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ORGANIZATIONAL STRUCTURE INFLUENCE ON CONSTRUCTION WASTE MANAGEMENT AMONG PENANG MALAYSIAN CONSTRUCTION INDUSTRY: AN APPROACH VIA PARTIAL LEAST SQUARE STRUCTURAL EQUATION MODELING

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Abstract

The construction industry is one of the industries that contribute to the economies of Malaysia and to be considered as a significant element to the Malaysia economy. At the same time, when the number of construction projects increases, the number of waste generated by the construction projects also increases which has many negative impacts on the environment and public health as well. In order to reduce the number of waste generated by construction projects, the waste must be properly handled and there must be effective construction waste management practices in every construction industry. Besides, previous studies have stated that the number of construction waste regarding material waste, buildings waste and so on is increasing day by day. The number of waste is on the rise due to the absence of an effective organizational structure which is an important aspect of construction waste management. To address these issues above, this research paper aims to: 1) to investigate the relationship between formalization and construction waste management in Penang construction industries; and 2) to investigate the relationship between centralization and construction waste management in Penang construction industries. The data were collected from 89 respondents among Penang construction companies. In this research, the PLS-SEM technique was used to assess both the measurement and structural models. The result shows that there is a significant relationship between formalization and construction waste management among the construction companies operating in Penang. Centralized organizational structure and construction waste management was also found to be positively correlated in this study.

Keywords: Organizational Structure, Construction Waste Management, Formalization, Centralization.

1. Introduction

According to Fredrickson, (1986), the framework for the facilitation of communications and efficient work process is the organizational structure of an organization and if there are poor organizational structure and lack of teamwork which lead to unequal distribution of tasks among departments and also directly affect the effective and efficient of construction waste management. Therefore, government policy plays a major role in executing the organizational structure for construction waste management and also the most important factor that influence effective and efficient construction waste management.

Nwufo, (2010) stated that waste management policy which is the enforcement of waste management laws in Nigeria facing g major problem. Based on the investigation, is revealed that waste management policy is not enforced and not really well understood by the employees. In turkey, wastes are generated because of some factors in the construction stage which include unused materials, incorrect materials, improper equipment and so on. Furthermore, in Hong Kong, various policies have been implemented in order to effectively manage the construction waste and Hong Kong also actively trying new construction waste management policies in line with the latest waste management (3R and polluter pays principles) philosophies (Adeleke et al., 2019; Taofeeq et al., 2019; Lu, et al., 2013).

According to Begum et al., (2007), construction waste generation in Malaysia has become one critical issue. This is a result of the rapid development of construction industries in Malaysia which leads to lots of construction waste been generated. Waste management system if not properly handled and managed will results in negative impacts on humans and the environment as well not only in Malaysia but also in any part of the world. The major issue that arises from the construction waste in Malaysia is illegal dumping of waste attitudes of contractors in the construction industry. In order to overcome these issues, Malaysia must start with the waste management hierarchy through specific construction waste regulations and also come out with some disposal strategies as well. One of the effective strategies in implementing effective and efficient construction waste management could be the organizational structure in Malaysia. The organizational structure will influence the effective construction waste management (Abulhakim & Adeleke, 2019; Bamgbade et al., 2019).

In addition, if there is a high demand for construction projects in Malaysia, the amount of construction waste also will increase in Malaysia (Siti & Noor, 2008). Based on a study reported by Rahmat and Ibrahim, (2007) 42% of 46% of illegal dumping of waste in Johor district is from construction waste. Moreover, according to Faridah et. al., (2004), more illegal dumpsite near along the road was discovered based on a study in Seberang Perai, Pulau Pinang. According to Jain, (2012), currently, in Asia, there are minimum construction waste management policies. So, there will be a need for national policies on

waste management in order to overcome construction waste problems. Therefore, organizational structure plays a significant role in implementing effective construction waste management and further enhancing the sustainability of a company, particularly in the construction industry. Thus, every company must have its own organizational structure. So, having a proper organizational structure will allow a company to implement effective and efficient construction waste management (Taofeeq et al., 2019; Hassan & Adeleke, 2019).

