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A PARTIAL LEAST SQUARES STRUCTURAL EQUATION MODELING (PLS-SEM) OF ENERGY MANAGEMENT CRITICAL SUCCESS FACTORS TO SUSTAINABLE UNIVERSITY IN MALAYSIA

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Abstract

This paper analyzes the critical success factors (CSFs) in energy management (EM) for the implementation of Sustainable University (SU) Key Performance Indicators (KPIs) at Malaysian research universities. Through a thorough review of the literature, CSFs related to EM were established, which were then contextually tailored through a pilot study and presented as a hypothesized template. Primary data was collected to 300 academic and non-academic staff of five research universities in Malaysia through questionnaire surveys. Modeling of the structural formula of partial least squares (PLS-SEM) was used to statistically verify the final version of the EM CSFs to achieve SU. This paper fills the knowledge gap by concentrating on the quantified contribution to the adoption of SU in Malaysia by the most significant EM CSFs. Findings from this paper have confirmed the hypotheses that four EM CSFs have a significant relationship to KPIs namely, top management support, understanding, strong stakeholder relationships, and risk management which ultimately lead to successful adoption of EM in achieving SU. It is hoped that the findings will provide guidelines for the Malaysian Higher Education Ministry to be more effective in achieving sustainability for all universities.

Keywords--- Critical success factors , energy management, sustainable university, partial least squares structural equation modeling

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INTRODUCTION

The world is currently facing the threat of crisis such as dwindling energy resources, climate change as well as environmental pollution and degradation. Energy consumption has increased considerably especially in developing countries. Because the construction industry accumulates about one-third of the final energy consumption (González et al., 2011), the continuous use of buildings in the future will drain energy resources. Nonetheless, this scenario has resulted in harmful effects on environmental degradation; leading to irreversible climate change, increased carbon dioxide (CO2) emissions, poor quality of life, and important pollution-related health problems (Bhargava, 2006; Al-Mofleh et al., 2009). University buildings are listed as commercial buildings in Malaysia and are not excluded from the problem of high energy use due to their activities and population (Sohif et al., 2009; Abu Bakar et al., 2013).Because university buildings are also high energy users, many of Malaysia's public universities have introduced EM programs to recognize the need for better energy usage. This initiative is important because all universities typically have large building areas, extensive facilities and a large number of building users (Sohif et al., 2009; Abu Bakar et al., 2013).

Energy management (EM) plays an important role in achieving the conservation of energy. Sustainable EM can be seen as the method of regulating the organization's energy consumption to ensure efficient energy use (Abu Bakar et al., 2013). Successful implementation of EM to key performance indicators (KPIs) to achieve sustainable university (SU) would rely on participation and cooperation at all levels of management. Science and training will be a critical tool in the most efficient way possible to improve this conservation (Denny & O'Malley, 2008). Accordingly, the Higher Education Ministry has urged all educational centers to save energy due to the high monthly electricity bill that has become the concern of many parties (Choong et al., 2012). Sustainability is an idealized society environment in which people can live long, healthy, efficient, without sacrificing their needs to respond to the government of Malaysia to reduce energy consumption. The key point for achieving sustainable EM in university is to ensure that the attitude and cooperation of all parties are strengthened by people for each unit. Several universities across Malaysia have adopted the trend towards sustainability where they are at the different stages of incorporating sustainable components into campus planning and management (Dola et al., 2013). Researchers in Malaysia, as well as other countries, have conducted studies on sustainable universities (SU). Many colleges overseas have become case studies for SUs such as the University of Amsterdam (van Weenen, 2000), Michigan University (Levy & Marans, 2012), Alabama College and Hawaii College (Emanual& Adams, 2011) as well as 80 other institutions in other countries run by Velazquez et al. (2006). However, many university leaders and researchers are still ignorant of the ideals of sustainability, contributing to unsustainable universities (Lozano, 2006; Nejati&Nejati, 2012). The SU campaign has not been adequately outlined, and most initiatives lack a long-term target plan and are exacerbated by a lack of stakeholder cohesion (Herremans&Allwright, 2000). The Government of Malaysia is aware of these problems and is committed to improving Malaysian energy consumption efficiency against SU. For example, at the Climate Change Summit in Copenhagen in 2009, Malaysia's prime minister vowed to voluntarily reduce the gross domestic product's CO2 emission intensity by up to 40% by 2020 compared to 2005 rates, subject to developed countries' financial and technical aid. The Malaysian government also endorsed the major global sustainable development framework of Agenda 21, the Rio Declaration on Environment and Development and the

