</td>
<td>Governance set up to implement SCO initiatives</td>
</tr>
<tr>
<td>GWU</td>
<td>George Washington University</td>
</tr>
<tr>
<td>HEIs</td>
<td>Higher Education Institutions</td>
</tr>
<tr>
<td>IARU</td>
<td>International Alliance of Research Universities</td>
</tr>
<tr>
<td>IBM</td>
<td>International Business Machines</td>
</tr>
<tr>
<td>KeTTHA</td>
<td>Ministry of Energy, Green Technology, and Water</td>
</tr>
<tr>
<td>KMO</td>
<td>Kaiser-Meyer- Olkin</td>
</tr>
<tr>
<td>$Mr$</td>
<td>Mean Score</td>
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</table>
N  Total number of respondents
PDCA  Plan-Do-Check-Act
PLS-SEM  Partial Least Squares-Structural Equation Modeling
$Q^2$  - value  Predictive relevance
$R^2$  - value  Coefficient of determination
SCO  Sustainable Campus Operations
SD  Standard Deviation
SEM  Structural Equation Modeling
SOV  Single Occupancy Vehicle
SPSS  Statistical Package for the Social Science
$t$  - value  significant relationships between independent variables
TBL  Triple Bottom Line
UConn  University of Connecticut
UHI  Urban Heat Island
UI  University Indonesia
UKM  Universiti Kebangsaan Malaysia
ULSF  University Leaders for a Sustainable Future
UM  Universiti Malaya
UMP  Universiti Malaysia Pahang
UMS  Universiti Malaysia Sabah
UNEP-SBCI  United Nations Environment Programme’s Sustainable Buildings
UNESCO  United Nations Educational, Scientific and Cultural Organization
UniMAP  University Malaysia Perlis
UPM  Universiti Putra Malaysia
USIM  Universiti Sains Islam Malaysia
USM  Universiti Sains Malaysia
UTAR  Universiti Tunku Abdul Rahman
UTeM  Universiti Teknikal Malaysia Melaka
UTHM  Universiti Tun Hussein Onn Malaysia
UTM  Universiti Teknologi Malaysia
UUM  Universiti Utara Malaysia
VOCs  Volatile Organic Compounds
WCED  World Commission on Environment and Development
WUR  Wageningen University and Research
<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
</tr>
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<tr>
<td>$\alpha$-value</td>
<td>Cronbach’s Alpha</td>
</tr>
<tr>
<td>$\beta$-value</td>
<td>Path coefficient</td>
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CHAPTER 1

INTRODUCTION

1.1 Background of Study
Sustainable development is defined as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). The World Commission on Environment and Development (1987) used this definition of sustainable development in the report entitled Our Common Future. This report is also popularly known as Brundtland Report following the name of a Norwegian, Gro Harlem Brundtland, who chaired the commission. The purpose of this Brundtland report is to strengthen the global agenda for change, as well as to establish a framework to address the strategies necessary to achieve sustainable development. Sustainability is the practice of striving toward a better future, which includes; (i) improving human health and wellbeing, (ii) protecting and restoring the natural environment, and (iii) fostering a stronger economy and financial well-being for businesses, organizations, families, and individuals. These three parts are often called the triple bottom line (TBL), which means all measures taken must be beneficial to the environment, economy, and social as illustrated in Figure 1.1.
Sustainability awareness on Higher Education Institutions (HEIs) started to arise among the public through an Earth Day celebration in 1970 when students buried an automobile to symbolize the deleterious impact of humans on the campus environment. It was then followed by energy crisis in 1970s that has led to greater awareness on environmental challenges. The environmental pollution and degradation caused by energy and material consumption is a side effect from various operations and activities on campus. Such activities cover teaching and learning, research and development, and provision of support services. Nowadays, it has become an issue at the global level and the concerns of policy makers and planner (Alshuwaikhat & Abubakar, 2008). Thus, the idea of sustainability is triggered as a result of consciousness of direct and indirect adverse effects to the environment due to such activities and operations at HEIs. Velazquez et al. (2006) define sustainable development for higher education as “a higher educational institution, as a whole or as a part, that addresses, involves and promotes, on a regional or a global level, the minimization of negative environmental, economic, societal, and health effects generated in the use of their resources in order to fulfill its functions of teaching, research, outreach and partnership, and stewardship in ways to help society make the transition to sustainable lifestyles”.