2. Literature Review

2.1 Overview of the Malaysian Construction Industry

One of the industries that engender wealth and the growth of the social and economies of the country is construction industries which are considered as the major stimulant to Malaysia economy. There were many types of industries in Malaysia that generates economic wealth towards the nation. However, construction industries contributing a significant effect on the economies of the country. In addition, there were also many Malaysian companies involved in construction sectors that provide economic strength that linked to the construction industry, construction projects provide jobs and also create the infrastructure crucial to keeping the nation moving forward. Nevertheless, the construction industry is one of the most challenge industries because it is risky and also one of the most booming industries in the whole world. Apart from that, according to the Department of Statistics, Malaysia (2019), the value of construction work done of RM36.5 billion in the fourth quarter of 2018 as recorded by Malaysian's construction sector.

Moreover, from the overall economic performance of Malaysia in 2018, 4.8% contributed to the GDP by civil engineering and specialized construction industries. (Department of Statistics, Malaysia). According to Trading Economics, the global macro models and analytics expectations by the end last quarter of 2019, the Gross Domestic Product for construction in Malaysia estimated to be RM14727 million. In addition, the construction sector is one of the top 5 industry in Malaysia which has a direct contribution to the economic performance of Malaysia. In 2018, the construction sector was in fourth place which is 4.8% behind the services sector which contributed 54.8%, the manufacturing sector which was 22.8% and the agriculture sector which was contributed 7.6% to the economic performances of Malaysia (Department of Statistics, Malaysia, 2019). Furthermore, the construction industry divided into two sectors which are non-residential (which including three sub-sectors which are heavy industrial, institutional and commercial engineering) and also residential sector. Therefore, each sector

has its own merits with a varied and rewarding range of projects (Azman & Adeleke, 2018; Bamgbade et al., 2019).

Basically, once the organizational goals were set, which is a way of maintaining the standards, rules, and procedures in guiding the employees in order to achieve the organization's goals is called formalization. (Auh and Menguc, 2007). Furthermore, in order to control the employees from carrying out different activities in the performance of routine work in the construction waste management, the formalization of the organization needs to be established in an organization (Adeleke et al., 2019; Taofeeq et al., 2019; Aiken and Hage, 1971). According to Amanda L. Webster, (2019), the formalized organizational structure concentrated on roles and positions instead of people in the positions. Amanda L. Webster also stated that formalization is a process which is by way of creating a formalized structure and includes the maintenance of the formal structure over time.

Centralized management is an approach by which a company makes the most important of its decisions at the top and focuses power at a single location or with an individual or small group of individuals. (Devra Gartenstein, 2019). Apart from that, a centralized organizational structure confines the managers in decision making and also the chief executive officers (CEO) or directors control the sole decision power in the construction waste management perspective. Thus, the centralized organizational structure gives authority to the managers and also the employees as well to make decisions and also performing their duties. (Hassan et al., 2019; Malik & Adeleke, 2018; Katsikea, et al, 2011).

2.2 Conceptual Framework

This research is conducted using the specified model with clearly defined variables which are dependent and independent variables. Based on the conceptual framework, the independent variables are the formalized organizational structure and centralized organizational structure, and the dependent variable is the construction waste management (waste disposal). Thus, the framework shows the relationship between these variables. Therefore, the relationship between the formalized and centralized organizational structure is deeply related to the construction waste management among construction projects in the construction companies in Penang, Malaysia.

