

A Model for Analyzing the Sustainability Performance in Educational Institutions

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Abstract—During the past two decades innumerable international initiatives have emphasized that education is an imperative for societies to become more sustainable. Sustainable development is the current context in which higher education must begin to focus its action plans. But the present system heavily relies on archaic models which reduce learning and action to reductionist thinking and mechanistic interpretation. Campus sustainability is receiving growing attention and has become a well-established study field, even though campus sustainability itself has not become a reality yet in most universities. The paper then validates a pre-existing model using multiple regression models. The results validated the proposed model. A sustainability index could be developed for the education sector in future using this conceptual framework. The educational institutions can use the sustainability index to analyze their sustainability performance and take the necessary steps for achieving the same. This paper is an initial step in this direction which could be researched further to measure the sustainability performance in the education system.

I. INTRODUCTION

The most adopted definition of sustainability is that “development that meets the needs of the present without compromising the ability of future generations to meet their needs (Brundtland Commission,1987).Sustainability refers to an integration of social, environmental and economic responsibilities, has begun to appear in the literature of business disciplines such as management and operations (Carter and Rogers, 2008). Social sustainability involves meeting basic needs, overcoming disadvantage because of disability and ensuring equitable distribution of opportunities in development (Baimes and Morgan, 2004). Environmental sustainability is the ability to maintain the qualities that are valued in the physical environment (Philip Sloan, 2016).

Higher education institutions can make a significant impact in promoting a sustainable future. The freedom and exposure which one gets to critical thinking in higher education are very unique enabling them to understand the society and its challenges and experiment on sustainability which has practical implications. At the Stockholm Conference in 1972 (UNEP, 1972), education was formally recognized on an international level to play an important role in fostering environmental protection and conservation. Higher education institutions are involved in embedding environmental education and education for sustainable development into their system. Many program leaders and academicians struggle to define and understand the concept of

sustainability which is perceived to be vague and value-laden. Several participants consider it to be difficult to operationalise the concept into clear learning objectives.

The Stockholm Declaration of 1972 was the first to make reference to sustainability in higher education and identified the interdependency between the humanity and the environment and suggested several ways of achieving environmental sustainability. In 1990 many universities signed the Talloires Declaration-a 10-point action plan for incorporating sustainability and environmental literacy in teaching, research, operations and outreach at colleges and universities (ULSF; 1990). In 1991 the Halifax university pointed out the continuing widespread degradation of the earth's environment, and the In The Swansea Declaration of 1993, participants from 47 different countries focused on finding ways -by which the universities, their leaders, scholars and students- to work together and employ their resources to rise up to the challenge of finding the balance between human quest for economic and technological growth and environmental preservation(UNESCO; 1993).

In this study we gather a group of indicators which can be used to measure the sustainability of the institution. They translate sustainability problems into measurable quantities of the "pillars of sustainability" (Elkington, 1999) with the aim of providing information on how the institution contributes towards sustainability. This study is based on the references from vast number of journals and data collected from a few educational institutions.

The purpose of this paper is to develop a model, which is a conceptual framework by considering the environmental, economic and social factors in education sector, to measure the economic, environmental and social practices, the three pillars of sustainability and to identify the various barriers encountered during adoption. This paper focuses on a paradigm shift which emphasizes on implementing sustainability using holistic and systematic thinking approaches. This paper is the first stepping stone in the path which can be researched further to measure the sustainability performance in the education system.

II. LITERATURE REVIEW

A. *Campus Sustainability*

In the last two decades, an increasing number of higher education institutions have been engaged in incorporating and institutionalizing sustainability into their systems(Ceulemans 2011;Lozano 2013; Shephard 2008).Alshuwaikhat and Abubakar(2008)defined that a sustainable campus should be environmentally healthy, with a prosperous economy through energy and resource conservation, waste reduction and with efficient environmental management; it should promote equity and social justice and export these values to the community.According to Milutinovic and Nikoli(2014), the vision of sustainable development in higher education is a world where everyone has the opportunity to benefit from a quality education and learn the values, behaviors and lifestyles required for a sustainable future and for positive societal transformation.Over the past decade, many universities have taken a more responsible approach to managing their environmental performance and improvement. This is not isolated to a single country or region, but has been particularly prominent in Europe, USA, Canada as well as in Australia, Asia, South America and Africa(Simkins G, Nolan A 2004).

