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Factors Contributing To Accident Occurrence on Malaysia Building Projects through Partial Least Square Structural Equation Modelling

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***Abstract**: - In Malaysia, construction companies have played a great role in the growth of the country's economy over the years. However, there have been incidents of increasing injuries as a result of being exposed to accidents within the industry. Some studies in the construction field have shown that safety performance has been decreasing. Most of the construction activities carried out by the construction companies has been in dangerous situations thereby exposing the workers to minor and major injuries which may sometimes lead to death. As a result, the organizations may sometimes change the goals of the projects because of the accident, thus affecting the organisation's level of advancement in the industry. To address the aforementioned issue, this paper aims to 1) investigate the significant relationship between workplace and building projects in Pahang construction projects, 2) investigate the significant relationship between materials and building projects in Pahang construction projects, and 3) investigate the significant relationship between equipment and building projects in Pahang construction projects. 132 construction companies that registered under the CIDB Malaysia among Kuantan, 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 equipment played a significant positive relationship on building projects among construction companies operating in Pahang, Malaysia.*

***Keywords**: - Building projects, workplace, materials, equipment, construction industry, Malaysia.*

1.0 Introduction

The level of the workplace exposure to injury and fatal accidents among the construction companies has been a great concern. This situation suggests that a poor safety performance exist in the construction industry (Rahman, & Adeleke, 2018). . It has been discovered that, in 2002/03, the rate of fatal accidents over the years in other industries has been 4 per 100,000 workers, but it has been 31% in the case of the construction industry. Falling from heights (46%) and being struck by moving vehicles (15%) accounted for the majority of the construction accidents. Based on the serious occurrence of the accidents, Arquillos et al., (2012) suggests that there is need to clarify the causes.

In Malaysia, the rate of accidents has seriously increased since 2000. This unpredictable occurrence in the construction industry has recently gained much attention of the government as well as non-governmental organizations. Governments over the world are now being motivated towards reasonable environmental practices that will bring change to the situation. To this end, more innovative development that can be gained from talented labourers is being expected from organizations for new standards so as to control the situation. Being a tropical country, Malaysia is inclined to a great deal of climatic catastrophes, particularly surges that happened each year. In Taman Merbau, a fatal accident happened in 2008 in the phase two construction site at Changlun, Malaysia where two construction site workers were buried alive by a 3.6 m depth of an excavated sand pile in a sewer trench. Similarly in Kuching, 20 foreign workers escaped serious injuries during the collapse of the structure that they were working on (Adeleke et al., 2018; Manu et al., 2012).

The adopted modelling confined to the collection, analysis and interpretation of data derived from the various causal processes of the accidents by previous studies in the construction industry has not been well developed. This approach is limited by the method of data collection such as under reporting and too broad a classification for the coding. In Malaysia, attitudes of construction companies' workers towards safety have dramatically changed in the past few years. Major contractors as well as government regulatory authorities are now keen on safety aspects. There are numerous circumstances where unassuming changes to materials or the manner by which they are provided could enhance security. However, at the display buyers are not utilizing wellbeing as a measure. Without this, providers have no consolation to be innovative (Dumrak et al., 2013).

Construction projects are built only once because they are unique (Fazlina, 2018). This research focuses on the construction companies in Pahang, especially in Kuantan area. In Pahang, most of the construction projects are carried out in Kuantan; so, this study will be conducted in Kuantan because it is the capital city of Pahang. Usually the main office is located at the city of the construction companies so that it will be easy to approach the construction companies that are located in Kuantan, Pahang. 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 workplace, materials, and equipment and building projects among Pahang Malaysia construction industry. According to Adeleke et al., (2018), most of the construction companies do not perform well when it comes to workplace safety.

2.0 Literature Review

2.1 Overview of 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 is an important responsibility being performed by the construction industry in improving the economic growth of the country (Hanapi et al., 2013). The construction industry's focus has been on time, quality and cost with little attention to the safety of construction sites, thereby making the construction sites accident-prone areas due to the high occurrence of accidents (Ayob and Ibrahim, 2016). Because of the dangerous nature of the construction sites, the high rates of accidents have led to absence from work, permanent disability, loss of productivity and even death (Jamaluddin et al., 2018).

