Assessing Awareness, Understanding, Construction Practices and Innovation towards Green Construction

Afzan Ahmad Zaini[1] Intan Rohani Endut[2]

Abstract: Green Construction is the construction activities that conserved energy, land, water and material to reduce the negative effect to the environment while assuring essential demand on quality and safety during project construction. This paper critically examine the contribution of awareness and understanding, green construction practices and green construction innovation with the green construction benefits. A measurement model based on the theoretical framework and exploratory factor analysis was developed and tested using structural equation modelling technique. This study employs a survey research methodology involving a total of 346 respondents among construction contractors, developers, clients and consultants in the construction industry. The findings indicate that the awareness and understanding, green construction practices and green construction innovation are significant predictors of the green construction benefits. From the practical perspective, the findings should alert the construction participants on the need of awareness and understanding, green construction practices and green construction innovation towards the green construction benefits. In addition, the findings can be used as diagnostic tool for continuous improvements in the Malaysian construction industry.

Keywords: Awareness and understanding, green construction practices, green construction innovation, green construction benefits, survey, Malaysia

I. INTRODUCTION

Construction is a major industry throughout the world, accounting a sizeable proportion of most countries' Gross Domestic Products [1], [2]. The growth of countries, especially developing countries, is measured by the physical development of construction projects. It has become more critical and generated more interest and attention from the government and construction project stakeholders in view of improving the performance in terms of cost, time and quality [3]. Green construction is relatively new compared to more mature disciplines like conventional construction. There are limitation and scarcity of information on certain aspects of green construction in the context of the construction industry. These areas include current practice, benefits, awareness and understanding and green construction innovation.

II. LITERATURE REVIEW

It is important to discuss the current practice, awareness and understanding, green construction innovation and its benefits in green construction.

A. Green Construction Practices

Green construction practices are currently focusing on enhancing biodiversity, improving air and water quality, controlling noise, reducing solid waste and conserving natural resources[4], [5].

The construction industry in China, for example is facing a great problem on energy consumption and pollution emissions. These impacts reflected in consumption of natural resources (e.g.water, energy and materials) [6]. Therefore, it is a great importance to solve the problems of land saving, energy saving, material saving and environmental protection during the construction process.

This can be realised through proper planning, design, production of construction materials, construction, installation, operation, maintenance and management of construction environment [7]. Besides, appropriate scientific management, for instance, the occupational health and safety management: OSHAS 18001, and advanced technology are important at guaranteeing the health and safety during construction of the project [8].

Research and development (R&D) is also one of the current practices in most of the construction firms to improve environmental performance [9]. In addition, [8] suggests the importance to recycle and reuse the construction materials and control the discharge amount of carbon dioxide (CO^2).

Country like Japan, UK, Sweden, Spain, Australia and the USA are actively implementing the environmental management system (EMS): ISO 14001 standard in construction industry to encourage the use of natural resources [10]. EMS is a standard emphasising the importance of managing elements of organisation's activities, products and services that interact directly with the environment [11].

EMS enables organisations to resolve environmental problems, reduce product cost, enhance the competitiveness of products in the international market, and increase the profit margin for the construction organisations [12]. In Hong Kong, for example, 150 construction firms are obtaining EMS: ISO 14001 as of September 2009 [13].

B. Awareness and Understanding in Green Construction

Awareness of green construction is closely related to the public awareness of environmental issues. At present, the knowledge and cognition on the sustainability of all parties, including policy makers, owners, designers, construction personnel and the public need to be further enhanced [14]. Analysis from literature culminates the awareness and understanding are crucial to ensure a successful implementation of green construction [4], [5], [11], [15]–[19].