Figure 1.1: Triple Bottom Line for Sustainability
(Elkington, 2010)
In educating sustainability to the campus society, the United Nations Decade of Education for Sustainable Development (ESD) (2005-2014) has highlighted the potential to promote sustainable operations at higher institution level. Sustainable operations at HEIs can be in the form of energy efficiency, waste management, water conservation, green building design, transportation, foods production, and green procurement. According to Koichiro Matsuura, who was the Director General of United Nations Educational, Scientific and Cultural Organization (UNESCO) for the years 1999 to 2009, education in all its forms and at all levels not only to create awareness within the community but also one of the most powerful tools to bring the changes needed to achieve sustainable development (UNESCO, 2005).

Universities have the potential to give an impact on the environment, as they have a wide campus area with large population, and also carry out complex operations not only conducting various teaching and learning activities but also involving in research and development, publication, consultation, innovation, and commercialization. In their research study, Yarime & Tanaka (2012) found that the dimensions of governance and physical operations have been given more focus in assessing the sustainability of a university as compared to other areas of education, research, and outreach. Moreover, in year 1990, Talloires Declaration urged on universities to carry out more sustainable physical operations, as well as to become an example of environmental responsibility by establishing long-term sustainability policies, and embed the importance of environmental sustainability amongst their citizens. It is not surprising that most of the university’s sustainability policies focus more on physical operations, and it is frequently mentioned in policy and being one of the main thrusts of campus sustainability initiatives (Wright, 2002). For example, Kyoto Declaration encourages universities to review their physical operations to reflect sustainable development practices. In addition, the Talloires Declaration also urges HEIs on providing an example of environmental responsibility by establishing institutional ecology policies and practices of resource conservation, recycling, waste reduction, and environmentally sound operations (ULSF, 2001). Both declarations are often referred by HEIs in developing and implementing SCO initiatives through centralized programs to promote green practices in achieving campus sustainability objectives.
Since university can be particularly well suited for the realization of sustainable development, it should provide a safe environment, ecological balance, and intergenerational equity that is compatible to the development, as it is a place to create professions and professionals. Perhaps, and most obvious, universities around the world can make a difference in education system, and these future citizens and leaders will play a critical role in helping us to move towards a more sustainable future. There are universities that incorporate all academics activities in their sustainable education, add students’ learning skills for sustainability within their coursework, and also incorporate sustainable practices through their professional staff as they play their roles as managers and operational contexts.

1.1.1 Model of Sustainable Campus

Given that sustainability issues are complex, it is imperative that Education for Sustainable Development (ESD) pursues an integrated approach in modeling sustainability in the core functions and systems of the university. Sustainable campus model is often used to provide an idea of how the campus sustainability can be achieved in a holistic and integrated way. In this section, six well known sustainable university models will be discussed.