Workplace factors such as difficulties in managing the available space and site layout have been accounted to be 49% of the cause of accidents in the construction sites. In about 100 accidents, local hazards on site were a contributing factor. Slip and trip hazards such as trailing cables, muddy conditions, uneven ground or debris are among the most cited problems. Representatives from various companies believe that the difficult conditions are inevitable because of the changing nature of the workplace and the activities on the construction sites. The poor conditions of some construction sites may be a symptom of lack of risk management and weak safety (Nenonen, 2011).Moreover, site conditions apart from the equipment and material, layout and space of the site, working environment such as noise, lighting, being cold, hot, or wet, scheduling of the work and housekeeping were among the most influential elements (Haslinda et al., 2016).

Hypothesis 1: There is a significant relationship between workplace and building projects.

Many incidents at the construction sites are caused due to deficiencies in condition and suitability of material such as packaging. Hazards are usually caused by the way the materials are supplied. Problem such as banding steel around plywood can result in arm laceration. Therefore, because such incident constitutes 25% of the causes of accident in the construction site, it should be prevented. Moreover, some hazards are naturally caused by materials such as very heavy steel angles that are manoeuvred thereby leading to the deficiencies of the materials (Hanapi et al., 2013).

Hypothesis 2: There is a significant relationship between materials and building projects.

Construction accidents sometimes are caused by ineffective use of safety equipment by workers. This situation cannot be absolutely eliminated but the frequency of its occurrence can be drastically reduced. When workers are observed constantly, the ineffective use of safety equipment by them can be immediately identified. When the safety equipment is not used properly by the workers, the supervisor must be able to influence their behaviours by using different methods such as spoken or even written warnings to prevent it (Pearce, 2012).

Hypothesis 3: There is a significant relationship between equipment and building projects.

2.2 Conceptual Framework

This study will be conducted by utilizing 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 projects (building projects) and the independent variables are workplace, material and equipment. The framework of the study is to depict the connection between independent and dependent variables of the study.

Independent Variables Dependent Variable

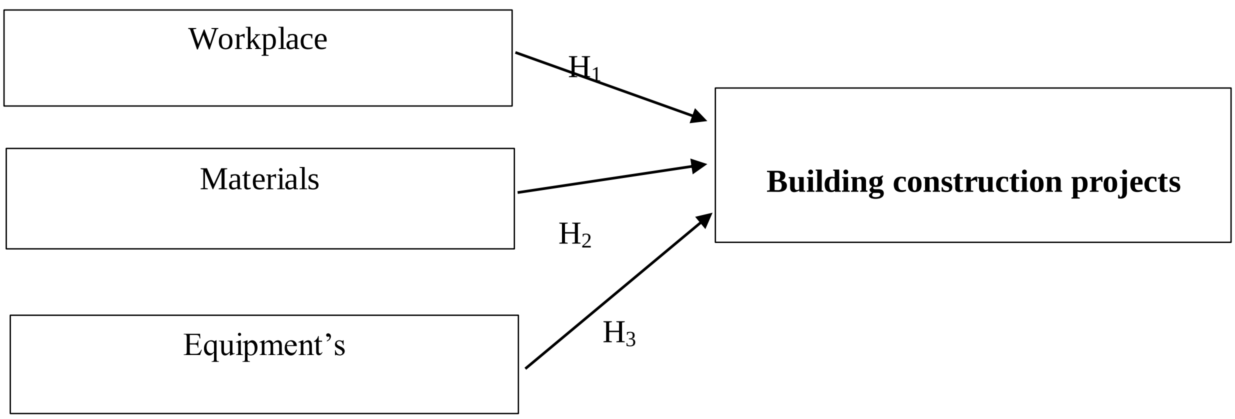

Figure 1: Research framework

2.3 Relationship between Workplace and Construction Projects (Building Projects)

Many workers involved in heavy physical work without effective cooling outdoors or indoors in tropical and subtropical regions are particularly in high risk. The construction workers' fatigue increases with the level of exposure to heat because a hot environment makes the workers to be easily prone to fatigue. The construction industry particularly in Malaysia experiences such a high rate of accidents. Workers are at a high risk of heat because of the inter-body heat production caused by physical labour (Shariffudina2016).