C. Green Construction Innovation

There are a few suggestions and strategies for green construction innovation. One of the green construction innovations is waste minimisation that was developed from [21]–[24]. A proper waste management system [4], [5], [11], [16], [17], [19], [20] is required and as the key factor for a successful implantation of green construction. Among other green construction innovation: standardization of design, stock control to minimize over-ordering, environmental education for the workforce, recycling and waste disposal ,companies as part of the supply chain, practicing just-in-time delivery approaches, penalties for poor waste management, incentives and tender premiums for waste minimization, waste auditing, increased use of off-site techniques, use of on-site compactors, suppliers required to provide materials and products in small batch sizes, reverse logistics, imposition of stricter regulations, establishment of longer customer-supplier relationship, increased awareness of environmental, social and economic impact, implementation of environmental management system, support and push from top-level

Faculty of Civil Engineering, Universiti Teknologi MARA, Malaysia
Email address: afzanahmadzaini@gmail.com

management, implementation of ISO14000 certifications, regular audits on green environmental standards, customer's willingness to pay extra for green construction and engagement by government bodies during the formulation of the regulations, setting up energy saving objectives at operational levels, consideration of energy objectives at the strategic planning level, value management of energy plans, lifecycle costing accuracy, proved education/awareness of designers about energy efficient materials and techniques use of cost and environmental assessment tools.

In addition, factors that are considered as green construction innovation are: high return on investment, role and responsibilities of stakeholders, effective labour and material management, financial well-being and capital intensity of organization, environmental policies and procedure, clear client's specification design and production, strict environmental regulations, manager's concern on the environment and its protection, commitment of top-level management, education and training, internal and external audit, technology processes and development, site environmental assessment, requirement on green equipment and machineries and financial investment in green technology [21]–[24].

D. Green Construction Benefits

Green construction creates values both in the area of waste minimisation and pollution reduction [4]. These may improve the environmental performance and financial of the industry. Financial benefits include lower energy costs, lower maintenance costs, enhance productivity and increase the market value. Green construction can increase resources efficiency, i.e. land efficiency, material efficiency and water efficiency using scientific management and technical progress[25]. In another related study, [26] observe that green construction can ensure quality and safety, maximise the conservation of resources and reduce negative impacts on the environment.

Green construction also can increase turnovers and profits by the creation of markets, improve products and green technologies, energy saving, improve environment and building life cycle, lead organisation to accept new ideas and stimulate creative thinking and improve customer satisfaction [5], [27]. Besides, the company also can be awarded a certificate and awards if obtaining the green assessment tool. These may improve the company's reputation and, therefore, improve the customer satisfaction.

III. RESEARCH METHODOLOGY

The exploratory factor analyses were conducted using SPSS 19. This statistical analysis was adopted when there are too many items to measure variable. The items need to be reduced into a manageable number before further analysis can be carried out. In the factor analysis procedure, items that possess similar characteristic will be grouped together under one component. Subsequently, the structural equation modeling or popularly known as SEM "a second generation statistical analysis techniques" was developed for analysing the inter-relationships among multiple variables in a model. The inter-relationships among variables could be expressed in a series of single and multiple regression equations.

The SEM technique employs the combination of quantitative data and correlational or causal assumptions into a model. Four requirements for executing SEM; sample size, multicollinearity, normality and outliers. Below are the related research questions and their corresponding hypotheses:

1) Research Question 1: How significant is the direct effect of green construction innovation on green construction benefits?
H1: Green Construction innovation has a significant direct effect on green construction benefits
2) Research Question 2: How significant is the direct effect of green construction practice on green construction benefits?
H2: Green Construction practice has a significant direct effect on green construction benefits
3) Research Question 3: How significant is the direct effect of awareness and understanding on green construction benefits?
H3: Awareness and Understanding have a significant direct effect on green construction benefits.

IV. THEORETICAL FRAMEWORK

It is important to discuss the concept and theoretical framework of green construction before executing SEM. The concept of green construction as describe by [28] is the reflection of sustainable development with the comprehensive application of technology, while [29] define the sustainable development as a development that meets the needs of the present and future generations.

