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The Effects of Project Triple Constraint on Malaysia Building Projects

[1]A. K. Hassan,[2]A. Q. Adeleke , [3]Taofeeq. D.M

[1, 2,3]Faculty of Industrial Management, University Malaysia Pahang, Lebuhraya Tun Razak, 26300 Gambang, Malaysia

***Abstract*: -** *This study was carried out in order to investigate the effects of project triple constraint (time, cost and quality) on the building projects situated in Kuantan Malaysia. The main goal was to examine a series of barriers that are related to the building projects, most of which were caused by delay in time, cost overrun and poor quality of the projects. Aside from these, the lack of proper planning regarding cost estimation may sometimes lead to overestimation or underestimation, thus resulting in the delay of building projects or incompletion of the task. This study employed quantitative research technique because it is most suitable for the investigation. Data were analyzed using both the IBM SPSS version 22 and smart PLS version 3.2.4 software. The general objectives of this research were to examine the size effect between time management, cost management and quality management on building projects. The respondents' profiles were analyzed using the SPSS while smart PLS was used to analyses the research objectives such as independent variable (time, cost, and quality) and dependent variable (building projects). The findings clearly showed that the project triple constraint (time, cost, and quality) had a positive relationship with the construction companies' building projects.*

***Keywords*: -** *project triple constraints, organizational control theory, time management, quality management, cost management, PLS-SEM.*

1.0 Introduction

Generally, projects are undertaken because they are part of the plans to take organizations to new levels of performance and to meet business needs (Van Wayngaag, Pretorius, & Pretorius, 2011). Project management involves planning, organizing, coordinating, leading and controlling resources so as to accomplish the project's objectives. The successful completion of the project's objectives could be constrained by many factors, such as scope, quality, schedule, budget, resources, risks, customers' satisfactions, and stakeholders' supports (Gido & Clements, 2015). The triple constraint is a triangle of time, cost and performance that borders on how every project must be achieved (Dobson M. S., 2004). Project managers must focus on three dimensions of success so as to complete all projects on time, within the estimated budget and delivering quality product or services acceptable to the sponsors or stakeholders (Greer, 2008). The different aspects that exist in the process of constructing a project are project scope, time and cost. Performance is sometimes referred to as

"scope" or "quality", and "cost" and "resources" are often listed separately (Dobson M. S., 2004).

Khalid (2010) defines Construction Company as a system that contains any part of portable elements used in the building of projects. The completion of any projects in the construction process depends on the accessible materials used for the construction (PMI, 2005). Project completion depends on the starting and ending time, as well as cost and quality. In the developed countries, the construction companies possess quality skills in terms of building construction; they know how to develop different construction projects suitable for their societies. They play important roles in the constructions of standard roads, bridges and airports (Ahmed, 2002). In addition, the

construction project is acknowledged as useful when it is completed on time.

A lot of problems are facing building projects in Malaysian construction industry that can lead to the incompletion of projects. Project triple constraint such as time, cost and quality vary from one building project to another in Malaysia; improvement and maintenance of the building project are connected to project triple constraint (Al-najar, 2010). Previous studies highlighted that poor building projects, collapsed projects, insufficient budget, and delay in time are the factors influencing Malaysia constructions (Ling, 2015). Series of barriers related to building projects are caused by waste of time, over cost, and poor quality of the projects resulting from the lack of proper planning concerning the time of project and, cost estimation which may sometimes be overestimated or underestimated, thereby leading to delay in the building of the projects or incomplete task (Ibrahim et al., 2010). Poor performance occurs in the building projects whenever the contractors and managers fail to implement effective cost, time and quality of the projects.

The concerned of this study is on how to prevent project managers from facing problems concerning the elements of the triple constraint in the process of constructing projects (Michael, 2004). Project is a temporary effort undertaken to create unique product or services; this definition draws attention to the specific time required for the operation of every project. The term project occurs in the organization where the project accomplishment is managed by quality, cost, and time which are normally called "triple constraint". In spite of the fact that the project is considered as vital by the stakeholders, all the team members involved in the project management should consider all the three triple constraints known as "iron triangle" or golden triangle (Duncan, 2011).

In order to achieve a successful completion of any project, the project team must understand the importance of the constraint quality (Pretorius, 2012). Moreover, projects have strategy and clear objectives for easier completion based on project management (Fred, 2015). Previous studies have given a list of the requirements needed by the project management in order to have a successful completion of building projects. There must be proper schedule which must be well suited to stakeholders' expectation, management of project activities, task-related works, and ability of project manager to meet the objectives of the projects.

The quality of performance in project management will help in identifying and overcoming challenges during the project construction. Building risk may result from unsuitable timing, budget and quality. In addition, improper cost of material sometimes occurs during the project management and this may affect the completion of the project (Darrel, 2010).

