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Emperical Evidenece on Construction Waste Management among Kota Bharu Malaysian Construction Industry: a PLS-SEM Approch

S.I. Ishak[1,] *A.Q. Adeleke,[2] & J.A. Bamgbade[3]

[1,2]*Faculty of Industrial Management, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300, Gambang, Pahang, Malaysia*

[3]*Faculty of Engineering, Computing and Science, Swinburne University of Technology Sarawak Campus, Sarawak, Malaysia*

**Corresponding author:* adekunle@ump.edu.my

Abstract

In Malaysia, construction companies have played a great role in the growth of the country's economy over the years. The poor motivation for the implementation of the construction on-site waste reduction, insufficient waste management skills, the shortage of appropriately designed and decently handled landfill system, lack of teamwork, unequal workload and task distribution among the divisions are the result of poor organizational structure among construction firms. Lack of frequent staff training, management performance, and human resource management practices and the problems of waste management regulations have also resulted in improper enforcement of waste management policy and planning framework for waste management. To address the aforementioned issue, this paper aims to 1) investigate the significant relationship between specialization and construction waste management (waste reduction) in Kota Bharu construction industry, 2) investigate the significant relationship between standardization and construction waste management (waste reduction) in Kota Bharu construction industry. 95 construction companies that are registered under the CIDB Malaysia among Kota Bharu, Malaysia construction companies were surveyed. PLS-SEM technique was used in this research to assess both the measurement and structural models. The results showed that specialization played a significant positive role in construction waste management (waste reduction) among construction companies operating in Kelantan, Malaysia.

Keywords: Construction industry, Organizational structure, Construction waste management.

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1. Introduction.

Construction wastes are the waste generated from construction activities. It includes different materials that come from different activities such as earth materials, for example; vegetation, soil, and rocks as a result of excavation work, leveling of land, clearance of the site, among others. On the other hand, wastes could be defined as unwanted things or unusable things. For this reason, waste is regarded as materials that are unwanted because they are considered to have no value. For example, the wastes that could be produced in building construction are wood, glass, concrete, steel, brick soil, gravels, metals, and other element (Rahman & Adeleke, 2018).

Issues related to construction waste management were also put into consideration by other researchers. For example, Wang and Yuan, (2008) made efforts in treating the on-site complexity of waste management through the use of a system dynamics approach. Furthermore, the use of traditional construction techniques and the lack of sufficient Waste Management skills are the problems associated with waste management. In another study, Wang and Yuan, (2006) revealed that lack of motivation resulted in poor execution of construction and demolition of waste on-site. Therefore, the need for government rules on waste management relatively with low charges of the landfill in China was suggested (Adeleke et al., 2019; Taofeeq et al., 2019).

An organizational structure is a framework in which communication and effective work processes are facilitated. Fredrickson (1986), stated that organizational structure is an equal workload, poor organizational structure and the lack of teamwork lead to unequal distribution of tasks among departments or divisions. Standardization is a dimension of the organizational structure that can reduce costs and also have a positive effect on processes. Besides, specialization plays a key role in the area of the operations' management evolution. The large-scale operations caused by the industrial revolution, require the need to categorize means of simplifying the complex processes which involved breaking down a task, optimization of the component steps, thereby encouraging workers to focus on repetitive task (Abulhakim & Adeleke, 2019; Hassan et al., 2019; Taylor, 1911). Standardization means that a measure of quantity, weight, scope, value, or quality was set up and set by an authority, as a rule, or norm (Merriam-Webster Dictionary 2014).

Construction projects are built only once because they are unique (Fazlina, 2018). This research focuses on the construction companies in Kelantan, especially in Kota Bharu area. In Kelantan, most of the construction projects are carried out in Kota Bharu; so, this study will be conducted in Kota Bharu because it is the capital city of Kelantan. Usually, the main office is located in the city of the construction companies so that it will be easy to approach the construction companies that are located in Kota Bharu,

Kelantan. This study will be beneficial to researchers and construction companies (employers and employees) in the Malaysian construction industry. So, this research aims to investigate the relationship between specialization, standardization, and construction waste management among the Kelantan Malaysia construction industry. Adekunle (2011) reiterated that the inability of the government to set clear roles and responsibilities among the three tiers of government for the construction organizations for the attainment of effective and efficient construction waste management practice led to the inefficiency of construction waste management (Adeleke et al., 2015).