The sustainable development in the construction industry is a long-term task, and the green construction plays a key role in green building [30]. This study suggests the Green Construction Practice, Awareness and Understanding and Green Construction Innovation which consists of "green technology requirement", "Procurement Strategy", "Managerial Concern", "Project Strategy", "Environmental Requirement" and "Client Requirement" has a significant direct effect on green construction benefits. Figure 1 illustrates the theoretical framework for this study.

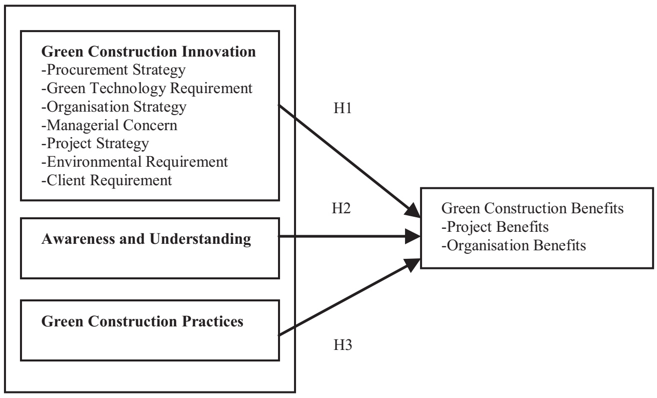

FIGURE 1
THEORETICAL FRAMEWORK

V. THE ASSESSMENT OF NORMALITY OF DATA

Normality assessment is an important task for the data at hand before proceeding to measurement model. The following results are presented in Table I. The normality assessment can be made by assessing the measure of skewness for every item. Since the absolute value of skewness for all items is within -1.0 to 1.0, it indicates that the data is normally distributed. Hence, the required assumption for employing the parametric statistical procedure is satisfied [31].

TABLE I
NORMALITY OF DATA

Items	Min	Max	Skewness
CSF16	1.000	7.000	**-.176**
CSF17	1.000	7.000	**-.047**
CSF18	1.000	7.000	**-.013**
CSF19	1.000	7.000	**-.033**
CSF20	1.000	7.000	**-.212**
CSF21	1.000	7.000	**-.106**
CSF8	1.000	7.000	**-.141**
CSF9	1.000	7.000	**-.130**
CSF10	1.000	7.000	**.089**
CSF11	1.000	7.000	**.024**
CSF12	1.000	7.000	**.015**
CSF13	1.000	7.000	**.041**
CSF15	1.000	7.000	**.069**
B7	1.000	7.000	**-.369**
B6	1.000	7.000	**-.553**
B5	1.000	7.000	**-.456**
B4	1.000	7.000	**-.477**
B3	1.000	7.000	**-.516**
B2	1.000	7.000	**-.390**
B1	1.000	7.000	**-.477**
B11	1.000	7.000	**-.464**
B10	1.000	7.000	**-.354**
B9	1.000	7.000	**-.573**
B8	1.000	7.000	**-.438**
CP1	1.000	7.000	**-.290**
CP2	1.000	7.000	**-.444**
CP3	1.000	7.000	**-.575**
CP4	1.000	7.000	**-.756**
CP5	1.000	7.000	**-.649**

CP6	1.000	7.000	**-.570**
CP7	1.000	7.000	**-.635**
CP9	1.000	7.000	**-.618**
CP10	1.000	7.000	**-.433**
U1	1.000	7.000	**-.476**
A1	1.000	7.000	**-.594**
CSF27	1.000	7.000	**-.039**
CSF28	1.000	7.000	**-.018**
CSF29	2.000	7.000	**.098**
CSF30	2.000	7.000	**.240**
CSF31	2.000	7.000	**.098**
CSF32	1.000	7.000	**-.090**
CSF25	1.000	7.000	**.132**
CSF26	2.000	7.000	**.102**
CSF22	1.000	7.000	**.042**
CSF23	1.000	7.000	**-.254**
CSF24	1.000	7.000	**-.155**
CSF6	1.000	7.000	**-.081**
CSF7	1.000	7.000	**-.137**
CSF1	1.000	7.000	**-.086**
CSF2	1.000	7.000	**-.153**
CSF3	1.000	7.000	**-.129**
CSF4	1.000	7.000	**-.172**
CSF5	1.000	7.000	**-.010**