1992 United Nations Declaration of Principles for Sustainable Management.

Malaysia's energy policy was established in 1979 and was broadly defined in terms of three policy goals that are supply, use, and environmental goals. All of these targets are to ensure adequate, safe and cost-effective energy supply, as well as encouraging efficient energy use and reducing inefficient energy consumption and directly mitigating the negative environmental impacts of energy consumption. In 2010, under the Tenth Malaysia Plan, the Malaysian government released the New Energy Policy, which encapsulates all efforts to achieve economic efficiency, the security of supply, and social and environmental goals. It shows that the Malaysian government has made a strong effort to promote sustainability from this proven energy policy. Such attempts have not been considered successful, however, as the country is currently facing EM problems, especially in universities. Second, Malaysian universities work to find solutions for energy (ZainulAbidin&Pasquire, 2005). Second, efforts to raise EM to SU have led to limited success. Depleting the ozone layer and greenhouse gas emissions endanger the survival of humans and thousands of other living species, the health of the world and its ecosystems, the protection of nations and future generations' heritage (The Talloires Declaration, 2012). Immediate action is needed to address these fundamental issues and reverse the trends. Universities have a major role to play in making these objectives possible in the training, research, policy formulation, and exchange of information required. University leaders, therefore, need to initiate and encourage the mobilization of internal and external capital to respond to this urgent challenge by their institutions.

A fundamental first step in implementing sustainability at any university is to establish an official environmental or sustainability task force or committee including faculty, students, staff and administrators, develop a campus plan to achieve the Declaration's overall objectives and monitor campus sustainability initiatives (Shriberg&Tallent, 2003). Surprisingly, this declaration was officially signed by only Universiti Malaya (UM) in the Talloires Declaration Institutional Signatory list in May 2012. This shows that universities in Malaysia are still far behind universities outside the country. As per Dr Irina Safitri Zen, director of the Campus Sustainability Office at UniversitiTeknologi Malaysia (UTM), "What Malaysian public universities only began to imitate in the late 2000s was the pattern of yesterday for leading universities such as Harvard, Yale and Massachusetts Institute of Technology, which started theirs in the 1990s." Nevertheless, the effort to identify CSFs for EM and evaluate their relationship with KPIs resulted in less interest, especially in public universities, although most literature, for example, highlighted Kellen (2003) and Flanagan (2005), argued that CSFs need to be defined to concentrate on performance management and evaluation. Despite the existence of similar research findings published worldwide, EM should be conducted in a university as it is considered to be a very suitable location to ensure that EM can be accomplished successfully. It is a core of thinkers, politicians and prospective entrepreneurs manufacturing (Cortese, 2003; Elton, 2003; Lozano, 2006; Tilbury et al., 2005). It is also considered a potential hub for fostering sustainable development (Sedlacek, 2013; Barth et al., 2011; Waas et al., 2010; Fadeeva& Mochizuki, 2010). According to Choong et al., (2012), if a university community is self-satisfied and is kept ignorant of this problem, then it will not succeed in implementing EM. There are several reasons why it is necessary for local universities to enhance energy-use behavior as a non-structural approach (Choong et al., 2012; European Environment Agency, 2013). First, universities have a large number of building users, so the human factor is crucial to saving energy. Sensitizing students with energy will help them become more diligent about saving energy in their lives. Second, universities have a wide range of facilities from classrooms, halls, offices, restaurants, sports centers, libraries, labs, stores, hospitals, hostels, and other similar facilities. Most of the energy systems found in such buildings, such as heating, ventilation and air conditioning (HVAC) and lighting systems, are still operated manually and therefore it is important to prescribe ways for students to use them effectively. Third, as a university is an educational institution, it is easy to implement education on energy saving. Fourthly, it can yield financial savings by using this method. It is possible to save 16 percent of energy expenditure by changing fuel-use actions (The UK Carbon Trust, 2011). For a college, this can be a significant amount, as it is not a single sum, but an annual investment. Eventually, energy-saving would improve the university's public image. Therefore, in the hope of filling the gap in the body of knowledge, this survey-based research paper aims to quantify the most important EM CSFs to KPIs in Malaysia's SU adoption. The primary objectives of this paper are:

- Identification of CSFs for EM to SU in Malaysia; and
- Modeling the quantified association between the defined CSFs for EM to KPIs in achieving SU by using the technique of Structural Equation Modeling (SEM).