One of the earliest models, which was proposed by Weenen (2000), is sustainable university classification model, as illustrated in Figure 1.2. The model has looked into the issue of sustainability in higher education through three angles in order to answer the questions of, (i) Why should we be involved? (ii) What can we do?, and (iii) How would we be organized? (Weenen, 2000). The proposed questions are answered separately in different axes and at different levels. For example, the question of “what can we do” is answered in ‘Engagement’ axis (i.e. y-axis). It expresses the primary approach for any organization is the operation of sustainable campus. The second level emphasizes research activities and education programs focusing on the campus operation. At the third level, this educational organization reformulates and influences the university management to establish a relevant policy. At the end, the policy will be adopted and incorporated in the university mission. The other two axes would have similar explanations with regard to their respective questions.
Meanwhile, Cortese (2003) has proposed another model as exhibited in Figure 1.3, which is higher education modeling of sustainability as a fully integrated system. This model illustrates that all parts of the university system and activities such as teaching, research, operations, and relations with local communities should be interlinked with one another. It seems that the activities are critical to achieving a transformational change, thus it can only occur by connecting them to each other. Briefly, these four elements have a specific role and have a significant relationship to each other in achieving a sustainable campus.
Campus sustainability assessment framework model (CSAF) or popularly known as sustainable egg, which contains several different indicators, has been proposed by Cole (2003). He is an academician and researcher at the Royal Roads University, Canada. The model constitutes two major parameters, namely people and ecosystem, together with their respective indicators as shown in Figure 1.4. Ecosystem indicators include air, water, land (i.e. space and planning), waste, and energy. Whereas, people indicators comprise knowledge, community, governance, economy, and wealth. The structure of CSAF is based on the ten (10) main indicators and broken down further into one-hundred and sixty-nine (169) sub indicators, to assess an educational institute. CSAF is also used as a standardized audit tool for Canadian campuses. Since this model has been designed for Canadian universities, the applicability of this tool for universities in other countries is doubtful (Beringer, 2006). Even some universities in Canada are unable to find information regarding indicators contained in CSAF.
Figure 1.5 shows the structure of the Plan-Do-Check-Act (PDCA) model of sustainable university as proposed by Velazquez et al. (2006). It consists of four (4) phases, which systematically exhibits concept of sustainability into vision and mission of university, as well as strengthening the policy and strategies for fostering sustainability into the four core businesses of university comprising education, research, outreach and partnership, and sustainability on campus. This model emphasizes that sustainability initiatives must be based on a continuous improvement. The PDCA cycle is a useful tool to coordinate continuous improvement efforts. This is a management philosophy that seeks improvements as a never-ending process of achieving small improvements.
Not much difference from the previous model proposed by Velazquez et al. (2006), Alshuwaikhat & Abubakar (2008) stressed that in order to promote campus sustainability, a university should have a clear vision and serious commitment from top management towards implementing sustainability initiatives. The implementation of sustainability approach becomes easier with the establishment of an organizational structure through either a department or a committee, and also the provision of necessary resources to achieve the sustainability vision. Alshuwaikhat & Abubakar (2008) have proposed the framework of approach to achieving campus sustainability, as presented in Figure 1.6, which adopts three main strategies, namely Environmental Management System (EMS) implementation, public participation and social responsibility, and sustainability teaching and research, in an integrated way. Each strategy has specific initiatives that could lead to achieving the sustainability mission of a university.
Last but not least, Mat et al. (2009) has also proposed a model entitled Model of Sustainable University, which consists of a structured phases starting with the directional phase that establishes the vision and mission to conceptualize the sustainability, as shown in Figure 1.7. These clear vision and missions will set the platform and fundamental principles in achieving the sustainability efforts. The bottom phase comprises various connected but departmentalized strategies being managed through a high level committee with established targets, policies, coordinating function and getting funder to sponsor the investment. The Management committee will always seek to improve, enhance and proactively take steps to acquire additional funds to support underlining targets and goals to be achieved within the stipulated time frame. The integrated model combines the EMS, community and public participations, social responsibilities, and at the same time research and teaching sustainability should be carried out.
All the sustainable university models mentioned and discussed earlier have presented a systematic procedure of how people response to sustainable initiatives within academic institutions. The models are designed to be used by the academic community members as a framework for developing and implementing sustainability missions, policies, strategies, procedures and indicators that can be used in their organisations.

1.2 Problem Statement

Basically, existing sustainable models cover the wide range of sustainability implementation at any university. None of the models, however, have directly and specifically proposed on how and what to be prioritized accordingly based on location, culture and etc. of the university itself. It is important to understand the
current situation in most universities, whether there is a sufficient condition for the establishment and compliance of all phases of the models. Implementing the sustainable university model is a process of continual improvement in environmental, social, and economic performance that should be made through incremental steps. This is also supported by Lozano (2006) who states that sustainability in universities should be performed in small steps according to the needs and situation at the university.

Even though there have been many campus sustainability initiatives currently underway, unfortunately, the progress on the part of campus society and society practices in making changes towards sustainability has not been as fast as the initiatives being in place (Tom et al., 2012; Velazquez, Munguia & Sanchez, 2005). It seems that the efforts are still divergent and not systematically applied within the universities. Other than issues of selecting the relevant initiatives, governance factors and university’s support from upper level administrators are also some of the crucial issues that needs attention as they play an important role in the university in making decision and making changes (Lidgren, Rodhe & Huisingh, 2006; Lozano, 2006).