V. Exploratory Factor Analysis

Factor analysis is a data reduction technique which takes a large set of variables and looks for a way in which the data may be summarised using a smaller set of factors or components [32]–[37]. This statistical approach involves finding a way of condensing the information contained in a number of original variables into a smaller set of dimensions (factors) with a minimum loss of information [38].

In this research, several factors were listed (green construction innovation and green construction benefits), and factor analysis was employed to reduce the variables into a smaller set of factors before confirmatory factor analysis can be carried out. Table II and Table III indicated the value of the Kaiser-Meyer-Olkin (KMO) statistic as 0.930 and 0.951, in which, according to Kaiser (1974), is satisfactory for factor analysis. Bartlett's test of Sphericity tests the hypothesis that the correlation matrix is an identity matrix. In this case, the value of the test statistic for Sphericity is large (Bartlett's Test of Sphericity = 2080 and 153) and the associated significance level is small (p = 0.000), which suggests that there is no need to eliminate any of the variables for the principal component analysis [39].

Table IV presents the summary of results from the rotated component matrix for green construction innovation and green construction benefits. In this case, seven components were extracted and rotated for green construction innovation while two components were extracted and rotated for green construction benefits. Varimax rotation was used, which assumes that the factors are not related, and tends to be easier and cleaner to interpret [33], [34].

TABLE II
Kaiser-Mayer-Olkin Measure of Sampling Adequacy for Green Construction Innovation

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.930
Bartlett's Test of Sphericity	Approx. Chi-Square	24762.175
	Df	2080
	Sig.	.000

TABLE III
Kaiser-Mayer-Olkin Measure of Sampling Adequacy for Green Construction Benefits

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.951
Bartlett's Test of Sphericity	Approx. Chi-Square	6739.186
	Df	153
	Sig.	.000

TABLE IV
The Description of Latent Constructs, Unobserved Variables and Items

Latent Constructs	Unobserved Variables	Items
Green Construction Innovation	Procurement Strategy (PS)	CSF1-Use of Procurement / Purchasing
		CSF2- Strategic Supply Chain
		CSF 3- Industry Market Structure
		CSF4- Changing Market Conditions
		CSF5- Return on Investment
	Green Technology Requirement (GTR)	CSF6-Specifying the green technology that must be used
		CSF7-Fines and penalties for non-compliance
	Client Requirement (CR)	CSF22-Financial investment in green technology
		CSF23- Clear client's specification, design and production of construction facilities
		CSF24- Client strongly shapes the products and process from the very beginning of the construction projects
	Environmental Requirement	CSF25-Environmental Impact Assessment (EIA)
		CSF26- Ecological and Impact Management (EIM)
	Organisation Strategy	CSF27-Scope of delivery, limitation and roll out plan
		CSF28- Promotion of corporate green image
		CSF29- Effective risk management
		CSF30- Compliance with accreditation system
		CSF31-Fulfill the function, process, structure and features
		CSF32- Low cost of compliance
	Managerial Concern	CSF8- Commitment of the top level management
		CSF9- Manager's raising environmental awareness
		CSF10- Good team communication and coordination
		CSF11- Role and responsibility of stakeholders
		CSF12-Proper organisational structures
		CSF13- Working environment in an organisation
		CSF15-Corporate sustainability
	Project Strategy	CSF16- Environmental policies and procedures in green construction
		CSF17- External Audit Environmental Performance
		CSF18- Project Environmental Assessment
		CSF19- Environment and social regulations
		CSF20- Technologies processes and development
		CSF21- Measurement and reporting compliance
Awareness and Understanding		A1- Level of Awareness in green construction
		U1- Level of Understanding in green construction
Green construction Practice		CP1-Recycling and Re-use
		CP2- Noise Controlling Plan
		CP3- Waste Abatement/ Reduction Plan
		CP4- Energy Saving Plan
		CP5-Material Saving Plan
		CP6- Land Saving Plan
		CP7- Air Pollution Reduction
		CP9-ISO 14001: Environmental Management System
		CP10- Research and Development (R&D) in green construction
Green Construction Benefits	Project Benefits	B8- Improve Health and Safety B9- Improve Customer Satisfaction
		B10- Stimulate Creative Thinking
		B11- Improve Building Life Cycle Performance
	Organisation Benefits	B1- Cost Saving
		B2- Water Minimisation
		B3- Company Reputation
		B4- Awards/ Certificate
		B5- Enhancing Productivity
		B6- Increase Market Value
		B7- Increase Resource Efficiency