The research findings were hoped to discover the most appropriate EM CSFs for KPIs, in particular, guidelines for the Malaysian Higher Education Ministry to be more successful and able to be extended to all universities to achieve sustainability. On the other hand, this paper could have consequences in terms of providing authorities with knowledge of the issues that obstruct the Malaysian universities' adoption of SU values.

LITERATURE REVIEW

For the purpose of setting priorities and allocating resources, especially management attention, critical success factors (CSFs) are made explicit. According to Bullen &Rockart (1981), CSFs provide practical and relevant insights into the process of strategic corporate planning and provide useful insight into the correct allocation of resources and organizational planning. Bullen &Rockart (1981) agreed that CSFs are a valuable contribution to the strategic planning process and that its approach needs to be developed to allow an organization to succeed in areas where high performance is important. Caralli (2004) wrote, "CSFs identify key performance areas that are important to fulfilling the organization's purpose. Such key areas are identified and regarded implicitly by managers when setting goals and guiding organizational activities and tasks that are essential for achieving goals. Nevertheless, when these key performance areas are made explicit, they provide the entire organization with a shared point of reference. Every project or program that the organization undertakes must, therefore, ensure consistently high performance in these key areas; otherwise, the organization may not be able to achieve its goals and may therefore fail to accomplish its mission. Gates (2010) claimed that CSFs are directly related to the purpose and objectives of an organization. Like other aspects of strategic planning that indirectly influence strategy, CSFs affect strategy through its effects on the achievement of its objectives by the company and its ability to allow the project to succeed. Based on the relationship between CSFs and strategies, as shown in Fig. 1. The European Foundation for Quality Management (EFQM) Excellence Model has been adopted for this research as it is the main framework for the development of sustainable excellence, enabling people in any organization and specifically in universities to understand the relationship between what universities do as enablers and the KPIs as an outcome (European Foundation for Quality Management, 2012).

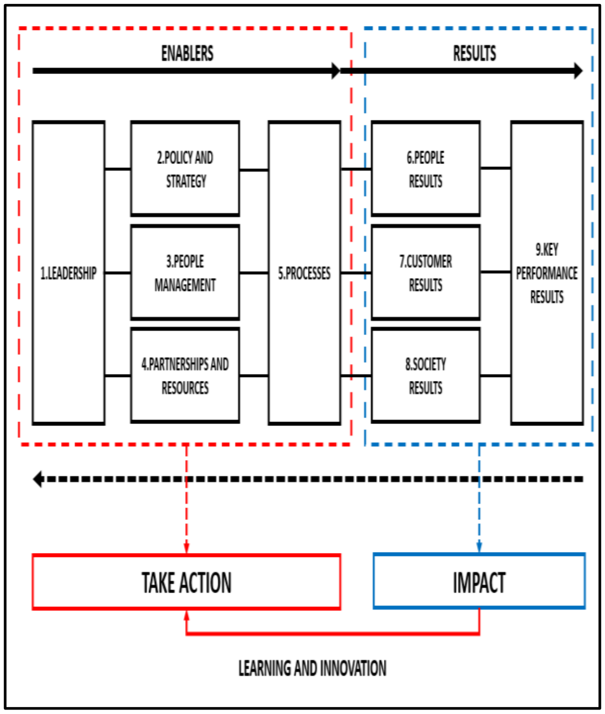

Figure 1. Relationship of enablers and results as a principal framework for sustainable excellence