Practically, since the concept of sustainable campus is still relatively new in Malaysia, the planning and implementation should be properly phased according to priority so that it can affect optimally on sustainability in campus operations. To consider this matter, many studies are needed from the very early stages in order to share information, understand the issues and concepts, and develop a plan for future actions appropriate to the local situation.

Going into the specific theme of sustainability through operations on campus is exactly what this study aims to do. It is driven by a desire to explore in more detail the areas of operations that should be given priority based on the SCO initiatives, as well as to investigate the critical success factors of governance in the local universities that would ensure the successful implementation of SCO initiatives. Since past researchers mostly covered areas of energy management (Abdullah, Hakim & Naim, 2015), product service system (Vezzoli et al., 2015), wastewater management (Keremane & Mckay, 2009), green building (Jabbour, Kasai & Jose, 2014; Richardson & Lynes, 2007; Zulkarnain et al., 2011), this study gives an opportunity for the researcher to develop a model of SCO that are suitable to be implemented at local public universities to ensure that the campus operates sustainably.
It is expected that the findings from this study can assist top management, decision makers, and parties involved in the planning of campus infrastructure and development of universities in ensuring the measures taken in adopting sustainability into campus operations are not in vain. Instead, it can give a good impact in deploying the SCO initiatives particularly in Malaysian public universities. A successful implementation of such actions can therefore give HEIs a positive impression of greening, and thereby catalyze the implementations of further campus greening initiatives.

1.3 Research Questions

In order to enlighten the campus sustainability issues stated above, this study embarks on investigating the following research questions:

i) What are the current practices of some major universities in adopting sustainability in campus operations?
ii) Which SCO initiatives are relevant for local public universities?
iii) What are the critical governance factors that influence the success of SCO initiatives implementation?
iv) What would be the standard model of SCO that can be applied in Malaysian public universities?

1.4 Research Objectives

The primary aim of this research is to propose a model of SCO for Malaysian public universities. At the same time, this study also aims at investigating the relevancy of initiatives and influence of university’s top management on the sustainable development of campus operations. In order to achieve the set aims, the following specific objectives have been outlined:

i) To identify and analyze the current practices of sustainable operations implemented by some major universities in the world;
ii) To determine relevant sustainable campus operation (SCO) initiatives that can be implemented at local public universities;
iii) To examine the critical success factors (CSFs) of governance that influence the implementation of SCO initiatives at local public universities, as well as to classify the CSFs into related groups; and

iv) To establish a Model of SCO for the Malaysian public universities.

1.5 Research Scope

This research study only focuses on two dimensions of sustainable campus, which are governance and physical operations since this dimensions have been given more attention in assessing the sustainability of a university as compared to other dimensions to look into the relationships between factors of governance against successful implementation of SCO initiatives. This study considers only Malaysian public universities due to the fact that public universities are largely funded by the Federal Government and are governed as self-managed institutions.

1.6 Research Method

This research study adopts a quantitative approach in identifying the SCO initiatives and CSFs of governance for local public universities. The data samples are collected through manual distribution of questionnaire survey forms amongst individuals who hold various universities’ administrative posts comprising Assistant Vice Chancellor, Director of Office, Head of Department/Unit, as well as other related posts at the Development and Property Management Office, and the Sustainable Department/Unit. List of respondents are obtained and shortlisted through deliberate search on the websites of each of the local public universities. Later, descriptive and factor analysis techniques using SPSS software v.22 are utilized prior to developing the structural equation model using SmartPLS software v.3.
1.7 Structure of Thesis

The structure of this thesis is divided into 7 chapters as follows:

Chapter 1 presents an overview of the thesis. It contains the background of research, problem statement, and the importance of studies that led to the formulation of the research question and the establishment of objectives and scope of the study.

Chapter 2 reviews critically the research work related to this study, which have been published by previous researchers. The purpose of this review is to obtain an overview of the study, and to list and document the items that are important for developing the questionnaire survey.