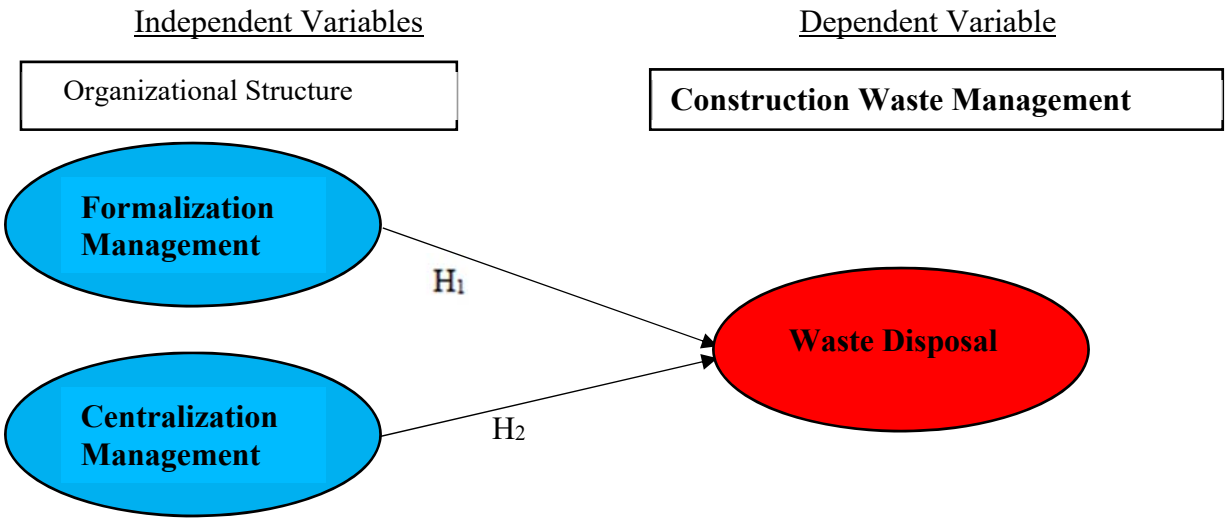

Figure 1: Conceptual Framework

2.3 Relationship between Formalization and Construction Waste Management (Waste Disposal)

In order to guide the employees in the organization, formalized organizational structure established as written description, rules and procedures. The effectiveness of construction waste management influenced by the different types of organizational structure. (Subani & Adeleke, 2020; Subramaniam & Nilakanta, 1996; Duncan, 1976). According to Black's Law Dictionary, 'the organization is hierarchical and bureaucratic' is known as a mechanistic organization which is characterized by highly centralized authority, formalized procedures and practices and also specialized functions which means the workers are working separately with their own assigned tasks.

According to Anderson, (2005), Pertusa Ortega, Zaragoza-Saez and Claver-Cortes, (2010), formal rules and standard policies and procedures control the decision making and working relationships in construction waste management organizations which are known as the formalization. In addition, the establishment of specific rules and procedures for the employees to get the job done based on the organization of construction waste management with a formal structure. (Bamgbade et al., 2019; Omer & Adeleke, 2019; Katsikea et al, 2011). Therefore, it hypothesized thus:

Hypothesis 1: There is a significant relationship between formalization and construction waste management

2.4 Relationship between Centralization and Construction Waste Management (Waste Disposal)

The centralization of sovereignty is established to be an essential problem to the effectiveness of an organization which is a centralized organizational structure. (Aiken & Hage, 1971). This is because previous studies have stated that decentralized and informal organizational structures can help in achieving the effectiveness of construction waste management. Decision-making and the training concerning a functioning department in an organization are known as centralization. (Adeleke et al., 2018; Subramaniam & Nilakanta, 1996). Moreover, according to Bedeian, (1986), the organizational efficiency in construction waste management will be an important subject in the study of organizations in order to determine the effectiveness of an organization.

The mechanistic structure in which the characteristics including centralization of authority, formalization of procedures and specialization of functions which directly improves the organizational efficiency in relation to the construction waste management. Most of the theorists hold to the point that centralization is and the extent to which decision-making for (financial, manpower, planning, and the organization's exceptional instances) is centralized at one point (Adeleke et al., 2016; Bamgbade et al., 2015; Taofeeq et al., 2020).