One of the essential features of the EFQM model is that it separates the outcome areas (the outcomes obtained by the organization[the "what"]) and the operational areas (the organization's management[the "how"]) (Westerveld, 2003). The CSFs for EM can be seen as enablers from the EFQM Excellence Model, and the Talloires Declaration's 10-point action plan for a SU can be viewed as the outcome areas. In the literature, it is commonly assumed that the CSFs have a positive effect on organizational efficiency (Baker, 1995; Kellen, 2003; Flanagan, 2005; Haktanir& Harris, 2005; Cetinkaya, 2011; von Rosing, 2013). Therefore, this analysis not only describes the construct of CSFs and indicators but also identifies the relationship between identified EM CSFs and KPIs. First of all, the common approach to implementing SU is to identify potential EM CSFs to achieve SU. As a result, many researchers around the globe have done a decent amount of studies on the CSFs to SU. To identify the potential EM CSFs for the KPIs in achieving SU in Malaysia, a review of these studies is needed. Therefore, to classify the EM CSFs, a review existing literature on the subject was conducted. Table 1 provides a description of the literature analysis performed by a systematic literature review, where content analysis is conducted by concentrating and selecting different "CSFs to SU" software in the literature collected. As shown in Table 1, 23 CSFs to KPIs are extracted from the literature review on the basis of the coding and then classified into five CSFs construct: top management support, comprehensive EM team, stakeholders' involvement, awareness and risks management.

Table 1. Potential EM CSFs to KPIs

EM CSFs	Description	Key references
TMS	**Top Management Supports**	
TMS1	Develop energy policy and guidelines	IAU (1950); ULSF (1990); Pinto &Slevin (1989); Sanvido et al., (1992); Cooke Davies (2002); Velazquez et al., (2006); Lozano (2006); Xu et al., (2011); Choong et al., (2012); Yang (2013)
TMS2	Leadership	IAU (1950); Pinto &Slevin (1989); Sanvido et al., (1992); Belassi&Tukel (1996); Xu et al., (2011); Choong et al., (2012)
TMS3	Create incentives by establishing an award for positive contribution	Morris & Hough (1987); Manan (2012); Yang (2013)
TMS4	Allocation of sufficient resources such as manpower, technology money and time	IAU (1950); ULSF (1990); COPERNICUS (1993); Belassi&Tukel (1996); Xu et al., (2011); Choong et al., (2012); Yang (2013)
TMS5	Training provision	COPERNICUS (1993); UNESCO (1993); Pinto & Kharbanda (1995); Choong et al., (2012); Manan (2012); Yang (2013)
CEMT	**Comprehensive EM Team**	
CEMT1	Conduct energy audit	Pinto &Slevin (1989); Belassi&Tukel (1996); Cooke Davies (2002); Velazquez et al., (2006); Lozano (2006); Choong et al., (2012); Manan (2012); Yang (2013)
CEMT2	Operations and maintenance	Morris & Hough (1987); Pinto &Slevin (1989); Belassi&Tukel (1996); Choong et al., (2012); Yang (2013)
CEMT3	Management review and verification	Morris & Hough (1987); Cooke Davies (2002); Lozano (2006); Choong et al., (2012); Yang (2013)
CEMT4	Continuous improvement	Pinto & Kharbanda (1995); Belassi&Tukel (1996); Cooke Davies (2002); Choong et al., (2012); Manan (2012)
GRS	**Good Relationship among Stakeholders**	
GRS1	Understanding of project vision and goal	Morris & Hough (1987); Pinto &Slevin (1989); Belassi&Tukel (1996); Cooke Davies (2002); Lozano (2006); Yang (2013)