Construction workers face various types of stress while they are performing high demanding physical tasks as a result of awkward posture, highly repetitive actions, excessive energy expenditure and excessive force demanding (Jia, 2016). The physical stress of workers during the day is increased by high temperature, solar radiation, humidity and poor air ventilation combined with physically demanding works. The risk of accidents and injuries is increased among construction workers when heavy physical workloads pose a threat of heat fatigue on them (Göçer, 2015).Therefore, this study proposes that there is a negative relationship between workplace and construction projects in Pahang, Malaysia.

2.4 Relationship between Materials and Construction Projects (Building projects)

Building projects consume 40% of the world's raw materials (Marzouk and El-Rasas, 2014). The choice of materials for a project requires the consideration of the aesthetic appeal and initial ongoing costs, life cycle assessment considerations (such as material performance, availability and impact on the environment) and the ability to reuse, recycle or dispose of the material at the end of its use (Sharma et al., 2011, Arshad et al., 2017) without running out or harming the environment at any time. In order for the present use of materials not to jeopardise the structure in the future, suitable materials must be adopted in building projects (Sharma, 2011).

According to Saidu and Shakantu (2015 many incidents at the construction sites are caused because of imperfect conditions and lack of suitable packaging materials. Hazards are usually caused by the way the materials are supplied. It is argued that suitability of materials, their usability and conditions of materials are all responsible for the occurrence of accidents in the construction sites. Therefore, they showed that there is a negative relationship between material and construction projects.

2.5 Relationship between Equipment and Construction Projects (Building Projects)

Building projects need different kinds of equipment and level of usage. Some building projects use light level of equipment. They need only simple and traditional equipment such as fork-lifters to handle materials. Besides, some building projects make use of moderate equipment. Moreover, heavy construction projects need sophisticated equipment for carrying out excavation. Equipment failures, falls and stuck by objects are the common causes of hazards (Adeleke et al., 2016).

The role of equipment is very important for enhancing productivity particularly for infrastructural works. Past research suggest that because equipment constitutes 36% of the total project cost, it can lead to high uncertainties and risk for owners who do not bother about them. According to Adeleke et al., (2015) and Huang & Hinze, (2006), the commitment of management needs to be backed up with safety equipment and supervision for the work.

Construction of building projects has been recognized as one of the major economic forces responsible for achieving the Malaysian target to become a developed nation by 2015 (Ramli et al., 2016).The condition of equipment is very significant and should be considered in the prevention of accident at the construction site. Overall, it is shown that there is a positive relationship between equipment and construction projects (Waris et al., 2013).

3.0 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 research purposes (Sekaran, 2006). The items from the existing literature and former researches were adopted and adjusted to construct the questionnaire items in order to make sure that all the important points are covered during measurement. The total number of 99 copies of questionnaire was personally collected from the sampled companies. So, the sample size for this research was 99 companies in Kuantan, Pahang.

3.1 Instrument Design

Quantitative method was used in this research as it is more structured than the qualitative method of data collection. Hence, the data was collected by using the questionnaire. As stated above, the method used in this research for data collection process was the questionnaire as it is found to be easier for the collection of data from the respondents.

The answers to the questions were recorded by taking input from the respondents and without the need for an interview. In analysing the data, SPSS software version 22.0 was used for respondents' demographics such as position, company existence, gender, company's prime location, company's ownership, work experience, number of full time employees and company ownership. The data analysis adopted for both independent and dependent variables was Smart PLS version 3.0. 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, to (5) very high, following (Adeleke et al., 2016).

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. 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	Accidents Occurrence	Workplace Materials Equipment	(Haslam , 2005)	Adapted
2	Construction project	Building projects	Yang (2007)	Adapted

4.0 Results and Discussions

4.1 Data Collection and Sample

In Kuantan, Pahang construction companies were given about 100 copies of the questionnaire. The number of the copies of questionnaire filled and returned was 99, thereby making the sample size for this research to be 99 respondents. Table 2 shows the summary of demographic scales of respondents for this research.