Chapter 3 outlines the methodology adopted for this study. This chapter focuses on research plan, as well as questionnaire design and data collection strategy. Also included in this chapter is the description of experts who review the draft of questionnaire survey along with results of pilot study. Apart from that, it provides details of various approaches to be used for data analysis including the description on the SmartPLS software applications as a tool in the development of the SCOs model for Malaysian public universities.

Chapter 4 presents the descriptive analysis results of data collected from the questionnaire survey by using SPSS software. It also discusses the results by highlighting the relevancy of each SCO initiative to be implemented at Malaysian public universities, as well as the ranking analysis results in determining the critical factors of governance that influence the successful implementation of SCO initiatives. Then, it further describes the factor analysis results in classifying the CSFs into their associated groups. This chapter also demonstrates the process of carrying out the analysis together with the reasons or assumptions involved.

Chapter 5 describes the development and establishment of a structural model of CSFs of SCO initiatives for Malaysian public universities. Basically, it discusses the model development using SmartPLS software version 3.0, based on the results obtained from factors analysis as discussed earlier in Chapter 4. Besides discussing the development processes, it also describes the assessment on the model in accordance to the standard procedure as proposed by the software developers to show graphical representation of relationship of the governance CSFs.
Chapter 6 summarizes the overall findings of this study, as well as presented the model of Sustainable Campus Operations for Malaysian Public Universities. It also outlines the limitation of the study, as well as suggestions for future research.
CHAPTER 2

SUSTAINABLE CAMPUS OPERATIONS (SCO’s)

2.1 Introduction

Talloires Declaration is the first official statement made in the year 1990 by universities’ presidents, chancellors, and rectors. It consists of a ten-point action plan for incorporating sustainability and environmental literacy by explicitly linking research, educational and operational activities in a whole-of-university approach towards institutional sustainability as exhibited in Figure 2.1. As a commitment to environmental sustainability in higher education, over four-hundred (400) university leaders from more than fifty (50) countries have signed Talloires Declaration (ULSF, 2008).

![Figure 2.1: A Whole-of-University Approach towards Institutional Sustainability](image-url)

(McMillin & Dyball, 2009)
However, Yarime & Tanaka (2012) mentioned that campus sustainability should take into account five categories, namely governance, operation, education, research, and outreach (as shown in Figure 2.2). These categories are considered as crucial elements of sustainability in HEIs and are often used as assessment tools in the studies of campus sustainability (Cortese, 2003; Ngadiman, 2014; Tom et al., 2012; Velazquez et al., 2006).

![Figure 2.2: Elements of Campus Sustainability (University of Saskatchewan)](image)

The descriptions for each of the campus sustainability elements are as follows:

- **Education**

  Sustainability in education is defined as education that focuses on the concept of sustainability in any form appropriate to the campus sustainability plan (Moore, 2006). It is related to the curriculum, teaching, and capacity development offered for students at the institution. Other learning opportunities for faculty members and staff are categorized in the governance section, and learning opportunities for communities are categorized in the outreach section (Yarime & Tanaka, 2012). Education for Sustainable Development (ESD) is more than just knowledge of the environment, economy, and society. It also covers aspects of skills,
perspectives and values that guide and motivate students to seek sustainability. The existing education system needs to develop a long-term strategy to change mindset of the students in order to understand and appreciate the issues of sustainability, and to take positive action to implement sustainable development agenda (Komo, 2009).

- Research

Research at universities is related to the institution’s efforts and commitments to promote research activities in relation to sustainability and to establish the surrounding conditions that would enable them (Yarime & Tanaka, 2012). Through research activities, university would be able to continue to grow and contribute useful knowledge to face the challenging future. With regard to the fact that research as a trigger for new knowledge, it is therefore undoubtful that the research activity is essential to ensure sustainability growth. University’s research sector has a vital role against short-term and long-term effects, and thus able to carry out research related to sustainability such as environmental issues, technological and environmental innovation, and to seek alternatives to reduce negative impacts on the ecosystem (Stephens et al., 2008). In addition, as an urgent need for sustainability, universities should take into account research of sustainable development because it is not just an academic exercise, but also as an important response to the environmental crisis that was growing rapidly and has become the most important research agenda (Ngadiman, 2014). There are several roles of university in driving the research; such as (i) promoting faculty to integrate sustainability research into the classroom or research activities, (ii) supporting the development of research networks that promote collaboration and dialogue across universities and funding agencies, and (iii) encouraging multi and cross-disciplinary research in relation to the sustainable principles or further efforts to improve sustainability (Brinkhurst, Rose, & Maurice, 2011). Apart from that, Cortese (2003) suggested that faculty and students should carry out research, which is not only as part of the learning experience that will enhance their education, but also to instill a sense to keep the balanced ecosystem in order to secure the occupation of inhabitants for present and future generations.
• Outreach