B. *The Existing System*

But the field of sustainability in higher education (HE) is a rather recent and emerging research area (Wright,2010). Most of the research to date has focused on environmental management and greening of university estates and operations, case studies and examples of good practice of universities, and on introducing sustainability content in specific courses (Cotton 2009,Fien 2002). The environmental management and greening of campus operations and estates have seen much more progress than curriculum development(Jones2010).Wals and Blewitt(2010) analysed the research published in the International Journal of Sustainability in Higher Education (IJSHE) during the years 2001-2010. They found that most articles focus on things such as: environmental management, university greening and reducing a university's ecological footprint. In more recent volumes, articles on pedagogy, learning, instruction, community outreach and partnerships appear on the rise. Evangelinos et al. (2009) argued that the promotion of sustainability in the context of higher education institutions can be achieved through teaching and research (Delakowitz andHoffmann, 2000), improvement of environmental management(Bonnet et al., 2002) and transmitting knowledge to society (Owens and Halfacre-Hitchcock, 2006).

The need for environmental sustainability in university campuses has been stressed in many articles(Barnes P, Jerman P. 2002, Bernheim A 2003., Cortese AD 2005).Bernheim [2003] asserts that academic institutions

are an integral part of the automobile-intensive, high-consumption, waste-intensive global landscape. Universities make a significant contribution to the development of our society and have a special societal responsibility, in particular with regard to youth training and public awareness about sustainability. Environmental degradation is another factor which calls for the need to implement sustainability in universities. Sustainability affects every sphere of the campus, ranging from classrooms, labs to the entire community. An integrated approach to promoting sustainability is a comprehensive way of addressing environmental compliance issues (Savely SM, Carson AI, Delclos GL 2007). Therefore, this paper proposes a more suitable integrated approach to achieving campus sustainability that could mitigate the limitations of the current practices in universities and ensures more sustainability through the integration of three dimensions of sustainability proposed by Elkington namely: environment, society and economic aspect (the Triple bottom line).

C. Economic Perspective

The relevance of incorporating economic aspect is stressed in many articles. Sustainability is characterized by economic growth based on social justice and efficiency in the use of natural resources (Lozano R:2006). For a city or an organization to be sustainable, it requires conservation and enhancement of its resources base, an elimination of poverty and deprivation of its inhabitants, broadening of the concept of development so that it covers not only economic growth but also social and cultural development. Elizabete (2005) have also identified economic aspect among five essential dimensions within the concept of sustainability, the others being ecological, social, cultural and spatial.

TABLE I. ITEMS UNDER ECONOMIC PERSPECTIVE

Sl. no	ITEM	Author	YEAR	Economic Items Code
1	Wind, solar and geothermal sources for heat and power	Habib Alshuwaikhat, Ismaila Abubakar	2008	EC1
2	Number of research projects that are multidisciplinary and interdisciplinary in the area of sustainability	Rodrigo Lozano	2008	EC2
3	Installation of centralized control systems	Habib Alshuwaikhat, Ismaila Abubakar	2008	EC3
4	Budget allocation, Office and personnel specially dedicated	Rodrigo Lozano	2006	EC4
5	Energy-efficient lighting such as T-8, compact fluorescents, and metal halide fixtures.	Habib Alshuwaikhat, Ismaila Abubakar	2008	EC5
6	Administrative support (with a detailed plan and budget)	Rodrigo Lozano	2006	EC6
7	Day lighting to illuminate classrooms	Habib Alshuwaikhat, Ismaila Abubakar	2008	EC7
8	Revenues from grants and contracts specifying sustainability-related research	Rodrigo Lozano	2006	EC8

D. Environment Perspective

Incorporating the environment dimension is all about the practices, procedures, processes, resources etc that are quintessential for developing, implementing and reviewing a university policy that can develop a sustainable environment.

According to Barnes and Jerman (2002), Environment management can be a successful tool for educational institutions to effectively manage diverse environmental concerns and improve campus sustainability. Implementing Environment management provides an effective guidance for organizational like universities to simultaneously establish, develop and review their operations and practices in more environmentally and socially responsible ways (Piper JM; 2002).

TABLE II. ITEMS UNDER ENVIRONMENT PERSPECTIVE

Sl no	ITEMS	AUTHOR	YEAR	Environment Items Code
1	Rainwater collection for toilet use	Rodrigo Lozano	2014	E1
2	Use more IT/technology	KaisuSammalisto	2014	E2
3	Bicycle use, Public transport	Rodrigo Lozano	2014	E3
4	Green purchasing	HanShi, Elizabeth Lai	2013	E4
5	Paper-usage reduction	Rodrigo Lozano	2014	E5
6	Landscaping management	HanShi, Elizabeth Lai	2013	E6
7	Treatment in situ of laboratory waste.	Rodrigo Lozano	2014	E7
8	Measures to implement ISO 14001 standard	Habib Alshuwaikhat, Ismaila Abubakar	2008	E8
9	A policy that promotes biodiversity	Marianne E. Krasny, Jesse Delia	2014	E9