GRS2	Good communication among stakeholders	IAU (1950); COPERNICUS (1993); Pinto &Slevin (1989); Belassi&Tukel (1996); Lozano (2006); Choong et al., (2012); Manan (2012); Yang (2013)
GRS3	Knowledge and skills	IAU (1950); COPERNICUS (1993); Morris & Hough (1987); Pinto &Slevin (1989); Belassi&Tukel (1996); Xu et al., (2011); Yang (2013)
GRS4	Trust among stakeholders	Pinto &Slevin (1989); Sanvido et al., (1992); Belassi&Tukel (1996); Lozano (2006); Xu et al., (2011); Yang (2013)
AWA	**Awareness**	
AWA1	Understanding the issues	ULSF (1990); COPERNICUS (1993); Pinto &Slevin (1989); Sanvido et al., (1992); Belassi&Tukel (1996); Lozano (2006); Xu et al., (2011); Yang (2013)
AWA2	Increase general energy awareness	IAU (1950); ULSF (1990); COPERNICUS (1993); UNESCO (1993); Pinto &Slevin (1989); Belassi&Tukel (1996); Lozano (2006); Choong et al., (2012); Yang (2013)
AWA3	Improve facility energy awareness	Choong et al., (2012); Yang (2013)
AWA4	Education by research and development, teaching and learning	ULSF (1990); COPERNICUS (1993); UNESCO (1993); Velazquez et al., (2006); Lozano (2006); Choong et al., (2012); Yang (2013)
AWA5	Community engagement and partnership	IAU (1950); ULSF (1990); COPERNICUS (1993); Velazquez et al., (2006); Lozano (2006); Yang (2013)
AWA6	Energy information	IAU (1950); COPERNICUS (1993); Velazquez et al., (2006); Lozano (2006); Yang (2013)
RM	**Risks Management**	
RM1	Risks identification	Morris & Hough (1987); Pinto &Slevin (1989); Cooke Davies (2002); Xu et al., (2011)
RM2	Risks assessment	Morris & Hough (1987); Pinto &Slevin (1989); Cooke Davies (2002); Xu et al., (2011)
RM3	Risks respond	Morris & Hough (1987); Pinto &Slevin (1989); Cooke Davies (2002); Xu et al., (2011)
RM4	Risks measurement by developing a contingency plan	Morris & Hough (1987); Pinto &Slevin (1989); Cooke Davies (2002); Xu et al., (2011)
KPI	**Key Performance Indicator**	
KPI1	The management of the university has raised the awareness towards an environmentally sustainable future to the public, government, industry and university itself.	The Talloires Declaration-10 point action plan (1990)
KPI2	The management of the university has encouraged the staff and students to engage in education, study, policy formation, and information exchange on population, environment, and development to move toward global sustainability.	The Talloires Declaration-10 point action plan (1990)
KPI3	The management of the university has confirmed that all university graduates are knowledgeable and responsible on environmental management and related fields.	The Talloires Declaration-10 point action plan (1990)
KPI4	The management of the university has created more programs on sustainability to all undergraduate, graduate, and professional students.	The Talloires Declaration-10 point action plan (1990)
KPI5	The management of the university has established institutional policies and practices of resource conservation and environmentally operations.	The Talloires Declaration-10 point action plan (1990)

KPI6	The management of the university has encouraged the involvement of government, foundations, and industry to support their solutions to environmental problems.	The Talloires Declaration-10 point action plan (1990)
KPI7	The management of the university has developed interdisciplinary approaches to curricula, research initiatives, operations and outreach activities that support an environmentally sustainable future.	The Talloires Declaration-10 point action plan (1990)
KPI8	The management of the university has established partnerships with primary and secondary schools to develop the capacity for interdisciplinary teaching about environment and sustainable development.	The Talloires Declaration-10 point action plan (1990)
KPI9	The management of the university has promoted its effort toward a sustainable future by working with national and international organizations.	The Talloires Declaration-10 point action plan (1990)
KPI10	The management of the university has established a secretariat and a steering committee to continue this momentum, and to inform and support each other's efforts towards sustainability.	The Talloires Declaration-10 point action plan (1990)

These CSFs include; top management support, comprehensive EM team, the good relationship among stakeholders, awareness and risks management. Therefore the following theory is proposed:

Hypothesis 1 - There is a significant relationship between top management support which consists of developing energy policy and guidelines, leadership, create incentives by establishing an award, allocation of sufficient resources and training provisions with KPIs towards a sustainable university.

Hypothesis 2 - There is a significant relationship between comprehensive EM team which consists of the conduct energy audit, operation and maintenance, management review and verification and continuous improvement with KPIs towards a sustainable university.

Hypothesis 3 - There is a significant relationship between good relationships among stakeholders which consists of understanding vision and goals, good communication among stakeholders, knowledge and skills and trust among stakeholders with KPIs towards a sustainable university.

Hypothesis 4 - There is a significant relationship between awareness which consists of understanding the issue, increase general energy awareness, improve facility energy awareness, education by research and development, teaching and learning, community engagement and partnership and energy information with KPIs towards a sustainable university.

Hypothesis 5 - There is a significant relationship between risk management which consists of risk identification, risks assessment, risks respond and risk measurement by developing a contingency plan with KPIs towards a sustainable university.