Universities and community are interconnected because the university acts as a professional and knowledge producer, while the community acts as an investor in education (Ngadiman, 2014). Outreach representing the extent of transformation that the institution has undergone towards reaching sustainability goals, such as networking with stakeholders outside the institution as well regional, national, and international engagement (Yarime & Tanaka, 2012). One of the ways that can be taken by the universities to help outside community is to share their knowledge on sustainable campus initiatives. The outside communities that are usually involved in this outreach and partnership include the civilians, government agencies, educational institutions, private sector, and government bodies (Stephens et al., 2008). As a result of this collaboration, it can support and enhance sustainability partnerships locally and globally. As an instance, collaborating with other institutions of higher education and looking for international cooperation in solving global challenges of the environment and sustainability through conferences and student exchange (Brinkhurst et al., 2011; Clugston & Calder, 1999), as cited by Ngadiman (2014). Many declarations and sustainability policies discussed the need for universities to put themselves in the larger community in which they live. University serves not only as a place for students to gain knowledge, but also to use the acquired knowledge for the purpose of solving complex problems of society (Ngadiman, 2014).

• Operation

An operation is responsible for the provision of all buildings and facilities within universities for maintaining a safe, comfortable and attractive campus environment that supports excellence in teaching, learning and research. In adopting sustainability in campus operations, various focus areas and goals are being set by universities around the world. Alshuwaikhat & Abubakar (2008) mentioned that environmental management system covers two areas, namely (i) environmental management and improvement, which relates to waste minimization, energy efficiency, and environmental conservation, and (ii) green campus which aims to promote construction of green buildings and transportation facilities. Sustainable operations emphasize features such as saving,
environmental quality and efficiency and effectiveness of resources. The operations must be able to lower carbon emission, as well as able to reduce the consumption of non-renewable sources, and the resources are selected based on life cycle assessment.

- **Governance**

University governance refers to the structures and processes to make responsible decisions covering issues that are prominent to both internal and external stakeholders of the university, as well as concerning the administrative structure and policy directions of HEIs. The administrative structure must consist of an active governing body with sufficient autonomy to fulfill its obligations and ensure the integrity of the university in accordance with the mission and vision of the university (Ngadiman, 2014). Element of governance also indicates a basic framework to promote sustainability in the institution, thus it includes visions and policies imposed on the whole institution with regard to working conditions, such as employment and payment (Yarime & Tanaka, 2012). In this regard, factors such as widespread support, the commitment of leadership, strategic planning, creating a culture of sustainable, effective communication, and implement feedback mechanisms can influence the success of governance as well as integrating sustainability in campus planning extensively (Laroche, 2009). Velazquez et al. (2006) have proposed three phases of restructuring an organizational, which include (i) developing a sustainability mission and vision for the university, (ii) setting up a committee functioning to establish sustainability policies and objectives, and (iii) implementing the strategic plan into education, research, outreach and partnerships, and also into the campus physical operations. In addition, sustainable policies also need to be developed with the incorporation of principles and specific objectives of sustainability into the implementation structure and support, and also into scope of work for all staff.