2.0 Literature Review

The construction industry is an economic investment whose relationship with economic development is well posited. Many studies have highlighted the significant contribution of the construction industry to national economic development (Myres, 2013). The importance of the construction industry is unique regardless of whether the country is underdeveloped, developing or developed. The construction industry appears more than once in the national accounts: GDP, GNI and GFCF (CIDB, 2013). The outputs are measured by gross output, capital formation and added value (CIDB, 2006). Moreover, out of all the contributions of different industries to the GDP, the service industry is the largest in terms of size while construction is the smallest. However, it may be seen that the contributions of the construction industry are consistent and impressive (Malaysia, 2014). The outlook of the Malaysian construction industry is quite impressive though the global economic climate is volatile. The economy is assumed to experience steady growth with an expansion of 6% towards 2020 and beyond.

Nation building requires involvement in and contribution to the efficiency, productivity, cost competitiveness, and environment in the construction industry so as to help the industry develop and utilize its resources more efficiently (Badawi, 2007). The construction industry has assumed an important role in generating wealth and improving the quality of life through government's

socio-economic policies and economic infrastructures; it further creates a multiplier effect on other industries, in manufacturing, financial services, and professional services (Robby, 2015). Malaysia has an obligation to achieve set goals for the future. The increasing technological challenge amid global opportunities should be a trigger for the development of construction industry strategy in Malaysia (Adeleke et al., 2016; Yusof, 2006). It is therefore important to understand stakeholders' roles in the construction industry (Datuk, 2014). A strategy employed by Malaysia construction industry to develop the sector is not only able to meet the challenges of international competition and to seize the opportunities afforded in the global market place, but also to make a significant contribution to the nation's aspirations and the welfare of its people (Malaysia, 2014).

Quality in the construction industry will have to encompass more than contractors alone. Architects and engineers will have to be involved as well using the three contributing factors (material, construction and design faults). About 50% of the failures can be attributed to design faults while 40% are due to construction faults and 10% are because of material faults (CIDM, 2015). The strategies and the action plans implemented by CIMP covered 10 years (2006 to 2015). This has been adopted for the growth of the construction industry in Malaysia (Jamil and Adeleke et al., 2018; Najib, 2015).

The unique problem of remote projects is that they lose control over communications and management (Sidawi,2012). This is due to several reasons such as lack of management skills, human resources and infrastructure. A few studies were undertaken particularly in the Gulf region regarding this issue and they, highlighted a few unique communications and management problems. There is a serious delay in sorting out of several project queries and problems; this can pose an adverse effect on the project's performance and process. Delays in decision making, loss of control and infrequent visits to the remote site can result in wasted time, excessive costs, unfocused quality, and poor construction quality.

This study focuses on the effect of project triple constraint on the building projects in Kuantan construction companies. The challenges faced during project management will be evaluated and measured based on triple project constraint and how each of the elements, time, cost and quality, are related to the building being managed. Baratta (2006) outlined that building projects depend on how to manage the schedule of project construction, how to manage the budget of a project, how to establish and achieve the objectives of the projects. These factors are based on project triple constraint and so it is important to identify the level of relationship the factors have with regards to the building projects (Dobson, 2004).

2.1 Conceptual Framework

The conceptual framework gives a description of how the variables relate to each other. The different variables here are the independent-dependent and moderator. Independent variable affects and determines the effect of another variable with the relationship. Project triple constraint (time, cost, and quality), in this research are the independent variables while the dependent variable is the building project. some scholars mentioned that the space of time in which a project is being constructed, cost estimation and proper evaluation of the quality of a project, have direct effect on the building, as shown in Fig. 1.

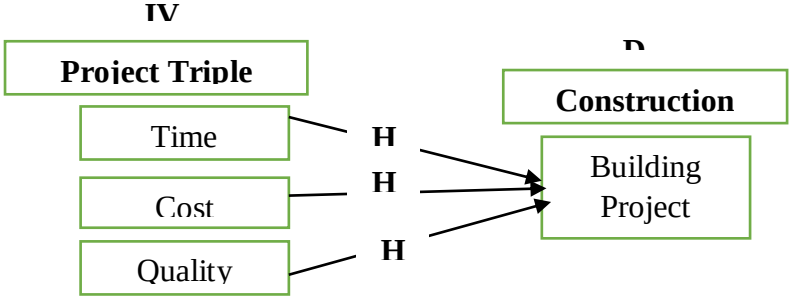

Fig.1. Conceptual Framework

2.2 Building projects

Chan (2015) states that project construction has contributed to Malaysia economic growth per capita income and in the development of people's standard of living. Project construction has been involved in bringing civilization through expansion of capital cities and improvement of infrastructures (Shenhar 2003). Project constructions are faced with many challenges in relation to time, cost and quality; all these are supposed to be properly managed in the process of constructing projects (Kotler, 2000).