E. Social Perspective

The major social responsibilities for a sustainable campus are (Habib Alshuwaikhat, Ismaila Abubakar :2008) Public partnership and participation, Community service and social justice. They further categorically states this as a strategy that seeks university stakeholders' participation in achieving sustainability and university social responsibility of promoting environmental justice and equity to all irrespective of race and gender and the need to care for the handicap and people of special needs. Becoming a sustainable university also requires partnership with private, governmental and non-governmental organizations (NGOs).

TABLE III. ITEMS UNDER SOCIAL PERSPECTIVE

SL NO	ITEMS	AUTHOR	YEAR	Social Items code
1	Specific actions towards certain target groups (e.g. gender equality, ethnic groups and minorities, foreign students)	Rodrigo Lozano	2014	S1
2	Sustainability outreach & publication	HanShi, Elizabeth Lai	2013	S2
3	Percentage of graduate students doing research in sustainability	Rodrigo Lozano	2006	S3
4	Percentage of faculty doing research in sustainability issues	Rodrigo Lozano	2006	S4
5	Public lectures and awareness programmes	Habib Alshuwaikhat, Ismaila Abubakar	2008	S5
6	Number of students enrolled in sustainability-related courses	Rodrigo Lozano	2006	S6
7	Interpretation, individual internalization and integration of SD skills in modified way of thinking	Kaisu Sammalisto	2014	S7
	Number and percentage (in respect to the total) of courses related to sustainability	Rodrigo Lozano	2006	S8

III. CONCEPTUAL FRAMEWORK

Education institutions can make a big impact in promoting a sustainable future. This study aims at developing a conceptual framework which would help the educational institutions to assess their own efforts towards attaining sustainability and then comparing their efforts to those of other institutions. The framework is depicted in the figure 1.

ESPE: Environmental Sustainability Practices in Education. It includes the set of practices and processes for developing, achieving and maintaining the policy of achieving sustainable environment. Kosnik (2007) categorized various initiatives of sustainable campus operations as building construction and renovation,

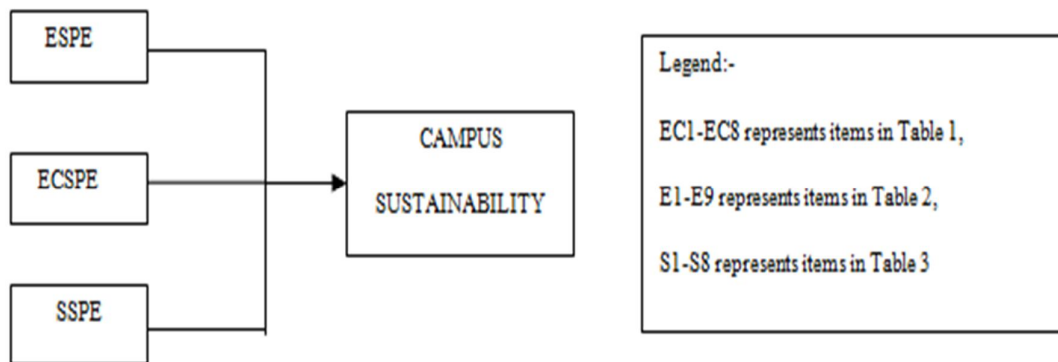


Figure 1. Conceptual Framework

energy management, transportation and water use. The implementation of green building practices has resulted in conservation of energy and water, reduced operating costs and added educational benefits.

ECSPE: Economic Sustainability Practices in Education. A critical component of any campus administration is its financial resources. Emerging barriers to sustainable campus measures are a lack of financial resources and the extensive costs associated with implementing sustainable initiatives.

SSPE: Social Sustainability Practices in Education. Students, faculty and staff are regarded as equal campus agents concerning sustainability measure (McIntosh et al., 2008). Universities have some social responsibilities of educating the students and the society about sustainability. It can help the universities increase efficiency of operations by removing waste from research, learning and other processes, increase awareness of environmental impacts of operations among all faculty, staff and students.

Triple Bottom Line is the fundamental concept of the framework. The framework is a first step and it can be worked on and a sustainability index can be developed. It shows a relationship between the independent and dependent variables. The influence of government regulations, mediators or moderators can be checked. It can be further expanded by the addition of sub-constructs to each dimension of sustainability.