2. Literature Review

2.1 Overview of the Malaysian Construction Industry.

The Malaysian construction industry is regarded as one of the driving forces of its economy. This industry plays a significant role in producing wealth together with making an improvement in the quality of life for Malaysians. The construction industry provides job opportunities and in this way contributes to the economy of the country (Razak Bin Ibrahim et al., 2010). Building projects are important responsibility being performed by the construction industry in improving the economic growth of the country and the standard of living of the citizen (Azman & Adeleke, 2018; Hanapi et al., 2013). The waste management approach is important to achieve and maintain the acceptable quality of the environment and support sustainable development is a complete, integrated and rational system approach (Minks,1994). Any leftover materials from any excavation or development of land, civil or constructive, road building, construction, remodeling or demolition, may be considered to be waste from construction & demolition. (EPD, 2004). Furthermore, Waste management as a means of managing construction waste management is not cost-effective and examining other alternative waste disposal methods such as recycling. Recycling, and reduction of waste from source are waste management strategies. (Taofeeq et al., 2019; Bamgbade et al., 2019; Minks, 1994).

Specialization plays a key role in the area of the operations' management evolution. Quick completion of the main tasks by workers is achieved through specialization (Newell & Rosen Bloom, 1981; Argote 1999; Schultz, McClain & Thomas, 2003).

In relation to an individual worker, there is a great benefit in the specialization because where individual staffs remain in the same task over time, knowledge related to the job or gain can help improve his or her performance (Huckman & Pisano, 2006; Humphrey, Nahrgang, & Morgeson, 2007).

Standardization is how far employees work within the organization in accordance with standard procedures and rules (Hsie and Hsieh, 2001). It ensures the employees complete their tasks and functions in a necessary manner so that the actions and conduct of an employee are routine and predictable (Jones, 2013) and the work is carried out at all locations in a common way (Daft, 1995;

Adeleke et al., 2019). Standardization is a mechanism to control the behaviour of workers in an organization in order to achieve the set objectives.

The mechanistic structured organization where the employees operate separately and specialize on a single function and also a well-defined hierarchy of authority, focuses on the individual specialization. The organizational efficiency of the management of construction residue can be a key subject in the study of organizations when identifying the effectiveness of an organization, and which is one of the concepts of organizational theory. The effective management of construction waste would sometime be aided by organizational structure. This is a consequence of the flexibility of this kind of structure, through the innovative ideas and support from members of the organization. Standardization is linked to the organizing efficiency of waste management in construction (Taofeeq et al., 2020; Sabodin & Adeleke, 2018).

2.2 Conceptual Framework

This study will be conducted by utilizing a specific model which is the conceptual model of the study and which clearly shows the independent and dependent variables that are used. As shown in the conceptual framework (Figure 1), the dependent variable of this study is Construction Waste Management (waste reduction) and the independent variables are Organizational Structure (specialization and standardization). The framework of the study is to depict the connection between independent and dependent variables of the study.

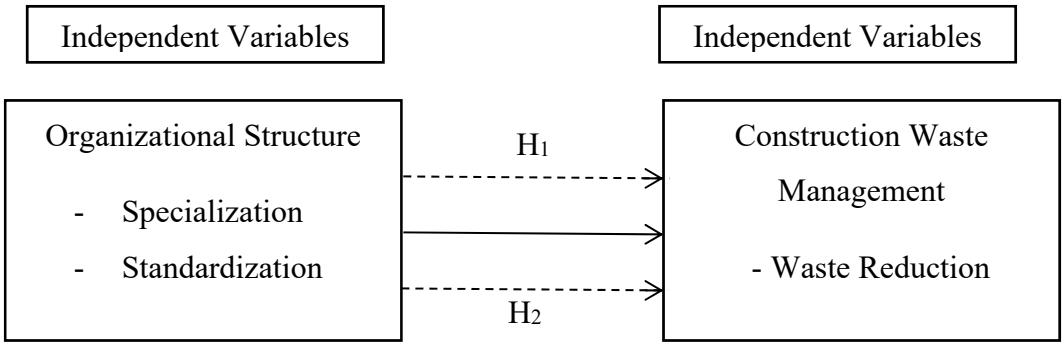

Figure1: Research Framework

2.3 Relationship between Specialization and Construction Waste Management (Waste Reduction).

Subramanian & Nilakanta (1996) considering that specialization is also defined as an employee's written commitment and willingness to move between different departments in an organization. The numerous components of the structure affect the efficiency of the organization. The structure is therefore classified into different categories as follows: (1) the mechanistic organizational structure (2) organic structure. Organic structure is the structure of an organization in which an integrated specialization exists, while the staff works together to foster coordination and work as a primary integration mechanism for teams (Subani & Adeleke, 2020; Bamgbade et al., 2019; Katz & Allen, 2004).