Carrying out project construction does not only cover budget cost but sometimes requires skills and training so as to improve the quality of the building construction. In addition, it involves having access to quality materials, good technology and proper training of workers; all these factors facilitate the development of construction companies. Idoro (2009) suggests that monitoring and managerial skills are significant to improving any building project. It is important to understand every task relating to a project during its implementation. Cost of a building project is very important because it speaks volume about the construction company. It is necessary to have enough budgets that can start and finish the building project; this is connected to how efficient the project managers are in estimating the cost of the projects (Abulhakim and Adeleke 2019; Odabasi, 2003). In addition, delaying the projects has a negative effect on the building projects; this can result in incompletion of the project.

Ling and Chan (2007) state that it is difficult to predict construction companies especially during the building of a project because they have different perspectives on projects. Nevertheless, the project triple constraint such as time, cost and quality can help to predict the progress of projects. Alahansini (2000) reveals that one of the ways of checking construction companies is based on the safety of an environment. Moreover, PMI (2016) mentions that building projects are sometimes faced by bad climate which can cause inconsistency in carrying out the projects in that environment. This case can ultimately result in workers running away from the project, thereby leading to the stoppage of the project. Michell and Edward (2009) evaluated the factors influencing building projects and how they caused delay on the projects; the findings revealed that there was relationship between the project triple constraint especially the quality and other elements such as time and cost.

2.3 Project Triple Constraint

The project triple constraint is a model that measures the project field. It indicates the best way of evaluating projects during construction. In this study, cost, time and quality of the building projects were considered in the construction companies as shown in Figure 2.1 (Leon, 2011). One of the benefits of this model is related to carrying out projects with significant change; however, project managers always ignore this case in the construction industry. Moreover, when changes occur in the process of operating the project triple constraint, it is necessary to consider constant variables during the building projects. But sometimes no limitation is incurred in some projects (Dobson, 2004). Project triple constraint is important for decision and evaluation of the building projects. Sometimes it is not enough because it requires other previous project activities for the evaluation (Pretorius, 2011).

The constraint of projects varies in terms of cost, time and quality which are called project triple constraint. It is important to identify and balance the variables in order to complete projects so as to enjoy the benefit. (Samaha, 2007). The unsuccessful outcome of projects is mostly due to delay in time, the intended deliverable areas, over cost and inadequate system (Gelbard and Pliskin, 2002). In addition, lack of analysis and design sometimes result in problems as previously suggested (Nienaber, 2003).

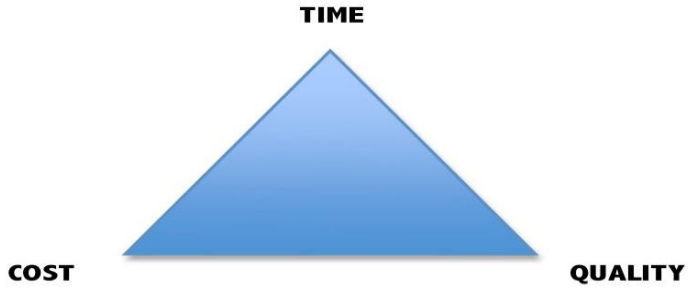

Fig.2 Project Triple Constraint, Duncan, (2011).

Many projects are being carried out using a complete project triple constraint with lack of training skills and infrastructure; this is caused by failing to recognize the importance of the three dimensions with projects building and other types of the construction project (Robertson, 2012). Some construction companies aim to assess the triple constraint in order to improve the success of the construction project. The project constraints for building projects are the major decision to be taken because it focuses on the areas which include time, cost and quality (Dobson, 2001). Some projects are incomplete because the manager failed to consider the project constraint in relation to monitoring, managing, and controlling the projects (Pretorius, 2001).

The quality of work in the construction industry is mostly related to the improvement of project based on project triples such as time, cost and quality. Before evaluating the performance of a job, the breakdown of the system should be understood because it depends on the project quality (Stellman, 2012). The time of the project is another constraint. The estimated and intended time of project completion should be evaluated in the construction company. Companies should always engage in following up scheduled projects by systematically planning operations so as to set up projects (Steyn, 2006). Project cost is the last elements to consider while establishing a project. Cost should be estimated to cover the whole project.

2.4 Relationship between Project Triple Constraint and Building Projects among Construction Companies

Relationship between the time of the project and building project is positive. This is because as the time increases, the process of building the project also increases. Time of the project depends on the allocated time; sometimes, when a delay in the time occurs in a project, it can lead to a prolonged time of actualizing the building project (Dobson, 2000). The relationship between cost of projects (second variable) and building projects in the construction industry is the main task to be considered in order to accomplish or achieve the intended project. The reason is that if there is positive relationship between the cost and the building projects, the increase in the cost will affect the progress of the construction project (Pretorius, 2001). Quality of the project is an important aspect of building projects.