2.2 **Declaration and Policy Related to Sustainability in Higher Education**

According to the Association of University Leaders for a Sustainable Future (ULSF), there was an increasing number of universities that have signed declarations pledging
themselves to implement more sustainable practices at least by applying their knowledge and expertise within their own campuses (ULSF, 2001). Since 1972, there have been so many national and international sustainability declarations and policies related to higher education being established as references to sustainability in higher education. With Stockholm Declaration as the starter, the declaration recognized the interdependency between humanity and the environment. Strengthened by its statement, “improve the human environment for present and future generations…a goal to be pursued together with, and in harmony with, the established and fundamental goals of peace and worldwide economic and social development” (UNESCO, 1972), the declaration clearly focused on human-centered. Stockholm Declaration offered twenty-four (24) principles to achieve environmental sustainability through bilateral and multilateral manners and the majority of the principles focused more on legislation. Principle no. 19 of this declaration stressed that the need for environmental education should start from school years until adulthood. “Education would broaden the basis for enlightened opinions and responsible conduct by individuals, enterprises and communities in protecting and improving the environment in its full human dimension” (UNESCO, 1972). Table 2.1 outlines the evolution of declarations related to sustainability in education from the year 1972 until the year 1997. Many universities attempt towards sustainability have signed these declarations.

Table 2.1: Chronology of Declarations Related to Sustainability in Higher Education

<table>
<thead>
<tr>
<th>Year</th>
<th>Sustainability Declarations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1972</td>
<td>The Stockholm Declaration on the Human Environment (UNESCO, 1972)</td>
</tr>
<tr>
<td>1977</td>
<td>Tbilisi Declaration (UNESCO-UNEP, 1977)</td>
</tr>
<tr>
<td>1990</td>
<td>The Talloires Declaration (ULSF, 1990)</td>
</tr>
<tr>
<td>1991</td>
<td>The Halifax Declaration (Lester Pearson Institute for International Development, 1992)</td>
</tr>
<tr>
<td>1992</td>
<td>Agenda 21 – Chapter 36 (UNESCO, 1992)</td>
</tr>
<tr>
<td>1993</td>
<td>The Kyoto Declaration (International Association of Universities, 1993)</td>
</tr>
<tr>
<td>1993</td>
<td>Swansea Declaration (UNESCO, 1993)</td>
</tr>
<tr>
<td>1994</td>
<td>CRE Copernicus Charter (CRE-Copernicus, 1994)</td>
</tr>
<tr>
<td>1997</td>
<td>Declaration of Thessaloniki (UNESCO, 1997)</td>
</tr>
</tbody>
</table>

Reference: Wright (2002)
Although many institutions have followed and signed such declarations as listed in Table 2.1, some institutions have chosen to take another approach to sustain their universities by creating their own environmental sustainability policies that cater their own specific interests as presented in Table 2.2. It can be clearly seen from the Table that most of the institutions have put more focus and much effort specifically on sustainability education and greening the physical campus operations.

Table 2.2: Various Universities Take on Specific Sustainability Policies

<table>
<thead>
<tr>
<th>Policy Focuses on Greening Physical Operations</th>
<th>Policy Focuses on Sustainability Education and Greening Physical Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queens University, Canada</td>
<td>California State University, United States of America</td>
</tr>
<tr>
<td>University of Buffalo, United States of America</td>
<td>Carnegie Mellon University, United States of America</td>
</tr>
<tr>
<td>University of Colorado, United States of America</td>
<td>Dalhousie University, Canada</td>
</tr>
<tr>
<td>University of Toronto, Canada</td>
<td>Durham University, United Kingdom</td>
</tr>
<tr>
<td></td>
<td>Oxford Brooks University, United Kingdom</td>
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<tr>
<td></td>
<td>George Washington University, United States of America</td>
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<tr>
<td></td>
<td>Lincoln University, United States of America</td>
</tr>
<tr>
<td></td>
<td>Lund University, Sweden</td>
</tr>
<tr>
<td></td>
<td>Massey University, New Zealand</td>
</tr>
<tr>
<td></td>
<td>Open Polytechnic of New Zealand</td>
</tr>
<tr>
<td></td>
<td>Tufts University, United States of America</td>
</tr>
<tr>
<td></td>
<td>Universidad National Autonoma de Mexico, Mexico</td>
</tr>
<tr>
<td></td>
<td>Universite Laval, Canada</td>
</tr>
<tr>
<td></td>
<td>University of Edinburgh, United Kingdom</td>
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<td></td>
<td>University of Hertfordshire, United Kingdom</td>
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<td></td>
<td>University of Manchester, United Kingdom</td>
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<td></td>
<td>University of South Carolina, United States of America</td>
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<tr>
<td></td>
<td>University of Sunderland, United States of America</td>
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<tr>
<td></td>
<td>University of Sussex, United Kingdom</td>
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<tr>
<td></td>
<td>University of Utrecht, Netherlands</td>
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<tr>
<td></td>
<td>University of Wales Swansea, United Kingdom</td>
</tr>
<tr>
<td></td>
<td>University of Waterloo, Canada</td>
</tr>
</tbody>
</table>