Hypothesis 2: There is a significant relationship between centralization and construction waste management

3. Methodology

The research design adopted by this study is a cross-sectional and quantitative approach which is one of the famous approaches used by social science researchers for their study. (Sekaran et al., 2001). Besides, the larger sample population is appropriate for quantitative methodology. (Adeleke et al., 2016; Kaya Yilmaz, 2013). By using a well-structured questionnaire to collect feedback from the respondent, the data was collected at single-point-in-time. (Sekaran and bougie, 2013). Therefore, the stratified random sampling technique was employed for sample selection for this study. This research was conducted among Seberang Perai, Penang construction companies and the total number of 89 samples was collected from the sample companies in Seberang Perai, Penang.

3.1 Instrument Design

The data collection technique used in this research is questionnaires to collect data from the respondent to get more information. Questionnaires are a convenient option to be considered when conducting a structured survey which including a combination of online surveys, email-based surveys, and self-

administered survey are the types of surveys used for the data collection for this survey. (Adeleke et al., 2015; Nigel Mathers et al., 2006). SPSS was used for analysing the data for descriptive analysis of the respondent's demographic characteristics which includes position, company's year of existence, gender, company's prime location, company's ownership, work experience, number of full-time employees and company ownership. SmartPLS version 3.0 was also used to analyse the data for the relationship between the independent and dependent variables. Besides, a five-point Likert scale ranging from 1 (strongly disagree), 2 (disagree), 3 (neutral), 4 (agree) and 5 (strongly agree) was also used to measure items of the independent and dependent variable in order to get the feedback from the respondents. Items of the questionnaire were adopted from Kamaruddeen (2011) and were all the English language. But some improvement and modification were done on the items of the questionnaire to ensure the detailed information is provided. Then, all entire questionnaire was translated into Malay to make sure every respondent understands clearly about all items that stated in the questionnaire and the respondent can read and answer the questionnaire with clarity. 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	Formalized and centralized organizational structure	Yusuf Nasidi (2016)	Adapted
2	Construction waste management	Waste disposal	Mohammed Arif, Deepthi Bendi, and Tahsin Toma-Sabbagh, (2012)	Adapted

4. Results

4.1 Data Collection and Sample

100 sets questionnaires were distributed to the construction companies in Seberang Perai, Penang. However, 89 sets of questionnaires were returned after the distribution which represents 89.0% for the response rate which is acceptable in this research. Table 2 shows a summary of the demographic characteristics of respondents for this study (Bamgbade et al., 2015).

Table 1. Summary of Demographic Scales of Respondents

Type	Items	Frequency (N)	Percentage (%)
Position	Engineer	29	32.6
	Project manager	15	16.9
	Quantity surveyor	9	10.1
	Contractors	5	5.6
	Site clerk	12	13.5
	Architect	6	6.7
	Design team	6	6.7
	Others	7	7.9
Working experience	1-3 years	49	55.1
	4-6 years	28	31.5
	7-9 years	10	11.2
	>10 years	2	2.2
Gender	Male	62	46.1
	Female	56	53.9
Type of project	Residential building	38	42.7
	Commercial building	22	24.7
	Educational building	11	12.4
	Others	18	20.2
Company ownership	Local	73	82.0
	National	13	14.6
	Others	3	3.4
Company prime location	Local market areas	28	31.5
	Across Malaysia	28	31.5
	Within a few states	23	25.8
	International markets	10	11.2
No. of employees	0-50	17	19.1
	50-100	25	28.1
	100-150	29	32.6
	>150	18	20.2
Company existence	1-3 years	3	3.4
	4-6 years	37	41.6
	7-9 years	17	19.1
	>10 years	32	36.0

4.2. Measurement Model

Before examining the hypothesis, the measurement model and the outer model were tested through the partial least square structural equation modeling (PLS-SEM) technique. Figure 2 shows the model of this research with the structural dimensions below (Rahman & Adeleke, 2018).