METHODOLOGY

In order to identify possible EM CSFs to KPIs in achieving SU in the Malaysian context, an in-depth analysis of documents, journal articles and conference proceedings published on the subject was carried out. In addition, a two-stage descriptive survey approach was performed as an appropriate method of data collection to further investigate new set of CSFs, specifically in the context of Malaysia: the pilot study and questionnaire survey (QS). Kumar (2010); Naoum (2012); Creswell (2009); Chua (2011); Brace (2013) stated that a questionnaire constructed must have the following characteristics; (i) a clear description of the questionnaires; (ii) an easy-to-understand answer; (iii) a selection of the most appropriate answers; (iv) a sequentially sorted questionnaire; and (v) an easy-to-understand answer to the respondents. Therefore, the QS consisted of three parts, about the purpose of this research and promised anonymity and confidentiality to the respondents; the second part consisted of questions to cover their demographics, while in the third part academic staff and non-academic staff were asked to provide feedback (based on the Likert scale of 1- very not important to 5-very important) on the EM CSFs to KPIs in achieving SU.

Prior to the second stage (quantitative non-experimental research stage), semi-structured informal interviews were conducted among the target population to identify the EM CSFs to KPIs in order to achieve SU and assess the importance of additional insights to the Malaysian SU context obtained from the literature. Consequently, a pilot questionnaire survey is performed for data accuracy before the questionnaire survey is conducted. Cronbach's Alpha reliability test was conducted to assess the accuracy of the answers for each respondent specified in the questionnaire by the CSFs for EM. The lower the Cronbach alpha coefficient of 1.0, the higher the quality of these products, the same definition is calculated. Generally, the reliability under 0.6 is weak, 0.7 is reasonable to accept. While the calculated value exceeds 0.8 is good (Sekaran, 2003). In this analysis, the reliability value of 0.7 for Cronbach's Alpha was set as the highly reliable benchmarks. This is in line with the opinion by Nunnally & Bernstein's (1994); Hinton et al. (2004); Hishamuddin (2005); Chua (2006); Hair et al. (2006); Radhakrishna (2007) and Leech et al. (2008). In the pilot study, an actual alpha of 0.775 was measured, which enabled the data collection process to proceed through QS to create a structural equation model of the EM CSFs to KPIs in Malaysia's achievement of SU.

Data analysis

Modeling of structural equations quantifies a structural association between independent structures (Hair et al., 2014). Structural Equation Modeling (SEM), which offers a robust analysis (Byrne, 2009), has been widely used by CSFs researchers around the world and is applicable both for simple model comparisons and for more complicated first and higher order variables analysis (Hox & Bechger, 1998). The SEM methodology consists of the measurement method (MM), which relates to the connection between each exogenous variable and its respective latent variable (Hair et al., 2014), and the structural model (SM) used as hypothesized to calculate the correlation between the constructs (Molenaar et al., 2000). The reflective measurement model can be assessed against the following aspects: indicator reliability, internal consistency reliability, convergent validity, and discriminant validity. The summary of the assessment of the reflective measurement model for this research are listed in Table 2.

Table 2. Various assessment aspects and criterion for reflective measurement model

Assessment Aspect	Criterion (s)	Accepted Values or Conditions	Related References
Indicator Reliability	Factor Loadings (FL)	Items with outer loading 0.70 or higher are considered highly satisfactory. For exploratory study designs, the MVs with loading value of 0.40 is regarded as acceptable, and less than 0.40 should be dropped.	Henseler et al., (2009) Chin (1998); Hair et al., (2010)
Internal Consistency Reliability	Cronbach's Alpha (Cα)	For confirmative study: 0.70 > CA > 0.90 For explorative study: 0.60 > CA > 0.70 Values must not be lower than 0.60	Cronbach (1951); Nunally & Bernstein (1994); Henseler et al., (2009)
	Composite Reliability (CR)	For confirmative study: 0.70 > CA > 0.90 For explorative study: 0.60 > CA > 0.70 Values must not be lower than 0.60	Werts et al., (1974); Nunally & Bernstein (1994) Henseler et al., (2009)
Convergent Validity	Average Variance Extracted (AVE)	Proposed threshold value: AVE > 0.50	Henseler et al., (2009); Hair et al., (2011)
Discriminant Validity	Cross-loadings	Indicator's loadings should be higher for the construct they measure than for any other construct	Chin (1998)
	Fornell-Larcker criterion	AVE of each construct should be greater than the construct's highest squared correlation with any other construct (Constructs were bold in diagonal)	Fornell&Larcker (1981)

The next move is to analyze the structural model after validating the measurement model. The aim of the structural model (inner model) is to assess the connection between the construct of CSFs to KPIs in order to achieve a sustainable university. However, the structural model is also used to test the hypothesis by testing the path coefficients for standardizing beta values (Hair et al. 2012).