VI. Confirmatory Factor Analysis

Confirmatory factor analysis (CFA) or measurement model is unmeasured covariance between each possible pair or latent variables. The measurement model is evaluated using the goodness of fit measures. Figure II presents the measurement model for all items involved in the study based on the theoretical framework shown in Figure I and the results from exploratory factor analysis.

AMOS software is executed, and the result of the factor loading is calculated and presented in Figure II. The level of factor loading, as suggested by [31], [40], [41] should be above the value of 0.6. All items are above 0.6-factor loading, but some of the items have a high value of

Modification Indices (above 15) which indicate the correlated errors between the items.

Thus, the measuring items need to be deleted from the measurement model. Item CSF14 and CP8 have been deleted due to the high value of Modification Indices. The description of latent constructs, unobserved variables and items are presented in Table IV.

VII. ASSESSING THE VALIDITY AND RELIABILITY OF A POOLED MEASUREMENT MODEL

A. Unidimensionality

The unidimensionality for this study is achieved when the measuring items have acceptable factor loadings, above 0.60. To ensure unidimensionality of a measurement model, any item having low factor loading should be deleted [41].

C. Reliability

Reliability is the extent of how reliable is the particular measurement model in measuring the respective latent construct. The Composite reliability (CR) for this study is achieved when the CR is greater than 0.70.

1) Internal Reliability
The internal reliability for this study is achieved when the Cronbach's Alpha for all items are greater than 0.70.

2) Construct Reliability and Average Variance Extracted
The measure of reliability and internal consistency of the measured variables representing the latent constructs. The calculation is performed by Stat Tools Package develop by James Gaskin. The output for the construct reliability, Average Variance Extracted, maximum shared variance and average shared variances are shown in Table V