IV. OBSERVATIONS AND DISCUSSIONS

The literature survey brings in light the factor that Higher education institutions in Europe have stronger will to integrate sustainability into their functioning (Disterheft, 2012; Karatzoglou, 2013; Matten and Moon, 2004). There is a deficit of interest among higher education institutions in states like Kerala to incorporate sustainability into their functioning. The authors through this paper aim to initiate steps to bridge this gap which has to be addressed within no time. The authors are of the opinion that the proposed conceptual model takes baby steps in a less traversed path where the scope of further research is unlimited in the context of higher education sector in Kerala.

The conceptual model by incorporating the social, economic and environmental aspects of the triple bottom line stresses on holistic, and systemic thinking perspectives (Ferrer-Balas et al., 2009; Koester et al., 2006; Sterling, 2004) rather than the Newtonian and Cartesian mental models (Lovelock, 2007; Nonaka and Takeuchi, 2001). The model attempts to prevent the compartmentalization of sustainability initiatives implemented throughout the system and replacing this with a more integrated approach. The environmental awareness of all the stake holders are improved and their responsibility for environmental improvement are clarified (Melnyk SA, Sroufe RP, Calanton R. 2003). The partnership between NGOs, government and private companies can be improved at local, national and international level to undergo Research and Development, organise workshops and seminars (Alshuwaikhat, H.M., Abubakar, I., 2008). The importance of green buildings and innovative technologies are highlighted here. The model also gives importance to public participation, community services and ensures social justice in the system making this more holistic and integrated.

The survey was made available online through google forms and advertised in LinkedIn online social platform. It was also sent to prospective respondents through e-mail. There were 300 respondents from various educational institutions. The district wise and gender wise composition of the respondents are shown below.

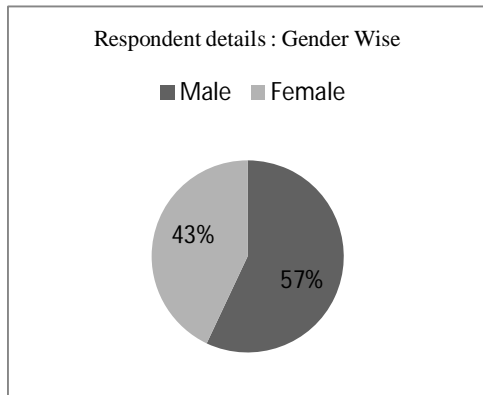


Figure 2. Respondent details: Gender wise

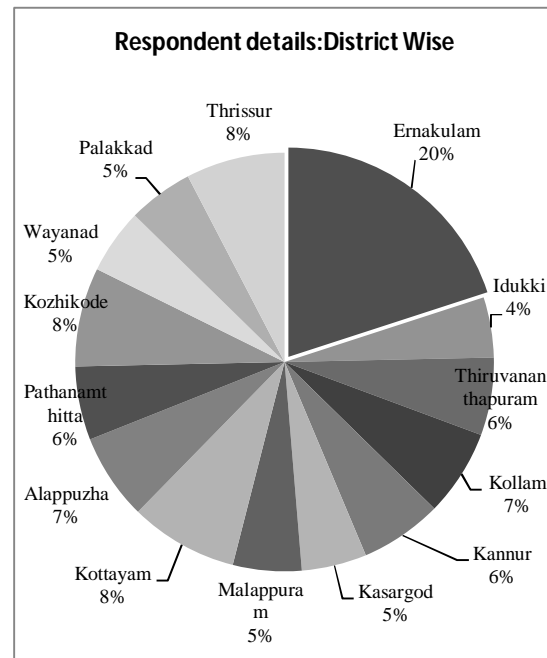


Figure 3. Respondent details: District wise

Reliability: Reliability of the instrument needs to be checked before any analysis. This was done in SPSS(IBM,2012) using cronbach’s alpha. The cronbach alpha of the instrument is .873 indicating a high level of internal consistency of the scale.

Data Analysis: The data analysis was carried out using SPSS to identify the in-depth relationships between the variables. The method employed is multiple linear regression analysis which was used to detect and quantify the inter –relationships between the independent variables and the dependent variable. 3 independent variable and a dependent variable were identified for regression analysis. The independent variables are environment, economic and social. The dependent variable is the performance indicator.

In order to facilitate the comparison for analysis the data were aggregated in the following way:

The items included under each construct varied from 1-7 based on the likertscale. The variables were formulated by the summation of value of each item under the variable.

$$\text{Environment} = \sum \text{E1-9}$$

$$\text{Economic} = \sum \text{EC1-8}$$

$$\text{Social} = \sum \text{S1-8}$$

The independent variables environment, economic and social for each respondent varied from (9-63),(8-56),(8-56) respectively. The dependent variable performance indicator was formulated similarly. Performance indicator = \sum (items under the variable performance indicator).