Reference: Wright (2002)
There are significant differences between the declarations and the institutional sustainable environmental policies. Declarations focus more on the moral responsibilities of universities to facilitate change and the need for environmental literacy, while institutional environmental policies focus specifically on sustainability education and development of sustainable physical operations within the university (Wright, 2002). For example, Talloires Declaration insists higher education to establish institutional ecology policies and practices of resource conservation, recycling, waste reduction, and environmentally sound operation (ULSF, 2001). However, no declaration offers practical actions to be taken in order to ensure more sustainable operations. Meanwhile, most of the environmental policies of the institution highlight specific actions to be taken to achieve sustainability goals and objectives by focusing more on the basis of a combination of environmental education and sustainable operations (Wright, 2002).

University of Waterloo, for instance, has not signed any sustainability declaration, but has created its own environmental policy. The University’s WATgreen Committee is in charge of implementing the university environmental policy, and it is responsible to animate environmental activities on campus, coordinate project activities of students, staff and faculty, raise awareness among campus community, as well as develop guidelines for environmentally responsible design practices on campus. Normally, policy is similar to those offered by the declarations in terms of guiding the committee and the greening efforts on campus, but for University of Waterloo’s WATgreen policy, the committee must work within specified economic parameters (Wright, 2002). Another university that has developed its own environmental policy is University of South Carolina (USC), whereby the policy states that sustainability must be built into the university curriculum, and recognizes the need for environmental literacy amongst faculty and staff (Wright, 2002). In 1990, University of Buffalo (UB) created the university’s Environmental Task Force (ETF) with the main task to develop campus environmental policies. However, in June 1999 UB became one of the signatory universities that embraced the Talloires Declaration. As much as fifteen (15) environmental policies related to environmental activities on the campus were revealed by UB and the policies have paid greater attention on energy efficiency and consumption issues. This is in line with UB’s definition of a sustainable campus, which is one that consumes minimal resource, uses one hundred percent post-
consumer recycled materials or materials from renewable resources, and utilizes energy generated from totally renewable and non-polluting resources (Wright, 2002). Just a few policies at UB mention about environmental literacy or implementing sustainability through modification of curriculum. Besides that, The George Washington University (GWU) is one of the American universities that took multiple approaches to green their campuses. GWU has signed the Talloires Declaration, working its own institutional environmental policy and has an agreement with the United States Environmental Protection Agency (EPA). The university highlights seven (7) principles in the policy, which include ecosystem protection, environmental justice, pollution prevention, strong science and data, partnerships, reinventing the university’s environmental management and operations, and accountability. Apart from UB and GWU, University of Toronto also highlights sustainable policy on greening physical operation. Even though there is a need for sustainability education to protect the environment through teaching, research and administrative operations, however the main objectives of the policy focus on physical operations and include the minimization of energy use, water use, waste generation, and pollution (Wright, 2002).

2.3 Focus areas of Campus Operations

There are various areas of concern related to operations on campus. Ngadiman (2014) claimed that there are ten areas of physical campus operations, which include building, energy management, air quality, green space, waste management, water management, transportation system, procurement and purchasing, dining/cafeteria management, and social facilities. However, Ministry of Energy, Green Technology, and Water (KeTTHA), in one of its publications entitled “Low Carbon Cities; Framework and Assessment System” (KeTTHA, 2011), has stressed that in order to become a green city, Malaysia needs to give more efforts into enhancing four (4) areas of concern, namely environment, transportation, infrastructure, and building.

On the other hand, Universitas Indonesia (UI) adopts six (6) areas as the main assessment categories for the UI GreenMetric World Ranking, namely infrastructure, energy, waste, water, transportation, and education. Each of the green areas brings its own weightage to sustainability impact as shown in Figure 2.3. Energy is the most
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