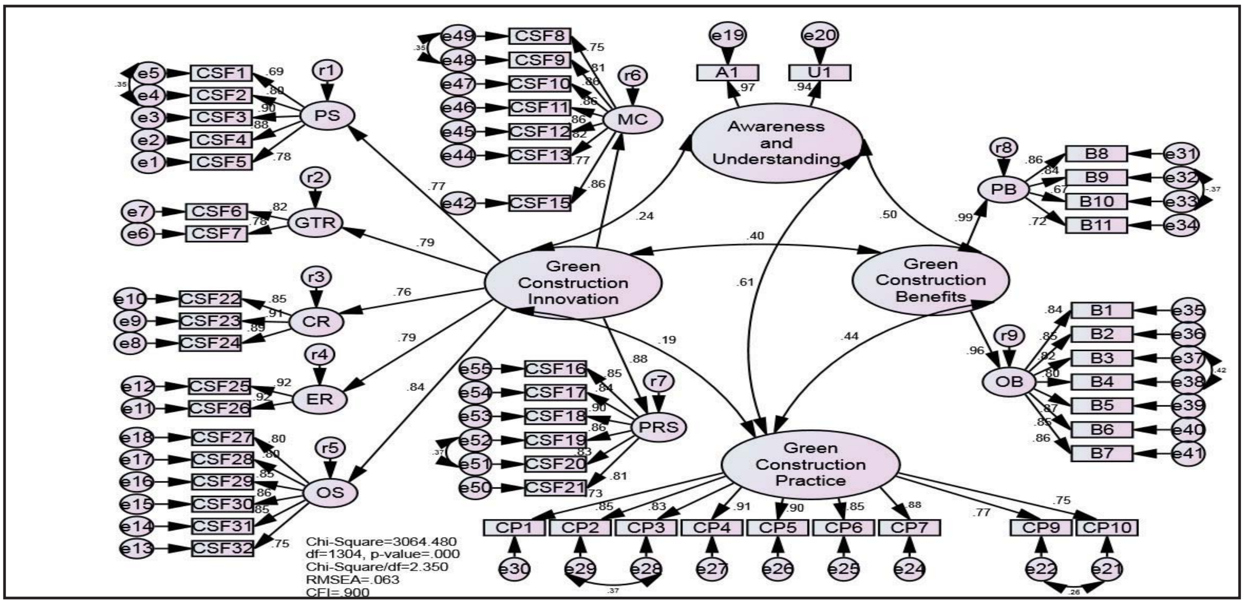

FIGURE II
MEASUREMENT MODEL

B. Validity

Validity is the ability of the instrument to measure what is supposed to be measured for a construct. Three types of validity are required are required for each measurement model:

1) Convergent Validity
The validity for this study achieved when all items in the measurement model are statistically significant. For this study, the AVE for all items is greater than 0.5.

2) Construct Validity
The validity for this study is achieved when the fitness indexes for GFI is above 0.9, CFI is above 0.90, RMSEA is less than 0.08 and the ChiSq is less than 5.0.

3) Discriminant Validity
This validity condition is achieved when the measurement model is free from redundant items. AMOS software will identify the pair of redundant items in the Modification Indices (MI). The maximum shared variance MSV<AVE, Average shared variance ASV<AVE and the square root of AVE greater than inter-construct correlations as tabulated in Table V.

TABLE V
CONSTRUCT RELIABILITY AND AVERAGE VARIANCE EXTRACTED

Constructs	CR	AVE	MSV	ASV
Green Construction Practice	0.953	0.692	0.368	0.199
Awareness and Understanding	0.955	0.913	0.368	0.226
Green Construction Innovation	0.932	0.664	0.161	0.084
Green Construction Benefits	0.980	0.961	0.253	0.202

VIII. EVALUATING THE FITNESS OF MEASUREMENT MODEL

The goodness of fit of the SEM is indicated by how well it reproduces the observed covariance matrix among the indicator items[42]. In SEM, there are a series of goodness-of-fit indexes that reflect the fitness of the model. The use of at least three fit indexes are recommended by [43], [44] including at least one index from each category of the model fit. The three fitness categories are absolute fit, incremental fit and parsimonious fit. Table VI presents the results of goodness-of-fit indexes based on the category and level of acceptance.

TABLE VI
GOODNESS OF FIT

Name of category	Name of Index	Level of acceptance	Results	Comments
Absolute Fit	RMSEA	RMSEA <0.08	0.063	Achieved the required fit level
Incremental Fit	CFI	CFI>0.90	0.900	Achieved the required fit level
Parsimonious Fit	ChiSq/df	ChiSq/df <5.0	2.350	Achieved the required fit level

IX. CONCLUSION

It has been established that there are many different theoretical model, themes and definition of green construction, but they all aim at improving the existing way of constructing buildings. Hence, it can be concluded that the measurement model: current practices, green construction innovation and awareness and understanding has a significant direct effect on green construction benefits. In other words, the development of the measurement model achieved the required fit level and can be used as indicators of continuous improvements in the Malaysian construction industry.

X. ACKNOWLEDGEMENT

The authors would like to thank Universiti Teknologi MARA for supporting this paper.