Estimating the time of a project involves making enquiry on how long it takes to complete the projects. This is supposed to reflect in the planning and implementation of the projects in relation to the time the project will be completed. Therefore, every construction project needs to specify the specific time to carry out the building projects (Hewagmage, 2011). There are activities required in determining the specific time of a project; these include the specific activity, planning time and defined resources. Moreover, this explains the arrangement of the work so as to facilitate the breakdown of the work.

The quality of a project is supposed to be evaluated, analysed and developed. The quality of project management is the main target and priority of any construction company; the aim is to reduce unnecessary cost, to monitor and to properly control the projects' activities; all these determine the success and the quality of the project (Sorin, 2013). The project management is supposed to ensure the effectiveness of the project triple constraint, which are time, cost and quality. Quality control of the projects is an important factor for determining how effective the building projects have been executed. It requires project maintenance. in order to improve the quality control of the construction company (Adeleke et al., 2016; Mane, 2015). Construction quality plan

facilitates the contractor's work so as to complete the building project at the necessary time.

3.0 Theory and Hypotheses

Organizational control theory demonstrates that there is relationship between both the internal and external project triple constraint factors and it further states that risk needs to be properly managed in the process of constructing projects, (Datuk, 2014). The focus on both internal and external factors by using organization control theory is based on the communication system between employers and the top management (Fazlina, 2017).

Hence, the following hypotheses were developed based on the strong evidence provided by the literature considering the influence of the project triple constraint on building projects in Kuantan construction companies.

H1: There is a significant relationship between time and building projects in Kuantan construction companies.

H2: There is a significant relationship between cost and building projects in Kuantan construction companies.

H3: There is a significant relationship between quality and building projects among Kuantan construction companies.

4.0 Objective

In line with the above-mentioned issues and arguments from the existing literature, the main objective of this article was to investigate the relationship between project triple constraints and building projects in Kuantan construction companies.

5.0 Methodology

This research method is based on structural equation modelling (SEM), and the research model was ascertained through the SmartPLS 3.0 software (Ringle, Wende, & Becker, 2015). PLS-SEM is an appropriate method of assessing the results in the current research because its algorithm permits the unrestricted computation of cause-effect relationship models that employ both reflective and formative measurement models (Diamantopoulos & Siguaw, 2006). Therefore, the reflective approach was employed in this research. This study also focused on the G7 contractors operating in Kuantan Malaysia construction industry that specialize in building construction project.

5.1 Scale of the Questionnaire

Kulatunga and Udayangani, (2006) state that Likert scales are proper and widely used in the attitudinal measurement. The Likert scale is commonly used to measure activities with a scale ranging from very low to very high. In this paper, the scale point is between 0.1 and 0.5 interval scales in order to quantify the risk attitudes of contractors involved in construction projects. The scale correspondingly represents respondents' attitudes from (0.1) very low that this factor has dramatic influence to (0.5) very high that this factor has dramatic influence. In this study, the selection of an odd scale particularly the 5-point scale is appropriate because it will increase the reliability of the data as well as lessen social desirability bias (Krosnick, J.A, 1991).

5.2 Source of Measurement Instrument

Table1. Below depicts the source of each measurement instrument that was used in the survey.

S/N	Variables	Sources	Remarks
1	Time	Bowen et al (2012)	Adapted
2	Cost	Rugenyi and Bwisa, (2016)	Adapted
3	Quality	Marte,(2012)	Adapted
4	Building Projects	Nerija, (2012). Adapted	

6. Results

6.1 Response Rate

A total number of 62copies of questionnaire were distributed to the selected Kuantan construction companies. Thereafer,62 copies of the Questionnaire was returned amounting to 100 % response rate. It indicates that there was no missing copy of any of the questionnaire.

Table 2. This table indicates copies of questionnaires

Items	Numbers
Number of questionnaires respond	62
Number of questionnaires distributed by manual	62
Number of Sample	62
Response Rate	100 %

6.2 Demographic Distribution of the Respondents

The demographic profile of the respondents was made up the following: position, gender, age, years of experience, qualification, company's specialization and company's location. A sample of designers, project managers, contractors, and engineers operating in the construction companies in Kuantan Malaysia were asked to complete the copies of questionnaire. The questionnaire adopted a five-point Likert scale on their views about individual factors affecting contractors' risk attitudes in the construction companies. Out of the total surveyed sample size (62), 62 responded, making it 100% response rate. The completed copies of questionnaire were analyzed (Adeleke et al., 2015).