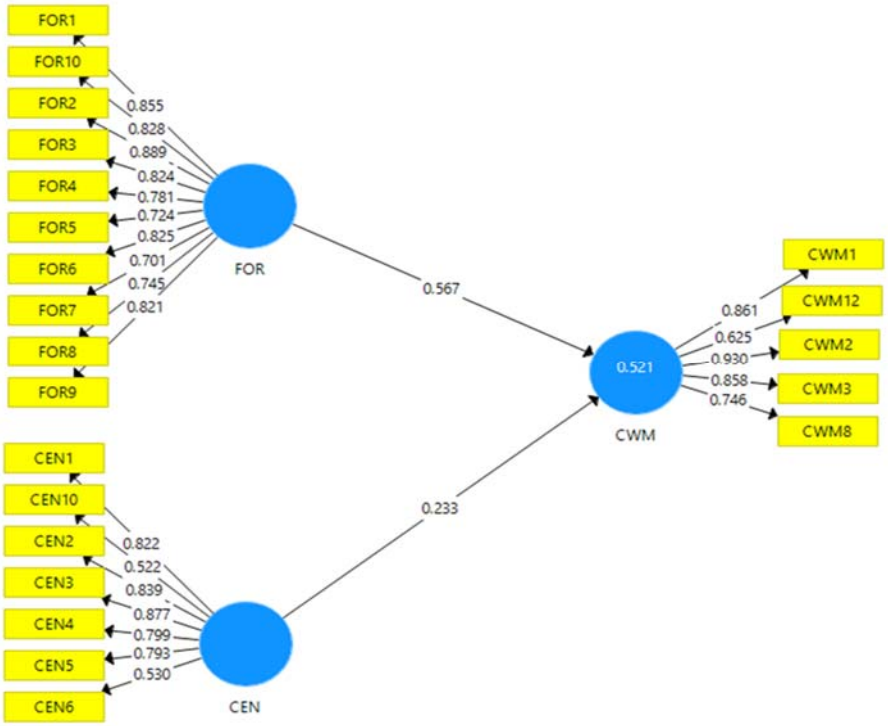

Figure 2: Measurement Model

Table 3 shows the content validity of the measurement used which can be explained in two manners. Firstly, there are high loading in the items on their respective constructs when related to other constructs. Secondly is the loading of the items were significantly loading on their respective constructs affirming the content validity of the measure used in this research (Adeleke et al., 2015; Chow and Chan, 2008).

Table 3 Content validity

	CEN	CWM	FOR
CEN1	**0.822**	0.429	0.434
CEN10	**0.522**	0.277	0.172
CEN2	**0.839**	0.359	0.417
CEN3	**0.877**	0.369	0.365
CEN4	**0.799**	0.396	0.434
CEN5	**0.793**	0.596	0.603
CEN6	**0.530**	0.299	0.297
CWM1	0.495	**0.861**	0.577
CWM12	0.435	**0.625**	0.364
CWM2	0.480	**0.930**	0.627
CWM3	0.460	**0.858**	0.683
CWM8	0.341	**0.746**	0.513
FOR1	0.419	0.611	0.855
FOR10	0.518	0.601	0.828
FOR2	0.499	0.61	0.889
FOR3	0.466	0.497	0.824
FOR4	0.388	0.445	0.781
FOR5	0.275	0.447	0.724
FOR6	0.324	0.581	0.825
FOR7	0.536	0.712	0.701
FOR8	0.427	0.431	0.745
FOR9	0.483	0.488	0.821

The convergent validity is considered to be the extent to which a group of variables converges to measure a specific concept. From that, the convergent validity is significant parts of validity to make sure the construct validity is related. So, to establish the convergent analysis, there are three criteria that were all measured at once, especially the factor loadings, composite reliability (CR) and average variance extracted (AVE). Moreover, all items of loading were tested which is acceptable for all items. Then, its values must be more than 0.5 following the literature of the multivariate approach. Besides, the other criterion is the composite reliability (CR) to examine convergent validity (Sabodin & Adeleke, 2018; Bamgbade et al., 2016).