Table 2: Summary of Demographic Scales of Respondents

Type	Items	Percentage (%)
Position	Contract manager Architect Contractor Project manager Engineer Other	12 13.00 21.2 19.00 34.3
Working experience	1-3 years 4-6 years 7-9 years >10 years	23.00 37.40 29.30 10.3
Gender	Male Female	65.7 34.3
Company ownership	Local national	91.90 8.10
Company prime location	Local market areas Across Malaysia Within few states International markets	44.40 35.00 17.00 3.00
No. of employees	0-50 50-100 100-150 150-200 >150	21.00 33.00 25.00 14.00 6.00
Company existence	1-3 years 4-6 years 7-9 years >10 years	5.10 39.00 13.00 42.40

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.

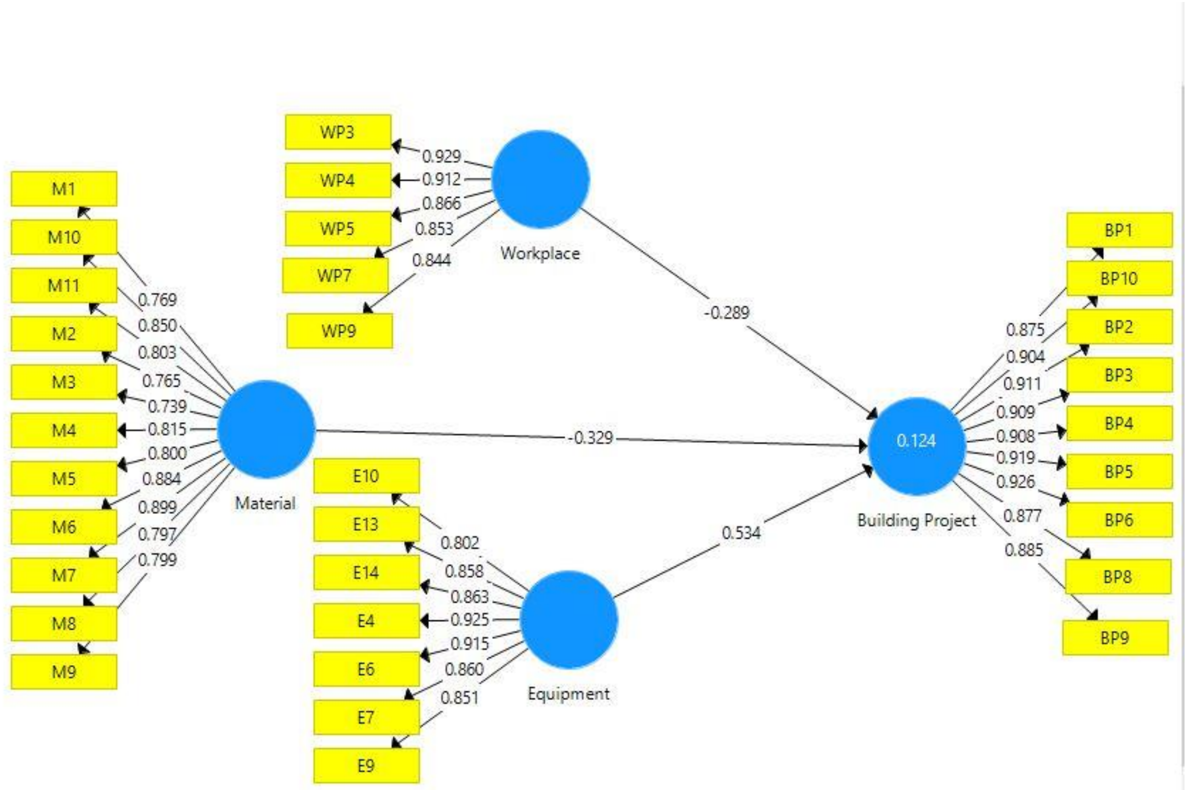

Figure 2: Measurement model

The measured content validity (Table 3) was explained using 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 (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, 2010).