Table 3 Summary of Demographic Scale of Respondents

Type	Items	Frequency(N)	Percentage (%)
Job Position	Project Manager Contractor Civil Engineering Designer Others	13 19 14 10 6	21.0 30,6 22.6 16.1 9.7
Working Experience	1-4 years 5-10 years 11-15 years >16	8 30 18 5	12.9 48.4 29.0 8.1
Age	20-24 years 25-30 years 31-35 years >36	6 16 22 18	9.7 25.8 35.5 29.0
Company Existences	1-3 years 4-6 years 7-9 years >10 years	10 16 26 10	16.1 25.8 41.9 16.1
Company Project	50-100 projects 200-300 projects 400-500 projects >600 projects	34 19 5 4	54.8 30.6 8.1 6.5
Type of Project	Real Estate Roads Bridge Others	41 9 5 7	65.1 14.5 8.1 11.3
Number of Employee	50-100 workers 150-200 workers 250-300 workers >above workers	45 8 4 5	72.6 12.9 6.5 8.1
Full Time Employee	50-100 workers 200-250 workers Above 400 workers	50 10 2	80.6 16.1 3.2

6.3 Collinearity Statistics (VIF)

Multicollinearity is the "extent to which a variable can be explained by the other variables in the analysis" (Tabachnick & Fidell, 2007). Because of collinearity, it is difficult to ascertain the effect of any single variable. This study included using

Variance Inflation Factors (VIF) to examine multicollinearity. A VIF value greater than 3 indicates multicollinearity. In this study, the VIF values were below the standard criteria, indicating no multicollinearity issue.

Inner VIF Value

CM - 2.596

QM - 1.045

TM - 2.576

6.4 Assessment of Measurement Model (Outer Model)

The PLS-SEM method and statistical software SmartPLS 3 (Ringle, Wende and Becker, 2015) were used to estimate the hypothesized model.

PLS-SEM is a non-parametric, multivariate approach used to estimate path models with latent variables (Joseph F

Hair, Ringle, Hult, Sarstedt and Thiele, 2017; Memon, Salleh and Baharom, 2017; Richter, Sinkovices, Ringle and Schlaegel, 2016; Rigdon2016). In this study, PLS-SEM was used for several reasons. First, it was adopted because of the exploratory nature of the research, as the study was to investigate the influence of project triple constraint on building projects. Second, the PLS-SEM can handle complex frameworks (Hair et al., 2016), and is recommended for the moderating models (Hair et al.2017; Hair et al. 2011; Henseler et al. 2009).

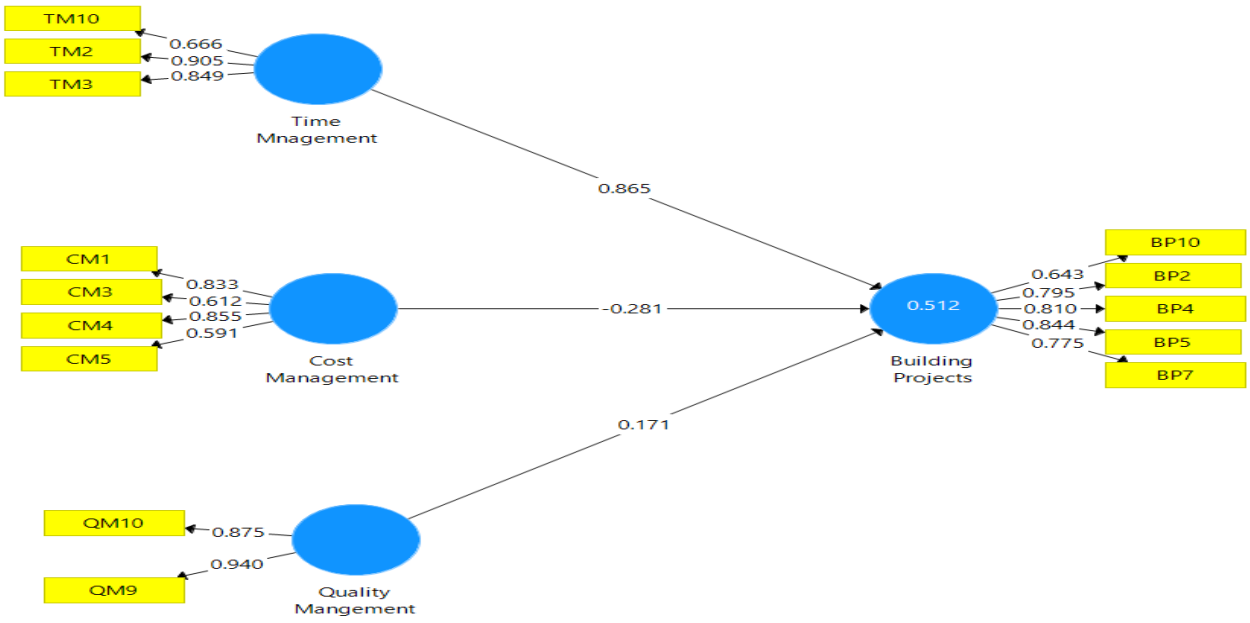

Fig.3. Evaluation of Measurement Model Through PLS Algorithm

6.5 Construct Reliability and Validity

This is in line with the criterion that Cronbach alpha coefficients of 0.60 is considered average reliability while a coefficient of 0.70 or higher indicates that the instrument has a high-reliability standard (Hair et al.2014; Sekaran, 2010). Hair et al (2011) suggests that the composite reliability coefficient should be at least .70 or more.