REFERENCES

[1] Thomsen, "Program management: concepts and strategies for capital building programs. Construction Management Association of American Foundations," 2008.

[2] R. Bon and D. Crosthwaite, *The future of international construction*. Thomas Telford, 2000.

[3] G. Ofori, "Indicators for measuring construction industry development in developing countries," *Build. Res. Inf.*, vol. 29 (1), pp. 40–50, 2001.

[4] O. Tatari and M. Kucukvar, "Cost premium prediction of certified green buildings: A neural network approach," *Build. Environ.*, vol. 46, no. 5, pp. 1081–1086, 2011.

[5] G. Y. Qi, L. Y. Shen, S. X. Zeng, and O. J. Jorge, "The drivers for contractors' green innovation: an industry perspective," *J. Clean. Prod.*, vol. 18, no. 14, pp. 1358–1365, 2010.

[6] Q. Shi, X. Lai, X. Xie, and J. Zuo, "Assessment of green building policies – A fuzzy impact matrix approach," *Renew. Sustain. Energy Rev.*, vol. 36, pp. 203–211, Aug. 2014.

[7] Z. Shengshi, "The Transformation and Thinking of Management Concept in Construction Industry Based on Sustainable Development," 2010, pp. 1–5.

[8] R. Pan, "Study on green construction and index system of green construction assessment," 2010, pp. 1221–1225.

[9] Tam and W. S. Tsui, "Green construction assessment for environmental management in the construction industry of Hong Kong," *Int. J. Proj. Manag.*, vol. 22, no. 7, pp. 563–571, 2004.

[10] J. Ball, "Can ISO 14000 and eco-labelling turn the construction industry green?," *Build. Environ.*, vol. 37, no. 4, pp. 421–428, Apr. 2002.

[11] P. T. I. Lam, E. H. W. Chan, C. K. Chau, C. S. Poon, and K. P. Chun, "Environmental management system vs green specifications: How do they complement each other in the construction industry?," *J. Environ. Manage.*, vol. 92, no. 3, pp. 788–795, 2011.

[12] Tam, C. M. Tam, S. X. Zeng, and K. K. Chan, "Environmental performance measurement indicators in construction," *Build. Environ.*, vol. 41, no. 2, pp. 164–173, 2006.

[13] Environmental Protection Department, "Waste Disposal Statistics," 2007. .

[14] Q. Shi, J. Zuo, R. Huang, J. Huang, and S. Pullen, "Identifying the critical factors for green construction – An empirical study in China," *Habitat Int.*, vol. 40, pp. 1–8, Oct. 2013.

[15] A. S. Hijjaz, "Sustainable Architecture and Urban Development: Green Design, Architecture and Materials," *Putrajaya Experiential Learning for Sustainable Development*. Pullman Lakeside, 2011.

[16] M. S. M. Idris, "Facility Management Contribution in Green Building Initiatives ," *Putrajaya Experiential for Sustainable Development*. Pullman Lakeside Putrajaya, 2011.

[17] A. Varnas, B. Balfors, and C. Faith-Ell, "Environmental consideration in procurement of construction contracts: current practice, problems and opportunities in green procurement in the Swedish construction industry," *J. Clean. Prod.*, vol. 17, no. 13, pp. 1214–1222, 2009.

[18] B. Jonathan, "Can ISO 14000 and eco-labelling turn the construction industry green?," *Build. Environ.*, vol. 37, no. 4, pp. 421–428, 2002.

[19] G. Ofori, "Greening the construction supply chain in Singapore," *Eur. J. Purch. & Supply Manag.*, vol. 6, no. 3–4, pp. 195–206, 2000.

[20] Tan, L. Shen, and H. Yao, "Sustainable construction practice and contractors' competitiveness: A preliminary study," *Habitat Int.*, vol. 35, no. 2, pp. 225–230, 2011.