The multiple linear regression model was used to check the inter relationship of the constructs. The normal q-q plot and the histogram with fitted normal curve was used to check the normality. The VIF and the tolerance test was used to check the multi-collinearity. Check for auto-correlation was done using Durbin Watson test. These diagnostics did not reveal any problems with the suitability of the model. The linearity and homoscedasticity were also checked.

V. RESULTS AND DISCUSSION

The results with respect to each construct are shown below.

F. Regression of Economic Items

R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Durbin-Watson
0.78	0.609	0.608	4.2631	0.609	1.909

ANOVA ^a						
Model	Sum of Squares	Df	Mean Square	F	Sig.	
1	Regression	8439.062	1	8439.062	464.348	.000 ^b
	Residual	5415.855	298	18.174		
	Total	13854.917	299			
a. Dependent Variable: PERFORMANCE						
b. Predictors: (Constant), ECONOMIC						

From the value of R square change, the independent variable(Economic) can explain 60.9% of the dependent variable(Campus Sustainability).Since the significance obtained is less than 0.05, there is a significant relationship between campus sustainability and economic construct.

G. Regression of Social Construct

R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Durbin-Watson
0.711	0.506	0.504	4.79315	0.506	1.954

ANOVA ^a						
Model	Sum of Squares	Df	Mean Square	F	Sig.	
1	Regression	7008.571	1	7008.571	305.061	.000 ^b
	Residual	6846.346	298	22.974		
	Total	13854.917	299			
a. Dependent Variable: PERFORMANCE						
b. Predictors: (Constant), SOCIAL						

From the value of R square change, the independent variable(Social) can explain 50.6% of the dependent variable(Campus Sustainability).Since the significance obtained is less than 0.05, there is a significant relationship between campus sustainability and social construct.

H. Regression of Environment Construct

R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Durbin-Watson
0.637	0.405	0.403	5.25849	0.405	2.062

ANOVA ^a						
Model	Sum of Squares	df	Mean Square	F	Sig.	
1	Regression	5614.708	1	5614.708	203.051	.000 ^b
	Residual	8240.209	298	27.652		
	Total	13854.917	299			
a. Dependent Variable: PERFORMANCE						
b. Predictors: (Constant), ENVIRONMENT						

From the value of R square change, the independent variable(Environment) can explain 40.5% of the dependent variable(Campus Sustainability).Since the significance obtained is less than 0.05, there is a significant relationship between campus sustainability and environment construct.

The authors believe that this model can serve as a strong foundation for revolutionary changes in the education sector in Kerala .This can have significant impact on the way people perceive education and generation cautious and vigilante of integrating sustainability into their activities can be shaped out.

VI. CONCLUSION

Campus sustainability is receiving growing attention and has become a well-established study field, even though campus sustainability itself has not become a reality yet in most universities. Environmental management system (EMS) is one tool in the overall process to enhance campus sustainability. A frequently reported barrier to campus greening has been the overall lack of awareness from students, faculty and staff. By offering hands-on approaches to tackle complex problems, the situation can be reversed. The emerging range of possible actions as designed by the research team as well as the early experience with sustainability in academic research contribute to the translation of sustainability into a range of tangible and realistic research actions. Campuses are heterogeneous and are involved in many scientific, social and educational activities, energy supply and usage, transport, sports etc. In order to contribute towards sustainability, universities must rethink their environmental policies. They should make campus sustainability the foundation for campus operations and must try to conserve natural resources and support their sustainable use, stimulate economic growth and improve society.

This paper focuses on a paradigm shift which emphasizes on implementing sustainability using holistic and systemic thinking approaches. Sustainable development implementations in the present system are excessively compartmentalized. The present work intends to replace this with a system which focuses on inter disciplinary integration within and outside academia. Many researchers have focused on participatory approaches which educate students as sustainability change agents. A sustainable campus community acts upon its local and global responsibilities to protect and enhance the health and well being of humans and ecosystems. It actively engages the knowledge of the university community to address the environment and social challenges that we face now and in the future.

The paper developed a conceptual framework by considering environmental, economic and social factors of sustainability in education sector. The model proposed was validated by the research which is an indication of A sustainability index could be developed for the education sector in future using this conceptual framework. The educational institutions can use the sustainability index to analyze their sustainability performance and take the necessary steps for achieving the same. This paper is an initial step in this direction which could be researched further to measure the sustainability performance in the education system.

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