Table 4 Construct Reliability and Validity

Items	Construct	Factor loading	CR	AVE
BP10		0.643		
BP2		0.795		
BP4	Building projects	0.810	0.883	0.603
BP5		0.836		
BP7		0.844		
CM1		0.775		
CM3	Cost management	0.833	0.819	0.537
CM4		0.612		
CM5		0.740		
QM10	Quality Management	0.855	0.904	0.825
QM9		0.591		
TM10	Time Management	0.875	0.852	0.661
TM2		0.794		
TM3		0.940		
		0.666		
		0.905		
		0.751		
		0.849		

Note: Composite reliability (CR) = (square of the summation of the factor loadings)/ (square of the summation of the factor loadings) + (square of the summation of the error variances). Average variances extracted (AVE) = (summation of the square of the factor loadings)/ (summation of the factor loadings) + (summation of the error variances).

Table 4 shows the different measured variable and each suitable criterion item that met the reliability and validity properties. The Cronbach's alpha score on building projects indicated 0.836 highest score, the cost management (0.740) also indicated high score, and both quality management (0.794) and time management (0.751) indicated high score. These indications suggest high internal consistency or very suitable to this research. Composite reliability of building projects was 0.883 highest reliability variable indicating an acceptable value and more consistent; cost management (0.819) also showed a high quality management (0.852); Average Variance Extracted (AVE) of building projects was 0.603, indicating high variance reliability of this item; cost management (0.537) was high since the minimum acceptable variance is 0.5; quality management (0.825) and time management (0.661) were also high.

6.6 Discriminant validity

Discriminant validity is defined as the dissimilarity of measurement tools in measuring different constructs. A necessary condition for discriminant validity is that the shared variances between latent variable and its indicators should be larger than the variances shared with other latent variables (Adeleke et al., 2018; Vinzi ital., 2010). In assessing the cross-loadings, the outer loading of an item should be greater on its respective latent variable than its cross-loadings on other latent variables. Table 5 shows that outer loading of each indicator was greater on its respective constructs.

Table 5: Factor Analysis and Loading of the items (Cross-Loading)

Items	BP	CM	QM	TM
BP10	**0.643**	0.489	0.069	0.713
BP2	**0.795**	0.215	0.357	0.404
BP4	**0.810**	0.152	0.175	0.378
BP5	**0.844**	0.189	0.119	0.372
BP7	**0.775**	0.455	0.331	0.576
CM1	0.359	**0.833**	0.259	0.651

CM3	0.124	**0.612**	0.310	0.447
CM4	0.441	**0.855**	0.089	0.688
CM5	0.148	**0.591**	-0.003	0.429
QM10	0.200	0.103	**0.875**	0.116
QM9	0.285	0.242	**0.940**	0.204
TM10	0.298	0.654	**0.295**	0.666
TM2	0.634	0.720	0.139	**0.905**
TM3	0.626	0.587	0.102	**0.849**

The second approach of discriminant validity was evaluated using the criteria suggested by Fornell-Larcker (1981). The author suggested that discriminant validity is achieved when the square root of each AVE construct is higher than the correlation of the construct to other latent variables. Table 6 shows the correlations between the variables and the values of the square root of the average variances extracted. This clearly indicates that all the diagonal values are greater than the correlation among the variables, suggesting adequate discriminant validity (Fornell and Larcker, 1981).

Table 6: Discriminant validity results based on Fornell-Larker criterion

Construct	**BP**	**CM**	**QM**	**TM**
Building projects	**0.776**			
Cost management	0.430	**0.733**		
Cost management	0.274	0.203	**0.908**	
Time management	0.677	0.782	0.184	**0.813**

6.7 Assessment of Structural Model (Inner Model)

A bootstrapping process with 5,000 interactions was performed to generate t-values and standard errors to confirm the statistical significance (Hair Jr et al., 2011). R2 was used to measure the predictive accuracy of the model (Rng, Ramayah, and Amin, 2015), and it represented the percentage of variance in the dependent variables as explained by the independent variables in the model (Hair Jr et al., 2011).

The structural model indicates relationship between the constructs, mostly based on hypothesis test of independent

variable and dependent variable, which is also called inner model; therefore, these assessments demonstrated project triple constraint (time, cost and quality) and building projects in order to evaluate the hypothesized relationship between the construct. In addition, r square for independent variable 0.512 that represented 51 % means that 3 independent variables are required to explain 51% variance of dependent variable.