Meanwhile, the mechanistic structured organization, where the employees operate separately and specialize on a single function and also a well-defined hierarchy of authority, focuses on the individual specialization. In addition, Duncan (1976) also proposes to enhance construction waste management in an organic structure, while the mechanistic structured type of organization represents a new aspect. The role of specialization is very significant and should be considered to reduce the waste for the construction industry. Therefore, they showed that there is a positive relationship between specialization and construction waste management (waste reduction). Thus it is hypothesized as follows:

Hypothesis 1: There is a significant relationship between specialization and construction waste management (waste reduction).

2.4 Relationship between Standardization and Construction Waste Management (Waste Reduction).

Standardization, according to Hsieh and Hsieh (2001), is the extent to which employees operate in an organization in accordance with standard procedures and rules. Standardization is linked to the organizing efficiency of waste management in construction. Therefore, standardization also affects the efficiency of construction firms. The effective management of construction waste sometime would assist by organizational structure. This is a consequence of the flexibility of this kind of structure, through the innovative ideas and support from members of the organization (Adeleke et al., 2018). Therefore, they showed that there is a negative relationship between standardization and construction waste management (waste reduction). Thus it is hypothesized as follow:

Hypothesis 2: There is a significant relationship between standardization and construction waste management (waste reduction).

3. Methodology

The data were collected at single-point-in-time, so this research is a cross-sectional research design (Adeleke et al., 2019; Bamgbade et al., 2019; Sekaran & Bougie, 2013). The research instrument is a questionnaire. This method is chosen as it is one of the most widely used and accepted instruments for social science researches (Adeleke et al., 2016; Sekaran, 2006; Bamgbade et al., 2015). The items from the existing literature were adopted and adapted to construct the questionnaire items in order to make sure that all the important points are covered during measurement. The total number of 90 copies of the questionnaire returned from the sampled construction companies. So, the sample size for this research was 90 companies in Kota Bharu, Kelantan.

3.1 Instrument Design

The quantitative method was used in this research as it is more structured than the qualitative method of data collection. Hence, the data was collected using the questionnaire. As stated above, the method used in this research for the data collection process was the questionnaire as it is found to be easier for the collection of data from the respondents. Five-point Likert scale was adopted to measure the independent and dependent variables which range from (1) very low, (2) low, (3) medium, (4) high, and (5) very high, following (Adeleke et al., 2018). According to Sekaran (2003) and Sekaran & Bougie (2009), to compute the standard deviation and the mean feedback on the variables and the mid-point of the scale a researcher must adopt the rating scale. In analyzing the data, SPSS software version 22.0 was used for respondents' demographic characteristics such as position, company years of existence, gender, company's prime location, company's ownership, work experience, number of full-time employees and company ownership (Hassan & Adeleke, 2019; Bamgbade et al., 2016). The data analysis adopted for both independent and dependent variables was Smart PLS version 3.0. All the variables in this research are multidimensional as presented in Table 1:

Table 1: Source of measurement

S/N	Constructs	Dimension	Source	Remarks
1	Organizational Structure	Specialization Standardization	Adeyoyin (2013)	Adapted
2	Construction Waste Management	Waste Reduction	Vleck (2001)	Adapted

4. Result and Discussions

4.1 Data Collection and Sample

In Kota Bharu Kelantan, construction companies were given about 95 copies of the questionnaire. 90 questionnaires were filled and returned, thereby making the sample size for this research to be 90 respondents. Table 2 shows a summary of the demographic characteristics of respondents for this research.