Table 4 Convergent validity

Construct dimensions	Items	Loading	Composite Reliability	AVE	Cronbach's Alpha
Centralization	**CEN1**	0.822	0.899	0.567	0.866
	CEN10	0.522			
	CEN2	0.839			
	CEN3	0.877			
	CEN4	0.799			
	CEN5	0.793			
	CEN6	0.530			
Construction waste management	**CWM1**	0.861	0.904	0.658	0.866
	Cwm12	0.625			
	CWM2	0.930			
	CWM3	0.858			
	CWM8	0.746			
Formalization	**FOR1**	0.855	0.947	0.642	0.938
	FOR10	0.828			
	FOR2	0.889			
	FOR3	0.824			
	FOR4	0.781			
	FOR5	0.724			
	FOR6	0.825			
	FOR7	0.701			
	FOR8	0.745			
	FOR9	0.821			

To the construct validity of the outer model, the discriminant validity is essential. The discriminant validity is compulsory to be tested before the hypothesis is examined through path analysis. The measurement revealed that the degree to which items differ among constructs. Then, the discriminant validity shown that items used different constructs do not overlap. As illustrated in Table 5, the square root of AVE for all constructs was replaced at the diagonal elements of the correlation matrix. Therefore, the discriminant validity of the outer model for this study was confirmed where the diagonal elements in the table were higher than the other elements of the column and row where they are located. From the testing made above for the construct validity of the outer model, it is believed that the obtained results pertaining to the hypotheses testing should be highly reliable and valid (Ismayana & Adeleke, 2020).

Table 5. Discriminant validity

	CEN	CWM	FOR
Centralization	**0.753**		
Construction waste management	0.545	**0.811**	
Formalization	0.550	0.695	**0.801**

The hypothesized relationship is the next part that needed to be examined when the goodness of the outer model was confirmed. Using SmartPLS, the hypothesized model has been examined through the running of the PLS Algorithm. As illustrated in Figure 4.10, the path coefficients were generated. According to Table 6 below, the result shows the hypothesis testing. The result showed that formalized organizational structure (FOR) variable has a significant positive relationship on construction waste management (β= 0.567, t = 6.248, p = 0.000). Therefore, the H_1: the effect of formalized organizational structure on construction waste management was supported. Other hypothesis H_2 (Centralized organizational structure) also have significant positive relationship on construction waste management (β=0.233, t = 2.222, p = 0.013). So, both variables have a significant relationship on construction waste management among Penang Malaysian construction industries (Samsudin et al., 2020; Jamil & Adeleke, 2018; Taofeeq et al., 2019).

Table 6. Hypothesis testing

Items	Constructs/variables	Beta	S/E	T-value	P-value	Findings
H_1	Formalization-> Construction waste management	0.567	0.091	6.248	0.000	Supported
H_2	Centralization-> Construction waste management	0.233	0.105	2.222	0.013	Supported

Cohen (1988) suggested that if the criteria of effect size is less than 0.02 (0.02 = small, 0.15 = medium, 0.35 = high). From Table 7, the effective size of formalization is large and centralization can be considered as small. The formula for calculating effect size is as shown below:

$$\text{Effect size (f)} = \frac{R^2 \text{ incl} - R^2 \text{ excl}}{1 - R^2 \text{ incl}}$$

Table 7. Direct Effect IV-DV

R-squared	Included	Excluded	f-squared	Effect size
Formalization	0.521	0.304	0.4530	Large
Centralization	0.521	0.486	0.0731	Small

5. Conclusion and Implications

This study focused on formalized and centralized organizational structure as an element of organizational structure on construction waste management in Penang Malaysian construction industries. Therefore, the future researcher can be explored to investigate a decentralized organizational structure or any other organizational structure elements on construction waste management and empirically validate the proposed model in this study.

Therefore, this study is important for the stakeholder whose work in construction industries especially the industries without effective construction waste management practices to improve the effective construction waste management and will also be of benefit to the academic world by contributing to the body of knowledge on construction waste management.

The contribution made by this research is both theoretical and practical where the addition of the existing literature about the formalization and construction waste management, centralization and construction waste is the theoretical contribution to this study. Besides, this study is one of the few studies that examine the effects of organizational structure on construction waste management Practically, this research can be of benefits to the employer such as managers, engineers, quantity surveyors and so on who are working on construction projects in the construction industries.

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