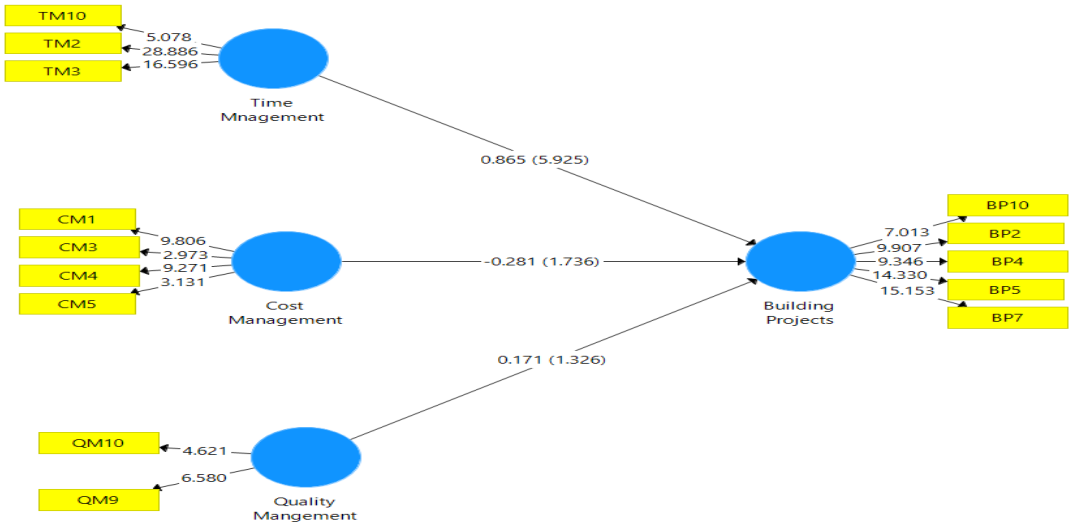

Fig.4. Evaluation of Structural Model through PLS Bootstrapping.

Table 7: Results of Bootstrapping for Structural Model Evaluation.

Hypothesis	Relationships	Standard deviation	T statistics	P value	Finding
H1	CM->BP	0.163	1.726	0.042	supported
H2	QM->BP	0.130	1.316	0.094	Not supported
H3	TM->BP	0.147	5.904	0.000	Supported

Note: ***Significant at 0.01 (1 -tailed), **significant at 0.05 (1 -tailed), *significant at 0.1 (1 -tailed).

The hypothesis testing was done by examining the absolutely unvarying parameter estimates, critical ratio and probability level. The findings pointed out that the latent constructs of exogenous and endogenous variables of the model were significantly related to contractors' risk attitudes. Moreover, this study used a comprehensive two-stage analysis whose measurement model was first confirmed by using construct reliability and discriminant validity. The SEM through structural model was achieved in order to estimate the hypothesized model relating to the data. In other to identify the relationship between the dependent and independent variables, the probability level of P value 0.05 was taken into consideration. In order to test the hypothesis, variables were regressed on each of the independent variables together with the dependent construct.

The results showed that quality management element has no significant effect on building project ($\beta = 0.130$, $t = 1.316$, $p>0.1$). The results also showed that cost management element has significant effect on building project ($\beta = 0.163$, $t = 1.926$, $p < 0.01$) and H3 which stated that time management had significant effect on building project. Table 7 shows the positive relationship between time management and building project ($\beta = 0.147$, $t = 5.904$, $p < 0.01$). As the self-assessment showed high performance, this study revealed that the respondents criticized the current performance in construction companies, which is a reflection of the problem of the study. Also, the small values of standard deviation suggest that this perception was virtually agreed upon among most contractors and engineers in the construction companies.

6.8 Coefficient of Determination (R2)

Having examined the significance and relevance of the path coefficients, the explanatory power of the structural model was determined. The explanatory power was examined by the coefficient of determination: R2 values (Hair Jr et al., 2012). Another essential criterion for measuring structural model in the PLS-SEM is the use of R-squared values or the coefficient of determination (Hair et al., 2011; Hair et al., 2012; Henseler et al., 2009). According to literature, R square is the indicator that shows the amount of variance examined in the endogenous variable by its exogenous variable. R square reflects the quality of the variables included in the model (Hair et al. 2010). However, there are many criteria that can be employed as guidelines for assessing the level of R square. For example, Cohen (1988) criterion opine that R square value

equals 0.26 or more is considered to be substantial, 0.13 moderate, and 0.02 weak. Meanwhile, Chin (1998) criterion states that R square value equals or more than 0.67 is substantial, 0.33 moderate, and 0.19 weak.