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

	BP	E	M	WP
BP6	0.926	0.096	-0.134	-0.073
BP5	0.919	0.120	-0.108	-0.031
BP2	0.911	0.071	-0.122	-0.162
BP3	0.909	-0.051	-0.223	-0.240
BP4	0.908	0.088	-0.168	-0.058
BP10	0.904	0.093	-0.140	0.014
BP9	0.885	0.029	-0.201	-0.140
BP8	0.877	0.177	-0.087	0.025
BP1	0.875	0.034	-0.097	-0.077
E4	0.103	0.925	0.613	0.771
E6	0.096	0.915	0.613	0.687
E14	0.050	0.863	0.562	0.647
E7	0.053	0.860	0.610	0.647
E13	0.047	0.858	0.597	0.693
E9	0.054	0.851	0.644	0.648
E10	0.023	0.802	0.565	0.674
M7	-0.189	0.520	0.899	0.548

M6	-0.149	0.524	0.884	0.503
M10	-0.078	0.642	0.850	0.595
M4	-0.081	0.711	0.815	0.667
M11	-0.026	0.778	0.803	0.711
M5	-0.029	0.743	0.800	0.667
M9	-0.008	0.704	0.799	0.550
M8	0.012	0.757	0.797	0.678
M1	-0.091	0.649	0.769	0.691
M2	-0.070	0.629	0.765	0.623
M3	0.060	0.763	0.739	0.689
WP3	-0.110	0.720	0.595	0.929
WP4	-0.083	0.686	0.565	0.912
WP5	-0.021	0.706	0.568	0.866
WP7	-0.001	0.715	0.581	0.853
WP9	-0.73	0.696	0.708	0.844

Converge validity can be explained as the degree to which a bunch of variables are 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 (Hari, 2010). The value of CR and AVE are presented in Table 4.

Table 4: Convergent Validity Analysis

Construct Dimension	**Items**	**Loading**	**Composite Reliability**	**AVE**	**Cronbach's Alpha**
Building Projects	**BP6**	0.926	0.975	0.813	0.971
	BP5	0.919			
	BP2	0.911			
	BP3	0.909			
	BP4	0.908			
	BP10	0.904			
	BP9	0.885			
	BP8	0.877			
	BP1	0.875			
Equipment	**E4**	0.925	0.956	0.755	0.948
	E6	0.915			
	E14	0.863			
	E7	0.860			
	E13	0.858			
	E9	0.851			
	E10	0.802			
Materials	**M7**	0.899	0.955	0.660	0.961
	M6	0.884			
	M10	0.850			
	M4	0.815			
	M11	0.803			
	M5	0.800			
	M9	0.799			
	M8	0.797			
	M1	0.769			
	M2	0.765			
	M3	0.739			
Workplace	**WP3**	0.929	0.946	0.777	0.937

The discriminant validity is necessary for construct validity of outer model. It is essential to be tested before examining the hypothesis through path analysis. It shows the extent to which items differentiate 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) was all loaded above the recommended threshold value of 0.5 and greater than the off-diagonal correlations.

Table 5: Validity Analysis

	Building project	Equipment	Material	Workplace
Building Project	0.902			
Equipment	0.082	0.869		
Material	-0.160	0.685	0.812	
Workplace	0.096	0.783	0.683	0.881

After confirming the goodness of the outer model, the next step was 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 above showed the hypothesis testing. The results showed that workplace (WP) variable had negative relationship on building projects (β= -0.289, t = 1.375, p <0.05). The second hypothesis H2, material, also had negative relationship on building projects (β=-0.329, t = 1.1215, p <0.05). But the third hypothesis H3, equipment, had a positive relationship with building project (β=0.534, t = 2.056, p<0.05).

Table 6: Results of the Inner Structural Model

Items	Constructs/variables	Beta	S/E	T-value	P-value	Findings
H_1	Workplace-> Building projects	-0.289	0.210	1.375	0.170	Not Supported
H_2	Materials-> Building projects	-0.329	0.270	1.215	0.225	Not Supported
H_3	Equipment's->Building projects	0.534	0.260	2.056	0.040	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 medium and less than 0.35 is considered as high (Cohen,1988). Based on Table 7 below, the effect size of equipment was small, material's effect size was small and finally workplace effect size was considered to be small.