Table 3. Assessment aspects and criterion for structural model

Assessment Aspect	Criterion(s)	Accepted Values or Conditions	Related References
Predictive Power	Path Coefficient (β)	Path coefficients must be at least 0.10 to account for a certain impact within the model (Hair et al., 2011). According to Hair et al., (1995), significance of path coefficient (t-value) as described below:- *p<0.1 (t>.1.65), **p<0.05 (t>1.96), ***p<0.01 (t>2.58)	Hair et al., (2011)

RESULTS AND DISCUSSIONS

EM CSFs to KPIs in achieving SU - the final SEM

The PLS-SEM model is first assessed at the measurement model stage. Henseler et al., (2009) suggest four aspects of assessment. These criteria include assessment of (i) indicator reliability; (ii) internal consistency reliability; (iii) convergent validity; and (iv) discriminant validity at indicator and construct levels as shown in Table 4.

Table 4. Measurement model assessment

Construct	Indicator	FL	CR	AVE	Cα
TMS	TMS2	0.859	0.875	0.637	0.822
	TMS3	0.792			
	TMS4	0.729			
	TMS5	0.808			
CEMT	CEMT2	0.796	0.924	0.753	0.893
	CEMT3	0.909			
	CEMT4	0.862			
	CEMT5	0.900			
GRS	GRS1	0.959	0.875	0.779	0.746
	GRS3	0.799			
AWA	AWA1	0.690	0.832	0.554	0.749
	AWA2	0.752			
	AWA3	0.729			
	AWA5	0.801			
RM	RM2	0.769	0.835	0.628	0.709

	RM3	0.808			
	RM4	0.801			
KPI	KPI1	0.717	0.892	0.542	0.858
	KPI2	0.756			
	KPI4	0.686			
	KPI5	0.753			
	KPI6	0.753			
	KPI7	0.678			
	KPI10	0.802			

Another type of validity of the construct used in PLS-SEM is validity discriminating. Discriminant validity refers to the extent that the construct does not correlate with other measures other than it (Hulland, 1999; Hair et al., 2006). The test and cross-loading of Fornell-Larcker are the two conditions for verifying the discriminating validity. Using the Fornell-Larcker criterion, every construct's AVE should have a higher value than any other construct's squared correlations (Fornell & Larcker, 1981). This was achieved by replacing the AVE's square root function with the diagonal correlation matrix. Of enough distinguishing validity, the diagonal elements in the corresponding rows and columns must be greater than the off-diagonal elements (Hulland, 1999). Table 5 presents the construct correlation matrix. It shows that the AVE (in bold) diagonal values are higher than the off-diagonal AVE. The test thus confirms the validity of the discriminant.

Table 5. Discriminant validity

Construct	AVE	AWA	CEMT	GRS	KPI	RM	TMS
AWA	0.554	**0.744***					
CEMT	0.753	0.713	**0.868***				
GRS	0.779	0.534	0.505	**0.883***			
KPI	0.542	0.160	0.137	0.117	**0.736***		
RM	0.628	0.221	0.153	0.146	0.672	**0.793***	
TMS	0.637	0.476	0.511	0.432	0.208	0.119	**0.798***

The next discriminating validity test is based on cross loads. For all CSFs, cross loads have higher values on their relative CSFs compared to the other class either in the same row or the same column as shown in Table 6. It verifies that the CSFs represent the allocated category of CSFs in each build, thereby affirming the model's discriminating validity.