Table 2: Summary of Demographic Scales of Respondents

Type	Items	Percentage (%)
Position	Contract manager	10
	Safety officer	22.22
	Project manager	7.78
	Worker	34.44
	Others	25.55
Working experience	1-3 years	32.22
	4-6 years	48.89
	7-9 years	12.22
	>10 years	6.64
Gender	Male	56.67
	Female	43.33
Type of project	Residential building	52.22
	Commercial building	33.33
	Educational building	8.89
	Others	5.56
Company ownership	Local	90.00
	National	10.00
Company prime location	Local market areas	51.11
	Across Malaysia	20.00
	Within a few states	26.67
	International markets	2.22
Company existence	1-3 years	4.44
	4-6 years	10.00
	7-9 years	38.89
	>10 years	46.67

No. of employees	0-50	41.11
	50-100	30
	100-150	18.89
	>150	10

4.2 Measurement Model

Before examining the hypothesis, the technique that was used to test and measure the inner and outer model is Partial Least Square Structure Equation Modelling (PLS-SEM). Figure 2 shows the model of this research with the structural dimensions (Malik & Adeleke, 2018; Bamgbade et al., 2015).

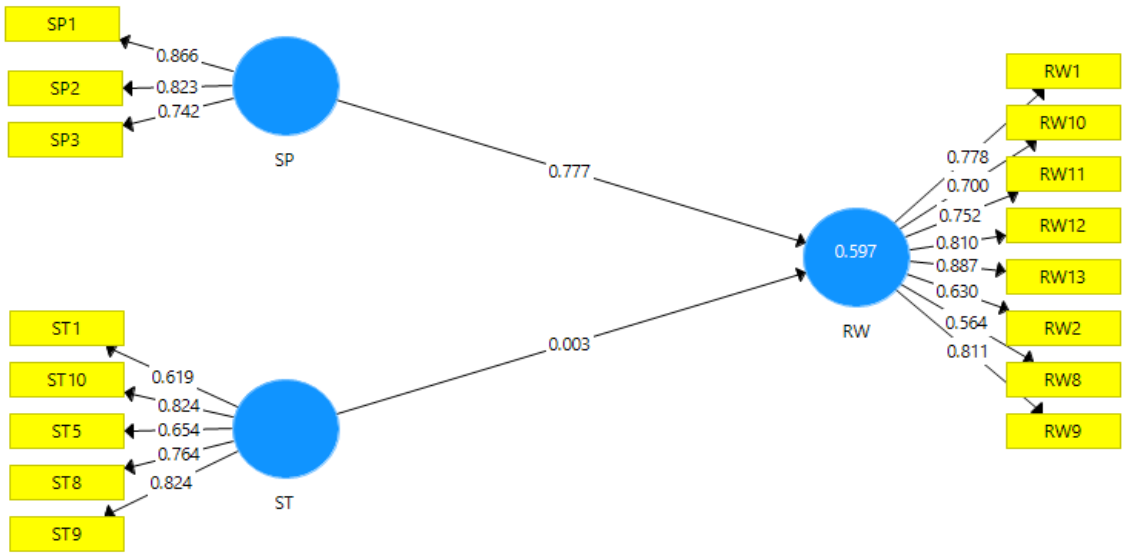

Figure 2: Measurement model

The measured content validity (Table 3) was explained in two different manners. The first way was through high loading in the items on their corresponding constructs in relation to other constructs. The second way was through the loading of items that were significantly loading on their corresponding constructs by confirming the content validity of the measures utilized in the study (Taofeeq & Adeleke, 2019; Chow and Chan, 2008). The following three (3) criteria were adopted for the purpose of establishing the convergent analysis: Composite Reliability (CR), Average Variance Extracted (AVE), and Factor Loadings (FL). The loadings of all items were tested and those that their values were more than 0.5 were accepted. CR is the degree to which a group of items shows latent constructs of the model (Hair et. al, 2011). Barclay et. al (1995), stated that when the AVE value is at least 0.5, then a set of items

have enough convergence to measure the concerned construct (Ismayana & Adeleke, 2020; Omer & Adeleke, 2019; Bamgbade et al., 2019).