Effect size is calculated using the below formula:

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

Table.7 Direct Effect IV-DV

R-square	Included	Excluded	f-squared	Effect size
Equipment	0.124	0.026	0.1119	small
Material	0.124	0.0548	0.0548	small
Workplace	0.124	0.099	0.0285	small

5.0 Conclusion

This study focused on workplace, materials, and equipment as factors responsible for the occurrence of accidents among the construction companies in Pahang, Malaysia. The findings of this study will help future researchers who want to conduct research to gain information from previous research regarding the construction field. Also, information regarding the possible causes of accidents in construction sites in Malaysia has been revealed.

This research will also benefit the construction workers who usually experience accidents and injuries so as to improve the safety performance, and not only the academic world.

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References

1. Adeleke, A. Q., Bahaudin, A. Y., Kamaruddeen, A. M., Bamgbade, J. A., Khan, M. W., Sitansu, P., and Afolabi, Y.A. (2019). An Empirical Analysis of Organizational External Factors on Construction Risk Management. International Journal of Supply Chain Management, 8(1), 932-940.
2. Adeleke, A. Q., Bahaudin, A. Y., Kamaruddeen, A. M., Bamgbade, J. A., Salimon, M. G., Khan, M. W. A., & Sorooshian, S. (2018). The influence of organizational external factors on construction risk management among Nigerian construction companies. Safety and health at work, 9(1), 115-124.
3. Adeleke, A. Q., Bahaudin, A. Y., & Kamaruddeen, A. M. (2018). Organizational internal factors And construction risk management among nigerian construction companies. Global Business Review, 19(4), 921-938.
4. Adeleke, A. Q., Bahaudin, A. Y., & Kamaruddeen, A. M. (2016). Preliminary analysis on Organizational factors influencing effective construction risk management: A case study of Nigerian construction companies. Sains Humanika, 8(2).
5. Adeleke, A. Q., Bahaudin, A. Y., & Kamaruddeen, A. M. (2016, August). Rules and regulations as potential moderator on the relationship between organizational internal and external factors with effective construction risk management in Nigerian construction companies: a proposed framework. In AIP Conference Proceedings (Vol. 1761, No. 1, p. 020008). AIP Publishing.
6. Adeleke¹, A. Q., Bahaudin, A. Y., & Kamaruddeen, A. M. (2015). A Partial Least Square Structural Equation Modeling (PLS SEM) Preliminary Analysis on Organizational Internal and External Factors Influencing Effective Construction Risk Management among Nigerian Construction Industries. Rev. Téc. Ing. Univ. Zulia, 38(143), 143-55.
7. Arquillos, A. L., Romero, J. C. R. & Gibb, A. (2012). Analysis of construction accidents in Spain, 2003-2008. Journal of safety research, 43, 381-388.
8. Ayob, M. F. & Ibrahim, M. S. (2016). Cost and contract administration in construction: divine perspectives, IIUM Press.
9. Bamgbade, J. A., Kamaruddeen, A. M., Nawi, M. N. M., Adeleke, A. Q., Salimon, M. G., & Ajibike, W. A. (2019). Analysis of some factors driving ecological sustainability in construction firms. Journal of Cleaner Production, 208, 1537-1545.
10. Chow, W. S., & Chan, L. S. (2008). Social network and shared goals in organizational knowledge sharing, Information Management, 45, 7, 24-30.
11. Cohen, J. (1988). Statistical power analysis for the behavioral sciences (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.
12. Dumrak, J., MostafA, S., Kamardeen, I. & Rameezdeen, R. (2013). Factors associated with the severity of construction accidents: The case of South Australia. Construction Economics and Building, 13, 32-49.
13. Fazlina, N., Rahman, A., & Adeleke, A. Q. (2018). Akademia Baru The Relationship between Effective Communication and Construction Risk Management among Kuantan Malaysian Construction Industries Akademia Baru, 1(1), 18–24.
14. Göçer, Ö., Hua, Y. & Göçer, K. (2015). Completing the missing link in building design process: Enhancing post-occupancy evaluation method for effective feedback for building

performance. Building and Environment, 89, 14-27.

15. Hair, J., W.C. Black, B.J. Babin and R.E. Anderson (2010). Multivariate data analysis. 7th Edn, Upper saddle River, New Jersey: Pearson Education International.

16. Hanapi, N. M., Kamal, M. M. M., Ismail, M. I. & Abdullah, I. A. P. (2013). Identifying Root Causes and Mitigation Measures of Construction Fall Accidents. Gading Journal for the Social Sciences, 17, 65-79.