Table 6. Cross loadings of measured items

Indicator	AWA	CEMT	GRS	KPI	RM	TMS
CEMT2	0.750	0.796	0.471	0.114	0.109	0.378
CEMT3	0.543	0.909	0.427	0.109	0.146	0.456
CEMT4	0.596	0.862	0.415	0.151	0.149	0.482
CEMT5	0.550	0.900	0.431	0.071	0.111	0.430
KPI1	0.103	0.115	0.083	0.717	0.503	0.153
KPI2	0.087	0.105	0.007	0.756	0.545	0.118
KPI4	0.134	0.081	0.122	0.686	0.500	0.136
KPI5	0.108	0.087	0.012	0.753	0.447	0.151
KPI6	0.104	0.107	0.104	0.753	0.446	0.127
KPI7	0.132	0.085	0.136	0.678	0.463	0.161
KPI10	0.156	0.124	0.142	0.802	0.537	0.221
AWA1	0.690	0.380	0.360	0.081	0.191	0.353
AWA2	0.752	0.460	0.360	0.064	0.128	0.357
AWA3	0.729	0.315	0.335	0.122	0.187	0.320
AWA5	0.801	0.812	0.488	0.162	0.154	0.390
RM2	0.175	0.122	0.120	0.419	0.769	0.085
RM3	0.265	0.194	0.169	0.540	0.808	0.179
RM4	0.098	0.057	0.067	0.607	0.801	0.026
GRS1	0.465	0.423	0.959	0.128	0.149	0.354
GRS3	0.524	0.532	0.799	0.061	0.097	0.472
TMS2	0.431	0.473	0.431	0.205	0.157	0.859
TMS3	0.335	0.284	0.186	0.179	0.091	0.792
TMS4	0.444	0.471	0.383	0.047	0.027	0.729
TMS5	0.374	0.480	0.433	0.147	0.042	0.808

The next step is to calculate the path coefficient of all building (paths) of CSFs by comparing beta (β) values between all paths. The direction coefficient reflects the relationships that are hypothesized. The maximum β value reveals the best independent relationship (CSFs indicator) to the dependent (KPIs to a SU) (Urbach and Ahlemann, 2010). Hair et al., (2011) argues that track coefficients must exceed 0.10 to compensate for the model's effectiveness. Nonetheless, by means of a t-value check, β value must be checked for its sense level. A non-parametric bootstrapping technique is used to execute the experiment (Chin, 1998; Hansmann&Ringle, 2004). The number of cases for carrying out a bootstrapping evaluation is equal to the number of actual observations for this report. On the other hand, as indicated by Henseler et al. (2009), the number of resamples is 5000 to produce a reliable estimate. Hair et al. (2011) suggest that acceptable t-values are 1.64 (level of significance= 0.10 or 10%), 1.96 (level of significance= 0.05 or 5%) and 2.58 (level of significance= 0.01 or 1%) for a two-tailed test.

Table 7. The structural model assessment

Hypothesis	Relationship	Path Coefficient (β)	t-value	Remarks
HI	Top Management Support -> Key Performance Indicators	0.163	2.424**	Significant
H2	Comprehensive EM Team -> Key Performance Indicators	0.003	0.032	Not Significant
H3	Awareness -> Key Performance Indicators	0.237	1.993**	Significant
H4	Risks Management -> Key Performance Indicators	0.114	1.672*	Significant
H5	Good Relationship among Stakeholders -> Key Performance Indicators	0.124	1.731*	Significant

Note: Significance value: *p<0.1 (t>.1.64), **p<0.05 (t>1.96), ***p<0.01 (t>2.58)

Results from Table 7 indicate that the β values obtained for top management support, awareness, risks management and good relationship among stakeholders are higher than the cut-off point value of 0.10, as indicated by Hair et al. (2011). For the CSFs construct with the most significant relationship with KPIs, the highest β value is awareness (β= 0.237) followed by top management support (β= 0.163). The next step is to explore that hypothesis arising from this study in depth. The t-values are higher than the minimum cut-off value of at least 0.05 or 5%. It means that four CSFs have a significant relationship with KPI in achieving SU, top management support (t = 2.424), awareness (t = 1.993), risks management (t = 1.672) and good relationship among stakeholders (t = 1.731).

CONCLUSION AND RECOMMENDATION

The result of the assessment has supported the hypotheses where four CSFs group namely top management support, awareness, risks management and good relationship among stakeholders have significant relationship with KPIin achieving SU. Furthermore, to clarify these relationships, there is a need to do further case studies. Research can be applied at any university in Malaysia, public or private universities that aim to achieve sustainability through the adoption of longitudinal survey, where data for independent and dependent measures can be collected at two different times using different types of scale.

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