Table 3: Factor Analysis and Loading of the items (Cross Loading)

	RW	SP	ST
RW1	**0.778**	0.735	0.320
RW10	**0.700**	0.467	0.206
RW11	**0.752**	0.549	0.115
RW12	**0.810**	0.644	0.296
RW13	**0.887**	0.694	0.299
RW2	**0.630**	0.396	0.147
RW8	**0.564**	0.441	0.242
RW9	**0.811**	0.609	0.337
SP1	0.714	**0.866**	0.316
SP2	0.656	**0.823**	0.347
SP3	0.502	**0.742**	0.411
ST1	0.264	0.333	**0.619**
ST10	0.307	0.359	**0.824**
ST5	0.115	0.236	**0.654**
ST8	0.144	0.165	**0.764**
ST9	0.298	0.389	**0.824**

Converge validity can be explained as the degree to which a bunch of variables is converged to measure a particular concept. The loadings of all items were tested and those that their values were more than 0.5 were accepted. CR is the degree to which a group of items shows latent constructs of the model (Taofeeq et al., 2019; Adeleke et al., 2015; Hari, 2010). The value of CR and AVE are presented in Table 4:

Table 4: The Convergent Validity Analysis

Construct dimensions	Items	Loading	Composite Reliability	AVE	Cronbach's Alpha
Reduced Waste	**RW1**	0.778	0.909	0.559	0.885
	RW10	0.700			
	RW11	0.752			
	RW12	0.810			
	RW13	0.887			
	RW2	0.630			
	RW8	0.564			
	RW9	0.811			
Specialization	**SP1**	0.866	0.853	0.660	0.743
	SP2	0.823			
	SP3	0.742			
Standardization	**ST1**	0.619	0.858	0.550	0.803
	ST10	0.824			
	ST5	0.654			
	ST8	0.764			
	ST9	0.824			

The discriminant validity is necessary for the construct validity of the outer model. It is essential to be tested before examining the hypothesis through path analysis. It shows the extent to which items differ between constructs. Moreover, it indicates that items that are used in different constructs do not overlap. As shown in Table 5, the square root of AVE for all the constructs was used to replace the diagonal elements on the correlation matrix. The diagonal elements are higher than the other elements of the same row and column where they are placed in the table. Therefore, the outer model's discriminant validity of this study was confirmed. As indicated in Table 5, a satisfactory discriminant validity was also achieved when the value representing the square root of the AVE (appearing bold on the diagonal) were all loaded above the recommended threshold value of 0.5 and greater than the off-diagonal correlations (Jamil & Adeleke, 2018).

Table 5: Discriminant Validity Analysis

	RW	SP	ST
Waste Reduction	**0.748**		
Specialization	0.479	**0.812**	
Standardization	0.338	0.431	**0.742**

After confirming the goodness of the outer model, the next step is to investigate the relationships that were hypothesized in the study. PLS Algorithm was run to investigate the hypothesized model through Smart PLS. The path coefficient was gained through running PLS Algorithm which is depicted in the Figure below. Table 6 below showed the hypothesis testing. The result showed that the Specialization variable has a significant positive relationship on reduced waste (β= 0.777, t = 8.593, p = 0.000). Therefore, H_1: specialization had a positive relationship with reduced waste. Other hypothesis H_2, standardization had negative relationship on reduced waste (β=0.003, t = 0.032, p = 0.487), following (Adeleke et al., 2016).

Table 6: Results of the Inner Structural Model

Items	Constructs/variables	Beta	S/E	T-value	P-value	Findings
H_1	Specialization-> Waste Reduction	0.777	0.09	8.593	0.000	Supported
H_2	Standardization-> Waste Reduction	0.003	0.101	0.032	0.487	Not Supported

As for effect size, when its value is less than 0.02 it is considered as small, less than 0.15 is considered as a medium effect while less than 0.35 is considered as high effect (Cohen,1988; Samsudin et al., 2020). Based on Table 7 below, the effect size of equipment was small, the material's effect size was small and finally workplace effect size was considered to be small as well.

Effect size is calculated using the below formula:

$$\text{Effect size (f)} = \frac{\text{R2 incl} - \text{R2 excl}}{1 - \text{R2 incl}}$$

Table 7: Direct Effect IV-DV

R-squared	Included	Excluded	f-squared	Effect size
Standardization	0.597	0.115	1.196	Large
Specialization	0.597	0.602	-0.0124	None

5. Conclusion

This research is focused on organizational structure as an element to reduce construction waste management in the Kota Bharu Malaysian construction industry. Therefore, future researches can be explored to investigate government policy on construction waste and empirically validate the proposed model in this research.

Thus, this research will not only be of benefit to those in the academic world but also to those in construction industries as well and other sectors of the economy that are involved in the generation of higher waste and to improve waste management in the workplace.

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