17. Haslam, R. A., Hide, S. A., Gibb, A. G. F., Gyi, D. E., Pavitt, T., Atkinson, S., & Duff, A. R. (2005). Contributing factors in construction accidents. Applied Ergonomics, 36(4 SPEC. ISS.), 401–415. https://doi.org/10.1016/j.apergo.2004.12.002

18. Haslinda, A., Saharudin, S., Roslan, N. H. & Mohamed, R. (2016). Safety Training, Company Policy and Communication for Effective Accident Management. Int. J. Acad. Res. Bus. Soc. Sci, 6, 141.

19. Huang, X., & Hinze, J. (2006). Owner's role in construction safety. Journal of construction engineering and management, 132(2), 164-173.

20. Jamaluddin, N., Yeoh, D., Ghani, A. H. A., Ayob, S. S., Ibrahim, M. H. W., Mohamad, N., Chik, T. N. T. & Ghafar, N. H. A. (2018). A Case Study of Residential Buildings Subjected to Cracking Failures. International Journal of Integrated Engineering, 10.

21. Jia, Y. A., Rowlinson, S. & Ciccarelli, M. (2016). Climatic and psychosocial risks of heat illness incidents on construction site. Applied ergonomics, 53, 25-35.

22. Manu, P. A., AnkraH, N. A., Proverbs, D. G. & Suresh, S. (2012). Investigating the multi-causal and complex nature of the accident causal influence of construction project features. Accident Analysis & Prevention, 48, 126-133.

23. Marzouk, M. M. & El-Rasas, T. I. (2014). Analyzing delay causes in Egyptian construction projects. Journal of advanced research, 5, 49-55.

24. Nenonen, N. (2011a). Occupational accidents in the Finnish local government sector: Utilisation of national statistics. International journal of injury control and safety promotion, 18, 321-329.

25. Pearce, J. M. (2012). Building research equipment with free, open-source hardware. Science, 337, 1303-1304.

26. Ramli, M. Z., Hanipah, M. H., Zawawi, M. H., Abidin, M. Z. Z., Zainal, N. A. & Halim, N. S. A. (2016). Cost comparison on industrialized building system (IBS) and conventional method for school construction project. Journal of Scientific Research and Development, 3, 95-101.

27. Razak Bin Ibrahim, A., Roy, M. H., Ahmed, Z. & Imtiaz, G. (2010). An investigation of the status of the Malaysian construction industry. Benchmarking: An International Journal, 17, 294-308.

28. Saidu, I. & Shakantu, W. (2015). A Relationship between Quality-of-Estimating, Construction Material Waste Genration and Cost Overrun in Abuja, Nigeria. Fourth Construction Management Conference, Nelson Mandela Metropolitan University, Port Elizabeth, South Africa. Edited Emuze, FA,.30.

29. Sekaran, U. (2006). Metodologi penelitian untuk bisnis. Edisi.

30. Sekaran, U. & Bougie, R. (2013). Research Methods for Business: A Skill Building Approach. New Jersey: John Willey and Sons. Inc.

31. Sekaran, U. (2003). Research methods for business. 4th Edn., New York: John Wiley & Sons Inc.

32. Sekaran, U. and R. Bougie (2009). Research methods for business: A skill building approach. 5th Edn., United Kingdom: John Wiley & Sons Ltd.

33. Shariffudina, S. I., Rohani, J. M., Taiba, M. F. M. & Azizb, R. A.(2016). Development of Physical Workload and Heat Stress Questionnaire for Construction Industry in Malaysia. Journal of Occupational Safety and Health, 93.

34. Sharma, A., Saxena, A., Sethi, M. & Shree, V. (2011). Life cycle assessment of buildings: a review. Renewable and Sustainable Energy Reviews, 15, 871-875.

35. Waris, A., Khamidi, M. F. & Idrus, A. (2013). Heavy equipment acquisition in Malaysian construction industry. Proceedings of the International Symposium on Business, Engineering and Industrial Applications, Kuching, Malaysia.

36. Zikmund, W. G. (2003). Sample designs and sampling procedures. Business research methods, 7, 368-400.