[21] P. C. Egbu, "Corporate Sustainability and Investment on Green Development," *Putrajaya Experiential for sustainable development*. Pullman Lakeside Putrajaya, 2011.

[22] C. Potbhare, V., Syal, M., Arif, Mohammed, Khalfan, M., and Egbu, "Emergence of Green Building Guidelines in India and their Comparison with Developed Countries," *J. Eng. Des. Technol.*, vol. 7(1), pp. 99–121, 2009.

[23] R. J. Dainty, A.R.J. and Brooke, "Towards Improved Construction Waste Minimisation: A Need for Improved Supply Chain Integration?," *Struct. Surv.*, vol. 22(1), pp. 20–29, 2004.

[24] J. Sarkis, "Evaluating Environmentally Conscious Business Practices," *Eur. J. Oper. Res.*, vol. 107 (2), pp. 159–174, 1998.

[25] M. Zhu, F. He, R. Tang, T. Liu, and L. Wang, "Primary Practice of Green Mine Construction in Limestone Mine," 2010, pp. 1–4.

[26] H. Li, X. Liu, and S. Tang, "Green Construction Bid Evaluation System Research Based on Comprehensive Evaluation Method," 2011, pp. 1–4.

[27] A. A. Zaini, "Creating Awareness and Understanding in Implementing Green Construction," in *IEEE Symposium on Business, Engineering & Industrial Application (ISBEIA 2013)*, 2013.

[28] Q. Shi, Y. Xu, and S. Chen, "Green Construction Alternatives Evaluation Using GA-BP Hybrid Algorithm," 2009, pp. 1–5.

[29] G. Brundtland, "Our common future: The world commission on environment and development," Oxford, 1987.

[30] Q. Shi and X. Xie, "A Fuzzy-QFD Approach to the Assessment of Green Construction Alternatives Based on Value Engineering," 2009, pp. 1–6.

[31] A. Zainuddin, *Research Methodology and Data Analysis*, 2nd ed. UiTM Press, 2012.

[32] C. D. Kinnear, P. R. and Gray, *SPSS for Windows made simple*, Release 10. . Psychology Press., 2000.

[33] J. Pallant, *SPSS Survival Manual*. John Wiley, 2001.

[34] T. Cooke-Davies, "The 'real' success factors on projects," *Int. J. Proj. Manag.*, vol. Vol. 20, pp. 185–190., 2002.

[35] P. L. Mokhtarian, "Factor analysis," 2008. [Online]. Available: http://www.its.ucdavis.edu/telecom/r11/factan.html. [Accessed: 14-Jun-2015].

[36] J. T. Pohlmann, "Factor analysis glossary: EPSY 580B-Factor Analysis Seminar," 2008. [Online]. Available: http://www.siu.edu/~epse1/pohlmann/factglos/. [Accessed: 14-Jun-2015].

[37] Z. Shehu, "The Framework for Effective Adoption and Implementation of Programme Management Withing the U.K Construction Industry," Caledonian University, U.K, 2008.

[38] J. F. . Hair, *Multivariate Data Analysis with Readings*, 3rd ed. Macmillan, 1992.

[39] R. Takim, "A Framework for Successful Construction Project Performance," Glasgow Caledonian University, 2005.

[40] & I. H. B.Suh, "Effect of trust on customer acceptance of Internet banking," *Electron. Commer. Res. Appl.*, pp. 247–263, 2002.

[41] A. Zainuddin, *A Handbook on SEM For Academicians and Practitioners*. Bandar Baru Bangi: MPWS Rich Resources, 2014.

[42] J. . Hair, *Multivariate Data Analysis*, 7th ed. Eaglewood Cliffs, NJ: Prentice Hall, 2010.

[43] J. . Hair, *Multivariate Data Analysis with Readings*, 4th ed. Eaglewood Cliffs, N.J: Prentice Hall, 1995.

[44] P. Holmes-Smith, *Structural Equation Modeling: From the Fundamental to Advanced Topics*. Melbourne: Streams, 2006.