Table 8 Variance Explained in the Endogenous Latent Variable

Latent Variable	**Variance Explained (R2)**	
Building Project	**0.512**	

6.9 Effect size

In accordance with criterion suggested by Cohen (1988), the effect size is less than 0.02 (0.02 = small, 0.15= medium, 0.35=high). From Table 9 below, the effective size of cost management, quality management, are considered to be small. The interaction was large only with time management and which is considered as high.

$$\text{Effect size: } f^2 = \frac{R^{2Included} - R^{2Exlcuded}}{1 - R^{2Included}}$$

Table 9. Effect Sizes of the Latent Variables on Cohen's (1988) Recommendation

R-Square	**Included**	**excluded**	**F-square**	**Effect Size**
Time Management	0.512	0.510	0.596	Large
Cost Management	0.512	0.507	0.058	Small
Quality Management	0.512	0.497	0.062	Small

70. Discussion

The first objectives investigated the effect of cost management on building projects in Kuantan Malaysia construction companies. This finding indicated that cost management had a significant effect on building projects based on the hypothesis testing. This suggests that most respondents supported that cost management is very important on the building projects in terms of cost estimation and activities. The result showed that cost management ($\beta = 0.163$, $t = 1.926$, $p < 0.01$) was significant and showed a positive correlation between cost management and building projects. The F-square which was 0.058 suggests that there is a level of effect between cost management and building projects. In addition, when Cronbach's alpha showed 0.740, it means there is high reliability and internal consistency within the variable cost management. These results contradicted Rugenyi & Bwisa's (2016) claim that there was no significant effect between the cost management constraint and construction projects in Nairobi (p=.381). However, the finding also concurs with Omondi (2017) claim that cost management has a significant effect on construction projects.

The second objectives examined the effect of quality management on building projects in Kuantan Malaysia construction companies. The finding indicated that quality management had a significant effect on building projects as presented in Table 7 ($\beta = 0.130$, $t = 1.316$, $p>0.1$). It means that most of the respondents supported the fact that quality management is very important in building projects in terms of quality control. The size of the effect between quality management and building projects was shown at a small level of 0.062 F-square. This result agrees with Tan and Hamzah's (2011) claim that the effects of quality management in construction projects and their results show that there was a significant influence of quality management on the building projects in Malaysia (p=0.719). This finding reveals the state of quality management related to building projects and the need to improve and maintain quality management.

The third objective investigated the effect of time management on building projects in Kuantan Malaysia construction companies. This study clearly presented that time management had a significant effect on building projects in Kuantan Malaysia construction companies. According to Table 7, the results indicated that time management ($\beta = 0.147$, $t = 5.904$, $p < 0.01$) had a strong relationship between the building projects. This result confirms the fact that time management is a very important factor that affects construction companies especially building projects. This finding agreed with Catanio, Armstrong, and Tucker (2013) who investigated further on time management and obtained that there was a significant effect of the time management on building projects in Kuantan Malaysia construction companies (P=.789). Therefore, this finding

suggests that time management has a greater relationship with the building projects.

Lastly, this finding indicated that the project triple constraint (time, cost and quality) have a strong relationship on the building projects. Looking at the effects and correlation, it all showed significant relationship with different capacity size effect.

8.0 Implication of the Study

This study examined the significance of project triple constraint on construction projects in Kuantan Malaysia. As previously mentioned, there are a lot of problems facing the construction industry in Kuantan, most especially factors related to the completion of projects: time, cost and quality. They are known as the project triple constraint which always determines the achievement of the building projects. Time management is a crucial factor that affects building projects, especially in Kuantan construction industry due to improper time management. This has been defined in this study because it has shown a significant effect on building projects. This study has revealed that priority should be given to quality and cost management in order to achieve success in many building projects. Furthermore, this study has shown a strong positive relationship of the project triple constraint (time, cost, and quality) on building projects; this would be of benefit to researchers, developers and government so as to improve infrastructures in the country.

This study suggests that there is a need for further studies on the influence of project triple constraint (time, cost and quality) in the construction industry as a determinant for building projects. because this study is only restricted to construction companies in Kuantan, the study on the effect project triple constraint on building projects should be extended to other construction companies across Malaysia. This could help in understanding the challenges facing other construction companies. It can also give room to examine other ongoing projects such as roads, bridge, real estate, and so on across different construction companies in Malaysia so as to know that the project triple constraint does not only affect the building projects but may also influence other types of construction projects.

9.0 Limitation of the Study

This research was limited only to Kuantan in terms of the case study. This study has some building projects that are not applicable to all the construction companies in Malaysia. So, the result is limited to construction companies in Kuantan. In addition, this study examined each variable such as cost, time and quality on building projects. This implies that each measured construct was specific regarding the effects on building projects. The data that were collected from the construction companies (building projects) took much time because most of the workers were very busy, thereby creating difficulties. More so, finance was another limitation because it requires adequate financial support to complete data collection for this research.

10.0 Conclusion

This study has established the fact that the project triple constraint (cost, time, and quality) affects the building projects. It has investigated the relationship among variables, and has helped to understand their effect on specific significant challenges facing construction companies especially building projects and the way to overcome the barriers they faced during the operation of these projects. This study has also established the effect of time management on the building projects. It has shown that the completion of building projects depends on how time is being managed. In addition, it has also established the effect of cost management on building projects, by indicating a significant relationship regarding budgeting and effective cost management in the process of constructing building projects. Besides, this study has illustrated that quality management plays a major significant role in the development of building projects. Hence, project triple constraint has shown strong positive results on the building projects regarding this study.

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